**Mackenzie Valley Highway Project**

# Fish and Fish Habitat Data Report for the Sahtu Region

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

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K'alo-Stantec

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# Executive Summary

The Government of the Northwest Territories (GNWT), Department of Infrastructure (INF) is proposing the Mackenzie Valley Highway Project (the Project) which involves the extension of the Mackenzie Valley Highway (MVH) from Wrigley to Norman Wells. The Project will include constructing a new all-season highway that largely follows the route of the existing Mackenzie Valley Winter Road, and the construction and operation of temporary and permanent borrow sources. The Project will pass through the Dehcho Region starting at Wrigley and a portion of the Tulita District of the Sahtu Region within the Northwest Territories (NT).

This data report presents technical data and analysis of fish and fish habitat in watercourses anticipated to be crossed by the proposed highway in the Sahtu Region as based on field surveys completed in 2021. Results indicate that all but three unnamed watercourses to be crossed by the proposed highway provide fish habitat or have the potential to provide fish habitat.

In October 2021, a field assessment was conducted on 27 watercourses crossed by the proposed Project alignment within the Sahtu Region. All watercourses drain into the Mackenzie River. All fish captured during the study were in the category of forage fish. Due to the timing of the field study in October, fish collection was not conducted on a number of the watercourses due to freezing conditions which could cause injury to fish if collections occurred. Fish habitat for larger bodied fish such as coarse and sportfish were generally rated.

There are 33 known species of fish within the Regional Study Area (RSA) as based on historical studies completed for other projects; however, not all species would be expected to utilize watercourses to be crossed by the proposed highway. Two species, the Western Arctic populations of Bull trout (*Salvelinus confluentus*) and Dolly Varden (*Salvelinus malma*), are listed under Schedule 1 of the *Species at Risk Act* as a species of “special concern” and ranked sensitive under the Northwest Territories Species Ranking. However, no additional regulatory restrictions apply to these populations as a result of being listed on Schedule 1.

Since species presence is not known at all crossing locations, restricted activity timing windows recommended by Fisheries and Oceans Canada (DFO) within the RSA permit instream work between July 15 and August 15. Activities to be conducted in or near water which cannot avoid these restricted activity timing windows it is recommended a request for review to be submitted to DFO. Additional detailed field assessments may be required to further assess fish habitat pending design of watercourse crossings, access requirements to quarries and proximity of quarries to waterbodies to evaluate potential residual effects related to the proposed Project.

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# Abbreviations

| | |
|---|---|
| % | percent |
| AT | Alberta Transportation |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| DFO | Fisheries and Oceans Canada |
| DAR | Developer's Assessment Report |
| INF | Department of Infrastructure |
| IORVL | Imperial Oil Resources Ventures Limited |
| GNWT | Government of the Northwest Territories |
| km | kilometre |
| LSA | local study area |
| m | metre |
| mm | millimetre |
| MVH | Mackenzie Valley Highway |
| MGP | Mackenzie Gas Project |
| MVRMA | *Mackenzie Valley Resource Management Act* |
| MVEIRB | Mackenzie Valley Environmental Impact Review Board |
| NT | Northwest Territories |
| NTCMA | Northwest Territories Conference of Management Authorities |
| RSA | regional study area |
| SAR | Species at risk |
| SARA | *Species at Risk Act* |
| the Project | the Mackenzie Valley Highway Project |

# Glossary

| | |
|---|---|
| Centerline | The location where the watercourse crosses the proposed Project alignment |
| Coarse fish | Fish species that are not used for subsistence or recreational fishing such as suckers and Arctic lamprey. |
| Drainage | Ephemeral feature that does not have a defined bed and banks. |
| Forage fish | Minnow-like species which are important food items for larger fish. |
| Migration habitat | Features used by fish to migrate through a watercourse or waterbody to access different habitats to carry out additional life stages. |
| Overwintering habitat | Habitat used by fish during the winter, typically when waterbodies are ice-covered. |
| Rearing habitat | Habitat used by larval and juvenile fish for feeding and shelter. |
| Spawning habitat | Habitat used by adult fish which are required to carry out spawning activities. |
| Sport fish | Fish used for subsistence or recreational fishing such as whitefish. |

# 1 INTRODUCTION

The Government of the Northwest Territories (GNWT), Department of Infrastructure (INF) is proposing the Mackenzie Valley Highway Project (the Project), which involves the extension of the Mackenzie Valley Highway (MVH) from Wrigley to Norman Wells. The Project includes constructing approximately 280 km of all-season gravel highway that largely follows the route of the existing Mackenzie Valley Winter Road as well as the construction and operation of temporary and permanent borrow sources. The Project will pass through the Dehcho Region and a portion of the Tulita District of the Sahtu Region within the Northwest Territories (NT); (Figure 1 of Appendix 1).

This report presents the existing conditions for fish and fish habitat in specific watercourses to be crossed along the proposed alignment within the Sahtu Settlement Area, where new watercourse crossing structures are proposed. This information is a requirement under the Terms of Reference of the Mackenzie Valley Environmental Impact Review Board [MVEIRB 2015) and will support the development of the Developer's Assessment Report (DAR). A description of existing fish habitat is provided (Table1.1).

# 2 STUDY AREA

The Project within the Sahtu is located between Dehcho Region and Sahtu Settlement Area border and Prohibition Creek, approximately 21 km south of Norman Wells, NT. The Project highway alignment parallels the Mackenzie River (located to the west) and passes through the community of Tulita.

The Project is located within the Taiga Plains Low Subarctic, Taiga Cordillera Low Subarctic and Boreal Cordillera Level III ecoregions. Each of these ecoregions is distinguished by different climatic factors.

## 2.1 Local Study Area

The study area is defined as the area 300 m downstream and 100 m upstream of each new watercourse crossing structure proposed to be constructed as part of the Project. This reference point is defined as the point where the highway centerline, as defined in the *Project Description Report (PDR) for Construction of the Mackenzie Valley Highway Tulita District, Sahtu Settlement Area* (EBA 2011) crosses the watercourse. This area was selected to provide local context for determining significance of Project specific and potential effects to be assessed in the DAR and to inform engineering design.

## 2.2 Regional Study Area

The Regional Study Area (RSA) is defined by a 15 km buffer on either side of the Project centerline from the border of the Dehcho Region and Sahtu Region to Norman Wells. The RSA includes the Mackenzie River and associated tributaries and drainages. A 15 km buffer was selected to provide regional context for determining significance of project specific effects and potential cumulative effects to be assessed in the DAR.

# 3 METHODS

## 3.1 Fish and Fish Habitat Assessments

### 3.1.1 Desktop Assessment

Potential watercourses crossed by the Project were originally determined based on information included in the PDR for Construction of the Mackenzie Valley Highway Tulita District, Sahtu Settlement Area (EBA 2011). Since then, some highway alignment changes were made in 2021 by GNWT-INF and included in this study. EBA (2011) completed fish habitat assessments from helicopter to identify potential watercourse crossings along the proposed Project alignment. Crossings were identified as either watercourses or drainages. Watercourses were identified as active channels with defined bed and banks while drainages were vegetated and/or had no defined bed and banks (EBA 2011).

During aerial surveys, EBA (2011) identified fish habitat potential based on the type of watercourse crossed by the proposed Project and did not rate the quality of habitat available. EBA (2011) identified fish habitat potential as follows:

- Non-fish bearing features is not used by fish during any life stage.
- Migratory channels: ephemeral features used by fish for migration only or contribute to downstream habitat quality.
- Spawning, rearing, and feeding watercourses: drainages and watercourses that are used by fish for at least one life stage as well as migration.

Primary sources for information on fish species presence in the RSA was gathered from existing literature EBA (2011); IORVL (2004); K'alo-Stantec (2021) and DFO's aquatic species at risk map (DFO 2019). The resulting historical fish capture data was reviewed for the presence of fish species at risk listed under Schedule 1 of the *Species at Risk Act* (SARA) and the Northwest Territories Conference of Management Authorities (NTCMA) Species at Risk List. Other species designations and status reports were also considered including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the General Status of Ranks of Wild Species in the Northwest Territories (GNWT 2016).

Life history strategies of key fish species of importance to communities within the RSA and species at risk (SAR) with historical presence within the Project area were summarized based on published literature. Life history strategies were provided for species that are expected to be of value for subsistence or recreational fishing and are predominantly sport fish (e.g., Arctic grayling, northern pike, lake whitefish). Forage fish (e.g., cyprinids) and coarse fish (e.g., suckers) are expected to occur within the RSA; however, life history strategies were not provided as they are less valued for subsistence or recreational fishing although still ecologically important to the aquatic system.

### 3.1.2 Field Assessment

Fish and fish habitat field assessments were conducted for K'alo-Stantec by a qualified biologist from Tetra Tech Canada Inc. between September 30 and October 11, 2021. Field assessments were conducted later than originally proposed due to delays in obtaining study approvals. This delay resulted in not being able to conduct fish capture at all watercourses due to freezing conditions which could result in injury to fish.

Watercourse features crossed by the proposed Project were grouped into the following categories:

- Drainage: ephemeral feature that does not have a defined bed and banks
- Watercourse: has defined bed and banks with flowing surface water that may be active year-round or seasonally.
- Wetland: a waterbody with defined bed and banks but does not have flowing water. A wetland may have an inlet and/or an outlet that connects it to another watercourse or water body.

The fish habitat assessment used procedures based on standard protocols outlined in Alberta Transportation's (AT) Fish Habitat Manual (AT 2009) and R.L. & L. Environmental Services Ltd. (1992). At each watercourse crossing location, six transects of the watercourse were established to document channel characteristics along a 400 m reach. Transects were established at 100 m and 50 m upstream of the centerline, the centerline, and 100 m, 200 m, and 300 m downstream of the centerline.
Where possible, the following information and observations were recorded at each transect:

- date and time
- photographs
- habitat-type (e.g., pool riffle, run) and area
- channel characteristics (e.g., channel and wetted widths, depths, gradient)
- bed material (substrate size distribution)
- obstructions to fish passage
- vegetation (instream and riparian)
- flood signs
- stage of stream

Bank materials, bank stability, bank slopes, cover, vegetation, and fish habitat were estimated visually. Channel width, wetted width, water depth, and bank heights were measured. Instream substrate composition was estimated visually at each transect.

Habitat characteristics were incorporated into a physical habitat classification system, which rated the quality of each macro-habitat type, based on physical characteristics (e.g., depth, cover, substrate), for different life history requirements (e.g., rearing, spawning, migration, overwintering) of different fish species known or potentially could occur within the LSA.

Generally, sport fish spawning habitat was rated of higher quality (i.e., good) where there was abundant large gravel (suitable for redd construction) and coarse substrate, such as cobble (suitable for broadcast spawning). Proximity to cover was considered, as it is important for some species such as bull trout. For northern pike, flooded riparian vegetation is required for spawning. Consistent flow and suitable depth for the various species were considered in determination of quality. For coarse fish, similar attributes to sport fish were considered as substrate utilized is generally similar overall. Forage fish exhibit a variety of spawning behaviours, and good spawning habitat typically includes instream woody debris, instream vegetation, or flooded riparian vegetation as well as a variety of substrates. In addition, forage fish are typically tolerant of lower flows and shallower depths. Ratings of moderate and poor were based on lower amounts of preferred spawning habitat at the assessed area based on professional judgement of the fisheries biologist.

Rearing habitat was rated as good quality where flows were suitable for larval and juvenile fish and where there was abundant overhead and/or instream cover. Rearing habitat was rated as better quality where substrate was coarser and complex because it is more likely to support colonization of benthic invertebrate communities as a food source for fish. Ratings of moderate and poor were based on lower amounts of potential rearing habitat at the assessed area based on professional judgement of the fisheries biologist.

Overwintering habitat was rated as good for sport and coarse fish where the watercourse does not freeze to bottom and consistent flows were maintained. Deep, pools were also considered as good overwintering habitat. These areas are likely to maintain sufficient dissolved oxygen concentrations for fish during the winter. Forage fish are generally small bodied, and many are more resilient to lower dissolved oxygen concentrations (e.g., brook stickleback, fathead minnow). These fish are able to successfully overwinter in wetlands (depth greater than 1.5 m), watercourses that do not freeze to the bottom or that freeze near to bottom. Ratings of moderate and poor were based on lower amounts of potential overwintering habitat at the assessed area based on professional judgement of the fisheries biologist.

Migration was rated as good where no barriers to migration were observed. Barriers such as cascades or rapids may not be passed by small-bodied forage fish but could be successfully jumped by an adult salmonid. Other barriers, such as beaver dams, may serve as partial barriers to larger bodied fish, such as sport and coarse fish, while forage fish are able to migrate past them. Ratings of moderate and poor were based on increasing potential for blockages to fish passage due to flow levels or other natural potential barriers at the assessed area based on professional judgement of the fisheries biologist.

# 4 RESULTS

## 4.1 Fish and Fish Habitat Assessments

Previously a total of 28 fish species had been documented within the RSA based on existing data from EBA (2011) and IORVL (2004). Field assessments in the Dehcho Region by K'alo-Stantec in 2020 (K'alo Stantec 2021)) included capture of an additional two species: brook stickleback (*Cluea inconstans*) and fathead minnow (*Pimephales promelas*). The 2021 field assessments in the Sahtu Region (this report) document an additional three species: finescale dace (*Chrosomus neogaeus*), pearl dace (*Margariscus margarita*) and northern redbelly dace (*Chrosomus eos*). These additional five species raise the total number of fish species documented in the RSA to 33. The capture of pearl dace and northern redbelly dace represents northern range extensions for both these species within the Northwest Territories. Table 4.1 provides the status for each species identified in the desktop assessment and field assessments.

Previous studies (IORVL 2004) conducted in the LSAs captured lake chub (*Couesius plumbeus),* slimy sculpin (*Cottus cognatus*), northern pike (*Esox lucius*), longnose sucker (*Catostomus catostomus)* and Arctic grayling (*Thymallus arcticus)*

There are no resident non-native fish within the LSA. Three Pacific salmon species (sockeye [*Oncorhyncus nerka*], chinook [*O. tshawytscha*], and coho [*O. kisutch*]) have been captured and are non-native and occasionally occur in the Mackenzie River system but are considered vagrant in the RSA. Chum salmon [*O. keta*] also occurs within the RSA however this species is unlikely to migrate up watercourses into the LSA due to the lack of adequate spawning habitat for this species. Only one spawning population of chum salmon has been reported in the Mackenzie River system, in the Liard River (R.L. & L, 1980) a tributary to the Mackenzie River.

The western Arctic population of bull trout (*Salvelinus confluentus*) and Dolly Varden (*Salvelinus malma*) are considered populations of Special Concern under SARA (GOC 2022a) and COSEWIC (GOC 2022b). Both species are listed as "sensitive" in the Northwest Territories by the NTCMA (GNWT 2020). Inconnu (*Stenodus leucichthys*) and Arctic cisco (*Coregonus autumnalis*) are also listed as "sensitive" by the NTCMA. Species listed as "special concern" or "sensitive" have no additional regulatory requirements associated with them.

There are no fish consumption advisories for watercourses in the LSA identified by the GNWT Department of Health and Social Services (GNWT 2021). No baseline contaminant baseline studies have been conducted for watercourses along the Project. No concerns over parasites in fish have been reported.

**Table 4.1 Known Fish Species Within the RSA**

| Species Information | | | Legislated Protection | Scientific Review or Recommendation | |
|---|---|---|---|---|---|
| **Family** | **Common Name** | **Scientific Name** | ***SARA*[a] (Federal)** | **COSEWIC[a] (Federal)** | **General Status[b] (Northwest Territories)** |
| Catostomidae | longnose sucker | *Catostomus catostomus* | No status | Not assessed | Secure |
| | white sucker | *Catostomus commersonii* | No status | Not assessed | Secure |
| Cottidae | slimy sculpin | *Cottus cognatus* | No status | Not assessed | Secure |
| | spoonhead sculpin | *Cottus ricei* | No status | Not at risk | Secure |
| Cyprinidae | emerald shiner | *Notropis atherinoides* | No status | Not assessed | Secure |
| | fathead minnow | *Pimephales promelas* | No status | Not assessed | Undetermined |
| | finescale dace | *Chrosomus neogaeus* | No status | Not assessed | Secure |
| | flathead chub | *Platygobio gracilis* | No status | Not assessed | Secure |
| | lake chub | *Couesius plumbeus* | No status | Not assessed | Secure |
| | longnose dace | *Rhinichthys cataractae* | No status | Not assessed | Secure |
| | northern redbelly dace | *Chrosomus eos* | No status | Not assessed | Secure |
| | pearl dace | *Semotilus margarita* | No status | Not assessed | Secure |
| | spottail shiner | *Notropis hudsonius* | No status | Not assessed | Secure |
| Esocidae | northern pike | *Esox lucius* | No status | Not assessed | Secure |
| Gadidae | burbot | *Lota lota* | No status | Not assessed | Secure |
| Gasterosteidae | brook stickleback | *Cluea inconstans* | No status | Not assessed | Secure |
| | ninespine stickleback | *Pungitius pungitius* | No status | Not assessed | Secure |
| Hiodontidae | goldeye | *Hiodon alosoides* | No status | Not assessed | Secure |
| Percidae | walleye | *Sander vitreus* | No status | Not assessed | Secure |
| Percopsidae | trout-perch | *Percopsis omiscomaycus* | No status | Not assessed | Secure |
| Peteromyzontidae | Arctic lamprey | *Lampetra arcticus* | No status | Not assessed | Undetermined |

**Table 4.1 Known Fish Species Within the RSA**

| Species Information | | | Legislated Protection | Scientific Review or Recommendation | |
|---|---|---|---|---|---|
| **Family** | **Common Name** | **Scientific Name** | ***SARA*[a] (Federal)** | **COSEWIC[a] (Federal)** | **General Status[b] (Northwest Territories)** |
| Salmonidae | Arctic cisco | *Coregonus autumnalis* | No status | Not assessed | Sensitive |
| | Arctic grayling | *Thymallus arcticus* | No status | Not assessed | Secure |
| | broad whitefish | *Coregonus nasus* | No status | Not assessed | Secure |
| | bull trout | *Salvelinus confluentus* | Special Concern | Special Concern | Sensitive |
| | Dolly Varden | *Salvelinus malma* | Special Concern | Special Concern | Sensitive |
| | Inconnu | *Stenodus leucichthys* | No status | Not assessed | Sensitive |
| | lake trout | *Salvelinus namaycush* | No status | Not assessed | Secure |
| | lake whitefish | *Coregonus clupeaformis* | No status | Not assessed | Secure |
| | least cisco | *Coregonus sardinella* | No status | Not assessed | Secure |
| | mountain whitefish | *Prosopium williamsoni* | No status | Not assessed | Secure |
| | round whitefish | *Prosopium cylindraceum* | No status | Not assessed | Secure |
| | Chum salmon | *Oncorhynchus keta* | No status | Not assessed | Undetermined |

NOTES:
[a] *Species at Risk Act* and COSEWIC (GOC 2022a; 2022b)
[b] General Status Ranks of Wild Species in the Northwest Territories (GNWT 2016)

### 4.1.1 Life History Strategies

#### *4.1.1.1 Lake Whitefish*

Lake whitefish or humpback is a common species harvested by communities throughout the Mackenzie River system including the RSA. Spawning occurs in the fall in lakes and larger rivers (Scott and Crossman 1998). There are no records of lake whitefish spawning in smaller streams, but they may utilize these streams to move between lakes and larger river systems for rearing. Lake whitefish are known to spawn in the Mackenzie River (Jessop and Lilly 1975) and in larger tributaries of the Mackenzie River.

Spawning typically occurs between late September and early October (Reist and Bond 1988) and eggs hatch in spring. Lake whitefish do not make redds but instead broadcast their eggs over cobble and gravel substrate (Scott and Crossman 1998). In rivers, larval lake whitefish are swept downstream and move into backwaters of rivers as nursery areas (Sawatzky et al. 2007) and then move into lakes until they reach maturity (Evans et al. 2001). It is unknown if there are lake whitefish that reside in major rivers for their entire life history (Evans et al. 2001).

Adult lake whitefish diet consists mainly of aquatic insect larvae (e.g., chironomids), snails, clams, amphipods, and other bottom organisms (Scott and Crossman 1998). Lake whitefish have also been known to feed on small fish and fish eggs (Scott and Crossman 1998).

Lake whitefish would not be expected to occur in the streams assessed during this study due to the lack of suitable habitat.

#### *4.1.1.2 Least Cisco*

Least cisco is a member of the whitefish family. The majority of information known about least cisco is from the lower Mackenzie River and delta. Although they are known to occur throughout most of the Mackenzie River, least cisco is not known to occur in Great Slave Lake (Stewart and Low 2000). Least cisco can be found in both lakes and rivers with some populations being only lake dwelling (Scott and Crossman 1998).

Spawning occurs in late September to early October with eggs broadcast over sand or gravel. Hatching typically occurs in May (Sawatzky et al. 2007). Least cisco feed on aquatic and terrestrial insects (Scott and Crossman 1998).

Least cisco would not be expected to occur in the streams assessed during this study due to the lack of suitable habitat.

#### *4.1.1.3 Inconnu*

Inconnu or coney is the only truly piscivorous (fish eating) whitefish and the largest member of the whitefish family. They may undertake long migrations; two tagged inconnu migrated almost 1,800 km from the Liard River to the Mackenzie River delta and Tuktoyaktuk (Stephenson et al. 2005). Inconnu have

been grouped into three migratory types: fully anadromous, partially anadromous, and freshwater (Howland et al. 2001). All three migratory types may be found in the RSA.

Inconnu spawning occurs in October over coarse cobble substrate and some sand (Alt 1969) in the Mackenzie River and larger tributary rivers (e.g., Peel River). After spawning, they migrate downstream to overwintering areas. Spawning of mature inconnu is believed to occur only every two to four years (Scott and Crossman 1998). Inconnu are not known to migrate up smaller streams like those assessed during this study although may be found at the mouths of streams that enter the Mackenzie River.

#### *4.1.1.4 Lake Trout*

Lake trout are mainly found in deep, cold water lakes but may also be found in some shallower lakes and larger rivers in the Northwest Territories (Scott and Crossman 1998). They spawn in the fall over cobble substrate along exposed shorelines and shoals of lakes (Callaghan et al. 2015). Lake trout spawning is not expected in the streams and smaller rivers in the RSA due to the lack of spawning habitat potential in these systems.

Lake trout feed on zooplankton, other fish, and occasionally small mammals (Scott and Crossman 1998). The presence of lake trout RSA is expected to be restricted to larger streams and used mainly for movement between lakes.

#### *4.1.1.5 Bull Trout*

Two types of bull trout have been identified in the Mackenzie Valley: migratory and non-migratory (Mochnacz et al. 2013). Bull trout have been reported in the Great Bear River (Mochnacz et al. 2013; IORVL 2004; Reist et al. 2002). However, they are not thought to spawn in the Great Bear River system as they usually spawn in smaller, steeper gradient streams (Mochnacz et al. 2013; IORVL 2004). It has been suggested that bull trout in the eastern tributaries of the Mackenzie River, such as those along the RSA, are individuals from tributaries on the west side of the Mackenzie River in search of feeding or overwintering areas (Mochnacz et al. 2013). Bull trout are not expected to occur in the streams assessed during this study due to the lack of suitable habitat.

Bull trout are fall spawners, making redds in gravel substrate (COSEWIC 2012). In the Northwest Territories, bull trout spawn in alternate years (Mochnacz et al. 2013). Incubation can range from 35 days to four months depending on water temperatures (COSEWIC 2012). As bull trout age, their diet transitions from aquatic and terrestrial invertebrates to fish (Stewart et al. 2007).

The Western Arctic population of bull trout is considered “of special concern” under SARA and COSEWIC (GOC 2020) and is considered “sensitive” under the General Status Ranks of Wild Species in the Northwest Territories (GNWT 2016). The population is widely distributed throughout the Western Arctic drainage; however, populations are not abundant (COSEWIC 2012). There are no population estimates for the Northwest Territories, but there is evidence of decline within the Western Arctic Population in some locations (COSEWIC 2012). This species is particularly vulnerable to habitat degradation and fragmentation as a result of industrial development (e.g., oil, gas, and mining development, commercial

forestry, road and urban development, and hydroelectric), displacement and hybridization with introduced species (i.e., brook trout [*Salvelinus fontinalis*]), and overexploitation which is exacerbated with misidentification (COSEWIC 2012).

#### *4.1.1.6 Dolly Varden*

Dolly Varden are unlikely to occur within tributaries of the Mackenzie River within the Project RSA. This is because the southern range of the northern population of Dolly Varden is the Gayna River, which is downstream of Norman Wells and outside the RSA. Dolly Varden have been reported in previous studies conducted within the RSA; however, these fish were likely misidentified bull trout (Reist et al. 2002).

There are two forms of Dolly Varden: a riverine form and an anadromous form which migrates to the Beaufort Sea to feed during the open water season (Stewart at al. 2010). Both forms construct redds in clear, groundwater-fed stream that do not freeze to the bottom in winter (Stewart et al. 2010). The age before migrations to the Beaufort Sea can vary depending on the population but typically occurs between two to four years (Stewart et al. 2010).

The Western Arctic population of Dolly Varden is considered “of special concern” under SARA and COSEWIC (GOC 2020) and is considered “sensitive” under the General Status Ranks of Wild Species in the Northwest Territories (GNWT 2016). The population within the Northwest Territories is not well understood and the extent of its decline is not known but serious declines have been observed in some populations (COSEWIC 2010). The known threats to the species include climate change, habitat loss through freshwater river desiccation, overharvesting, and changes to groundwater recharging at overwintering sites (COSEWIC 2010). Additional potential threats include offshore infrastructure (which can disrupt anadromous forms), resource extraction which may alter habitat, and increasing fishing pressure driven by development of transportation corridors (COSEWIC 2010).

Dolly varden are not expected to occur in the streams assessed during this study due to the lack of suitable habitat.

#### *4.1.1.7 Arctic Grayling*

Arctic grayling is found in clear, cold streams, rivers, and lakes (Scott and Crossman 1998; Ford et al. 1995) and are present in numerous streams along the RSA. Male Arctic grayling reach maturity at three to four years of age; females mature later at four to five years (Low and Read 1987).

Arctic grayling spawn in the spring as ice-cover begins to break-up over gravel or cobble bottoms (Scott and Crossman 1998). No redd is built and instead, eggs are broadcast over the substrates. Young-of-the-year remain in their natal streams for up to 15 months (Ford et al. 1995). Adults may move into larger systems to overwinter (Scott and Crossman 1998). Juveniles feed mainly on zooplankton and gradually shift to larger aquatic and terrestrial invertebrates as they mature (Scott and Crossman 1998).

Arctic grayling have the potential to occur in the larger streams assessed in this study.

#### *4.1.1.8 Northern Pike*

Northern pike occur in rivers, streams, and lakes throughout the Mackenzie River Valley (Scott and Crossman 1998). Spawning occurs just after ice-out in weedy areas on flooded terrestrial vegetation with eggs hatching 12-14 days later (Scott and Crossman 1998). Spawning adults may remain in the stream or lake where they spawned or move downstream to associated systems (Evans et al. 2002). Pike fry move into slower waters in tributaries or into the mainstem Mackenzie River in late July (Jessop and Lilly 1975).

Adult northern pike prefer shallow portions of rivers, with no velocity or slow water and areas with aquatic vegetation (Casselman and Lewis 1996; Ford et al. 1995; Jessop and Lilly 1975). In mid-August and September, pike will move from shallower areas to deeper overwintering areas before freeze-up (Jessop and Lilly 1975).

#### *4.1.1.9 Burbot*

Burbot or loche is a freshwater cod and is the only freshwater fish which spawns in the winter in the Northwest Territories. Burbot spawn in lakes over sand, gravel, or cobble substrate. In rivers and streams, burbot typically spawn in low-velocity areas within main channels or in side-channels behind depositional bars over fine gravel, sand, or fine silt substrate (McPhail and Paragamian 2000). It is expected that suitable spawning habitat for burbot does not exist in most watercourses in the RSA due to shallow water depth and high likelihood of being frozen to or near the bottom.

Juvenile burbot may use smaller streams during the open water season and potentially could occur in some LSA watercourses. Young burbot feed on mainly aquatic invertebrates moving to a diet of fish as they become adults (McPhail and Paragamian 2000; Scott and Crossman 1998).

#### *4.1.1.10 Forage Fish*

A variety of forage fish are found in watercourses along the RSA with Slimy sculpin, ninespine stickleback and brook stickleback being three of the more common and abundant forage species captured during fisheries surveys conducted for the Mackenzie Gas Project (IORVL 2004). Forage fish species are found in smaller and larger watercourses along the RSA including those assessed in this study and are identified in Table 4.1 and Table 4.2. These species spawn in late spring or summer in flowing or stagnant water over a wide range of substrate types depending on species preferences.

### 4.1.2 Watercourse Crossings

A summary of watercourse crossings assessed in the LSA is provided in Table 4.2 and Figure 1 of Appendix A. Site data sheets and photographs are provided in Appendix A. In total 27 watercourses were assessed in 2021.

Restricted Activity Periods (timing windows) have been developed by DFO for periods when instream activities are to be avoided in order to protect sensitive life stages of fish species. Since fish species presence is not known at all crossing locations a conservative approach was adopted. The recommended restricted activity timing window within the RSA based on this conservative approach is August 15 to July 15 (DFO 2013) therefore DFO recommends instream works occur between July 15 and August 15. Works in or near water which cannot avoid the restricted activity timing windows should submit a request for review to DFO. This does not apply if a watercourse is dry or frozen to the bottom when works occur.

**Table 4.2 Watercourse Crossings Assessed in the Sahtu Settlement Area**

| Watercourses | Potential Watercourse Crossing Locations Assessed in 2021 | | | | Fish Presence |
|---|---|---|---|---|---|
| | Km[a] | UTM | | | |
| | | Zone (W) | Easting | Northing | |
| Unnamed watercourse | 797.9 | 10 | 437740 | 7101829 | Brook stickleback, Pearl dace, Northern redbelly dace, Finescale dace |
| Unnamed watercourse | 805.5 | 10 | 435589 | 7108255 | Brook stickleback, Pearl dace |
| Unnamed watercourse | 812.7 | 10 | 434329 | 7115337 | Potential |
| Unnamed watercourse | 815.0 | 10 | 432721 | 7117031 | Potential |
| Unnamed watercourse | 820.7 | 10 | 433131 | 7121799 | Potential |
| Unnamed watercourse | 821.9 | 10 | 432580 | 7123103 | Potential |
| Unnamed watercourse | 823.0 | 10 | 431979 | 7123968 | Potential |
| Unnamed watercourse | 826.0 | 10 | 431007 | 7126834 | Potential |
| Unnamed watercourse | 826.3 | 10 | 430947 | 7126834 | Potential |
| Unnamed watercourse | 828.6 | 10 | 429991 | 7129070 | Potential |
| Unnamed watercourse | 834.1 | 10 | 425724 | 7132189 | Potential |
| Unnamed watercourse | 835.0 | 10 | 425405 | 7132988 | Potential |
| Unnamed watercourse | 837.1 | 10 | 424624 | 7135022 | Potential |
| Unnamed watercourse | 843.3 | 10 | 422310 | 7140408 | Potential |
| Unnamed watercourse | 846.4 | 10 | 419947 | 7142715 | Potential |
| Unnamed watercourse | 857.4 | 10 | 415860 | 7151196 | Potential |
| Unnamed watercourse | 872.9 | 10 | 412679 | 7164554 | Unlikely |
| Unnamed watercourse | 879.1 | 10 | 411064 | 7169505 | Potential |
| Unnamed watercourse | 879.4 | 10 | 411209 | 716858 | Potential |
| Unnamed watercourse | 880.2 | 10 | 411595 | 7170626 | Unlikely |
| Unnamed watercourse | 880.6 | 10 | 411800 | 7171054 | Brook stickleback, Finescale dace, Pearl dace |
| Unnamed watercourse | 883.6 | 10 | 411615 | 7173282 | Unlikely |

**Table 4.2 Watercourse Crossings Assessed in the Sahtu Settlement Area**

| Watercourses | Potential Watercourse Crossing Locations Assessed in 2021 | | | | Fish Presence |
|---|---|---|---|---|---|
| | Km[a] | UTM | | | |
| | | Zone (W) | Easting | Northing | |
| Unnamed watercourse | 884.8 | 10 | 411300 | 7174635 | Brook stickleback, Pearl dace |
| Unnamed watercourse | 891.4 | 10 | 406839 | 7178354 | Potential |
| Unnamed watercourse | 919.9 | 10 | 394956 | 7198775 | Potential |
| Unnamed watercourse | 940.1 | 10 | 375325 | 7203625 | Potential |
| Unnamed watercourse | 981.2 | 10 | 629352 | 7227768 | Potential |

NOTE:
[a] Km location is approximate to Project

#### *4.1.2.1 Crossing Km 797.9 – Unnamed Watercourse*

Channel width at the centerline of the proposed crossing location was 4.3 m with a depth at the time of the assessment of approximately 0.9 m. Maximum channel width was 16.8 m and a maximum depth 1.2 m in the assessed area. Substrate was a mixture of organics and fines. Grasses were observed in the stream bed and logjams were present upstream and downstream of the proposed crossing site. An old beaver dam was present 300 m downstream of the proposed crossing site prior to a downstream wetland area. The banks at the centerline were stable. Overhead cover was estimated at 10% consisting mostly of grasses. Instream cover was estimated at 30% consisting mainly of woody debris.

Fishing was conducted using minnow traps. Four species were captured: brook stickleback, finescale dace, pearl dace and one unidentified Cyprinid (minnow). Spawning is rated as moderate for forage fish, and none to poor for coarse and sportfish. Overwintering is rated as poor to moderate for all three fish categories. Rearing is rated as good for forage and coarse fish species and moderate for sportfish. Fish passage is rated as good to moderate for all three categories of fish.

#### *4.1.2.2 Crossing Km 805.5 – Unnamed Watercourse*

The location was a wetland with no defined channel with the exception at the centerline. Channel width at the centerline was 0.3 m. Average depth at the centerline was 0.45 m (0.36 m to 0.62 m) at the time of the assessment. Substrate composition was estimated at 20% organics and 80% fines. Dominant riparian vegetation is grasses and shrubs.

Fishing was conducted using minnow traps. Two fish species were captured brook: stickleback and pearl dace. Spawning habitat is rated as good for forage fish and none for coarse and sport fish. Overwintering potential is rated as poor to moderate for forage fish and poor for coarse and sportfish. Rearing habitat is rated as good for forage fish and poor to moderate for coarse and sportfish. Fish passage is rated as moderate for forage fish and poor to moderate for coarse and sportfish.

#### *4.1.2.3 Crossing Km 812.7 – Unnamed Watercourse*

Channel width at the centerline was 1.37 m with an average depth of 0.14 m during the time of assessment. Maximum channel width in the assessed area was 1.8 m and a maximum depth of 0.57 m. There was woody debris throughout the assessed area and some minor logjams which may result in partial barriers to fish passage. At the centerline substrate composition was estimated to be 50% organics and 50% fines. Downstream substrate composition was more diverse with fines, small gravel, larger gravel and cobble. There was some minor undercutting of the banks upstream of the centerline with the channel becoming poorly defined and low water depths. The banks were stable at the centerline. Several beaver dams were present in the area, one at the downstream side of the centerline, another beaver dam at a tributary to the watercourse 50 m upstream and one more beaver dam but abandoned further up the tributary where the channel is dry. The tributary runs parallel to the winter road and goes subsurface near the abandoned beaver dam.

Fishing was conducted using a backpack electrofisher but no fish were captured. Spawning habitat was rated as good for forage fish but poor for coarse and sportfish. Overwintering was rated as none to poor for all three categories of fish. Rearing was rated as good for forage and coarse fish and moderate for sport fish. Fish passage was rated as moderate to good for forage fish and moderate for coarse and sportfish.

#### *4.1.2.4 Crossing Km 815.0 – Unnamed Watercourse*

Channel width at the centerline was 1.9 m with a water depth of 0.1 m at the time of the assessment. Maximum channel width is 2.5 m and maximum depth was 0.1 m in the assessed area. The watercourse drains into a wetland. Logjams were present upstream. At the centerline substrate was mainly fines (60%) with small gravel (20%) cobble (10%) and organic matter (10%). Overhead cover was 80% mostly from deciduous trees. Instream cover was 30% consisting of woody debris. Banks were moderately stable consisting or organic material at the centerline.

Due to the shallow water depths no fishing was conducted. Overall fish habitat was rated as poor.

#### *4.1.2.5 Crossing Km 820.7 – Unnamed Watercourse*

The channel was poorly defined within a floodplain. Channel width at the centerline was 15.5 m and water depth 0.2 m. Maximum channel width was 95 m in a flooded area 100 m upstream from the centerline. Maximum depth in the assessed area was 0.5 m in the assessed area during the time of the assessment. Substrate at the centerline was 100% organics. The banks were moderately stable on the left bank and stable on the right bank. Overhead cover was 5% with instream cover estimated at 10% being contributed to by grasses growing in the streambed. A beaver dam was present 300 m downstream of the centerline. An exposed culvert was present that had been installed at the winter road crossing.

Fishing was conducted using minnow traps. No fish were captured. Spawning was rated as poor to moderate for forage fish and none for coarse and sportfish. Overwintering potential was rated as poor for forage and coarse fish and none to poor for sportfish. Rearing was rated as moderate for forage fish, poor for coarse fish and none to poor for sport fish. Fish passage was rated as moderate for forage fish and poor to moderate for coarse and sportfish.

Channel width at the centerline is 1.3 m and water depth at the time of assessment 0.4 m.
Maximum channel width in the assessed area was 2.4 m and maximum water depth at the time of assessment was 0.4 m. The channel between 100 m and 200 m downstream was frozen to the stream bed. At the centerline the substrate was 50% fines, 30% small gravel and 20% large gravel. At the time of the assessment the substrate was covered in leaves and woody debris. Both banks at the centerline were moderately stable.

Overhead cover was estimated at 30% consisting mainly of deciduous trees with conifers further back. Instream cover consisted mainly of woody debris.

No fishing was conducted due to freezing conditions. Potential spawning habitat was rated as moderate and overwintering potential as poor for all three fish categories. Rearing habitat was rated as good for forage and coarse fish and moderate for sportfish. Fish passage was rated as moderate to good for all three fish categories.

#### *4.1.2.6 Crossing Km 821.9 – Unnamed Watercourse*

Channel width at the centerline was 1.3 m with an average water depth of 0.4 m. Maximum channel width was 2.1 m 300 m downstream of the centerline with a water depth of 0.1 m. The channel was dry between 100 m and 200 m downstream. Substrate at the centerline was a mixture of fines, and small and large gravel. At 100 m upstream and 200 and 300 m downstream substrate consisted of organics, fines and small gravel while at 50 m upstream substrate was organics and small gravel. Substrate at 100 m downstream was a 100% small gravel. Overhead cover was 30%, dominated by overhanging woody debris. There was debris buildup throughout the watercourse which may create potential barriers for fish passage. Banks at the centerline were moderately stable but unstable upstream and 100 m downstream from the centerline becoming moderately stable again further downstream.

No fishing was conducted due to freezing conditions. Spawning habitat was rated as moderate for all three categories of fish while overwintering was rated as poor. Rearing habitat was rated good for forage and coarse fish and moderate for sport fish. Fish passage was rated as moderate to good for all three categories of fish.

#### *4.1.2.7 Crossing Km 823.0 – Unnamed Watercourse*

At the time of the assessment the watercourse was mostly frozen. Channel width at the centerline was 0.2 m with an average depth of approximately 0.2 m at the time of the assessment. Maximum channel width is 1.9 m which was 100 m upstream of the centerline. Maximum water depth at the time of the assessment was 3.0 m. Substrate at the centerline and through most of the assessed portion of the watercourse was a mixture of large gravel, cobble and boulders. Overhead cover was estimated at 60% consisting mainly of shrubs and deciduous trees. Instream cover was estimated at 40% which consisted of woody debris and boulders. Woody debris and logjams were observed throughout the assessed reach. The banks at the centerline were moderately stable.

No fishing was conducted due to the watercourse mostly frozen. Fish habitat for rearing was rated at moderate to good for forage fish, moderate for coarse fish and poor for sport fish. Overwintering potential was rated as none to poor for all three categories of fish. Rearing habitat was rated as good for forage and coarse fish species and rated moderate for sportfish. Fish passage was rated as moderate to good for all three categories of fish.

#### *4.1.2.8 Crossing Km 826.0 – Unnamed Watercourse*

The channel was irregular with poor connectivity upstream of the centerline. Channel width at the centerline was1.8 m and a water depth of approximately 0.3 m at the time of the assessment Maximum channel width was 3.0 m at 100 m upstream of the centerline. Maximum water depth was 0.3 m.

Substrate at the centerline was estimated at 60% organics and 40% fines. Upstream of the centerline substrate was 100% fines while downstream of the centerline substrate was 100% organics. Overhead cover was estimated at 80% consisting mainly of trees and shrubs. Instream cover was estimated at 80% consisting mainly of woody debris. The banks at the centerline were moderately stable however 100 m downstream the banks become unstable with signs of erosion. There is evidence that there was a fire previously in the assessed area.

Fishing was conducted using minnow traps, but no fish were captured. Spawning habitat was rated as moderate to good for forage fish and none for coarse and sportfish. Overwintering potential was rated as moderate to good for forage fish, moderate for coarse fish and poor to moderate for sportfish. A ponded area upstream of the centerline may provide overwintering habitat. Rearing habitat was rated as moderate to good for all three categories of fish. Fish passage was rated as moderate for all three categories of fish.

#### *4.1.2.9 Crossing Km 826.3 – Unnamed Watercourse*

The watercourse was braided with debris jams and shrub islands. Channel width at the centerline was 1.1 m with an average depth of 0.1 m. Maximum channel width was 4.0 m upstream of the centerline. Maximum water depth in the assessed area was 0.3 m at the time of the assessment.
Substrate consisted of 100% organics and was the dominant substrate type throughout the assessed reach. Overhead cover was estimated at 50% from shrubs and trees. Instream cover was estimated to be 40% due provided by woody debris in the watercourse. The banks at the centerline were unstable. There was evidence of bank erosion on the left bank 100 m downstream of the centerline. There are signs of an historic fire in the upland area.

Fishing was conducted using a backpack electrofisher but no fish were captured. Potential spawning habitat was rated as poor to moderate for forage fish and none for coarse or sportfish.
Overwintering potential was rated as poor for forage fish and none for coarse and sportfish.
Rearing habitat was rated as moderate for forage and coarse fish and poor to moderate for sportfish.
Fish passage was rated as moderate for forage fish and poor for coarse and sportfish.

#### *4.1.2.10 Crossing Km 828.6 – Unnamed Watercourse*

Channel width at the centerline was 0.8 m and water depth averaged 0.4 m at the time of the assessment. Maximum channel width in the assessed area was 1.9 m with a maximum depth of 0.5 m at the time of the assessment. Substrate at the centerline was 60% fines, 30% small gravel and 10% large gravel. Fines and small gavel were the dominant substrate types in the assessed area. Overhead cover was estimated at 70% dominated by overhanging trees. Instream cover was estimated at 40% mainly contributed by woody debris. The banks were stable at the centerline. There was new plant growth in upland area due to historic fire.

No fishing was conducted due to freezing conditions. Spawning habitat was rated as moderate for forage fish and poor for coarse and sportfish. Overwintering potential is rated as poor for forage fish and none for

coarse and sportfish. Rearing habitat is rated as poor to moderate for all three categories of fish. Fish passage is rated as moderate for forage fish and poor to moderate for coarse and sportfish.

#### *4.1.2.11 Crossing Km 834.1 – Unnamed Watercourse*

Channel width at the centerline was 1.1 m and a water depth of 0.1 m at the time of the assessment. Maximum channel width is 1.3 m and maximum water depth was 0.6 m at the time of the assessment. Upstream of the centerline there was low flow with some pooling. Substrate at the centerline was 100% fines. Downstream of the centerline small and large gravel is present in addition to fines. Overhead cover was estimated at 70% composed mainly of shrubs and deciduous trees. Instream cover was estimated at 40% with undercut banks and woody debris. Logjams were present throughout the assessed reach. Banks at the centerline were unstable as were most of the assessed reach.

No fishing was conducted due to freezing conditions. Spawning habitat is rated as moderate for forage fish and poor for coarse and sportfish. Overwintering potential is rated as none to poor for all three categories of fish. Rearing habitat is rated as moderate for forage and coarse fish and poor to moderate for sportfish. Fish passage is rated as poor to moderate for all three categories of fish.

#### *4.1.2.12 Crossing Km 835.0 – Unnamed Watercourse*

At the time of the assessment the area was covered in snow and the watercourse mostly frozen over. Channel width at the centerline was 1.9 m and was the maximum channel width of the assessed reach. Average water depth at the centerline was approximately 0.1 m. Maximum water depth of the assessed reach at the time of the assessment was 0.8 m. Substrate composition at the centerline was estimated to be 10% fines, 40% small gravel, 40% large gravel and 10 % cobble. This substrate composition was similar upstream of the centerline, but downstream 200 m and 300 m downstream substrate was primarily organics. Overhead cover was estimated to be 70% consisting of shrubs and deciduous trees. Instream cover was estimated to be 50% consisting mainly of woody debris and undercut banks. At the centerline the banks were unstable but most of the assessed reach had moderately stable banks.

No fishing was conducted due to freezing conditions. Spawning habitat is rated as moderate for forage fish and poor for coarse and sportfish. Overwintering potential is rated as none to poor for all three categories of fish. Rearing habitat is rated as moderate for forage fish and poor to moderate for coarse and sportfish. Fish passage is rated as poor to moderate for all three categories of fish.

#### *4.1.2.13 Crossing Km 837.1 – Unnamed Watercourse*

Channel width at the centerline was 1.2 m and average water depth was 0.1 m at the time of the assessment. Maximum channel width was 2.7 m and maximum water depth in the assessed reach was 0.2 m at the time of the assessment. Step pools were created by downed woody debris in the upstream reach of the assessed area. Substrate composition at the centerline was a mixture of small gravel (20%), large gravel (35%), cobble (10%), and boulders (25%). Substrate composition was similar throughout the assessed reach. Overhead cover was estimated at 10% being dominated by shrubs. Instream cover was estimated at 30% provided by cobble. The banks at the centerline were unstable but becoming

moderately stable downstream of the centerline although some undercutting of the banks was observed. Evidence of previous fire history was observed.

No fishing was conducted due to freezing conditions. Spawning habitat is rated as moderate to good for forage fish and moderate for coarse and sport fish. Overwintering potential is rated as none to poor for all three fish categories. Rearing habitat is rated as moderate for all three categories of fish. Fish passage is rated as moderate for forage fish and poor to moderate for coarse and sportfish.

#### *4.1.2.14 Crossing Km 843.3 – Unnamed Watercourse*

The site was snow covered at the time of the assessment. Most of the downstream assessed reach was a flooded area within the trees with no defined channel. Maximum depth was 0.39 m. Substrate was 30% fines, 30% small gravel, 30% large gravel and 10% cobble. Overhead cover was estimated at 60% created by deciduous trees while instream cover was estimated at 80% provided by grasses and woody debris. The watercourse was considered not fish habitat and no fishing was conducted.

#### *4.1.2.15 Crossing Km 846.4 – Unnamed Watercourse*

The upstream section and centerline of the assessed reach was flooded with no defined channel, frozen and snow covered at the time of the assessment and therefore no data could be collected for the centerline and upstream reach. From the centerline to 100 m downstream the watercourse was also flooded with the channel banks becoming defined. The channel developed sinuous meanders downstream but could not be accessed for additional data collection due to flooded portions upstream of this lower section of the reach. At 100 m downstream, channel width 1 was 2.5 m with an average depth of 0.7 m. Maximum water depth was 0.8 m at the time of the assessment. Substrate consisted of 40% organics and 60% fines. Overhead cover was estimated as 30% consisting mostly of leaning branches from trees and instream cover was estimated at 30% provided by woody debris. Banks downstream were moderately stable.

No fishing was conducted due to freezing conditions. Spawning habitat for all three categories of fish is rated as poor as well as the potential for overwintering and fish passage. Rearing habitat is rated as moderate to good for forage fish, poor to moderate for coarse fish and poor for sportfish. The proposed crossing location is unlikely to allow fish passage.

#### *4.1.2.16 Crossing Km 857.4 – Unnamed Watercourse*

The upstream section of the assessed reach was flooded through low shrubs and grasses. Flooding is likely related to beaver dams impounding water. Beaver dams were present upstream and downstream as well as one at the centerline. Approximately 130 m downstream the channel converged with a larger channel. This second channel was flooded and meandered around debris dams. Channel width at the centerline was 2.3 m with an average depth of approximately 0.3 m. Maximum water depth was 0.6 m at the time of the assessment. Overhead cover was estimated at 10% with some small shrubs.
Instream cover was estimated at 40% consisting mostly of woody debris and some grasses in the

channel. Substrate at the centerline was approximately 60% organics and 40% fines. The substrate throughout the assessed reach was either organics or fines or a mixture of both.

No fishing was conducted due to freezing conditions. Spawning habitat is rated as moderate for forage fish and none for coarse and sportfish. Overwintering potential is rated as moderate for forage fish and poor for coarse and sportfish. Rearing habitat is rated as moderate to good for forage fish, poor to moderate for coarse fish and poor for sportfish. Fish passage is rated poor for all three categories of fish. The downstream section of the assessed reach provides better fish habitat than at the centerline.

#### *4.1.2.17 Crossing Km 872.9 – Unnamed Watercourse*

The location is in wetland habitat with no to poor connectivity to another waterbody and no defined channel. A rig mat was over the crossing location. An exposed pipe from a pipeline was noted in the channel. Downstream is a flooded wetland area with submerged aquatic vegetation. The substrate was fines and organics throughout the assessed reach. Overhead cover was estimated at 10% as the area was mostly clear. Instream cover was estimated at 60%, dominated by aquatic vegetation.

One minnow trap was set for one hour, but no fish were captured. It is unlikely the proposed crossing location provides fish habitat.

#### *4.1.2.18 Crossing Km 879.1 – Unnamed Watercourse*

The crossing location appears to be a wetland area and was frozen over at the time of the assessment. The wetland is connected to the watercourse proposed crossing location at Km 879.4. Beaver activity was observed upstream of the centerline and a beaver lodge and impoundment downstream. Overhead cover was estimated at 30% mainly provided by grasses. Instream cover could not be estimated due to the watercourse being frozen. There are ponds located both upstream and downstream of the centerline.

No fishing was conducted due to frozen conditions. There is potential good habitat for forage fish during the open water season but likely poor for coarse and sportfish. Low oxygen levels (0.68 mg/L) likely limits potential for overwintering of fish.

#### *4.1.2.19 Crossing Km 879.4 – Unnamed Watercourse*

Channel width at the centerline was 5.2 m with an average water depth of approximately 0.4 m. Upstream the area was flooded through the trees. Maximum water depth in the assessed reach was 0.5 m at the time of the assessment. Substrate at the centerline was composed of organics as well as upstream of the centerline while downstream was predominantly fines. Overhead cover was estimated at 60% provided mainly by shrubs while instream cover was estimated at 50% mainly through woody debris in the water column. Grasses and aquatic vegetation were observed in the channel upstream of the centerline. The banks at the centerline were stable. Undercutting of the banks were observed 300 m downstream of the centerline. Aerial imagery of the area shows it is connected to Site 879.1 on the

upstream side and appears to have wetland characteristics upstream of T1 (100 m upstream) based on the aerial imagery but was snow covered at time of assessment.

No fishing was conducted due to unsafe conditions for electrofishing and freezing conditions. Spawning habitat was rated as poor to moderate for forage fish and none for coarse and sportfish. Overwintering potential was rated as poor to moderate for forage fish and poor for coarse and sportfish. Rearing habitat was rated as moderate for forage fish and poor to moderate for coarse and sport fish. Fish passage was rated as moderate to good for forage fish and moderate for coarse and sport fish.

#### *4.1.2.20 Crossing Km 880.2 – Unnamed Watercourse*

Channel width at the centerline was 2.7 m with an average water depth of 0.2 m at the time of the assessment. Maximum water depth in the assessed reach was 0.2 m at the time of the assessment. Upstream 100 m of the centerline the area was flooded with no defined channel. There is poor connectivity until 100 m downstream of the centerline where connectivity improves. The channel narrows 300 m downstream and has a steep grade with several logjams. Overhead cover was estimated at 30% provided by shrubs and trees while instream cover was estimated at 20% mainly provided by woody debris. At the centerline the left bank was stable while the right bank was moderately stable.

No fishing was conducted due to shallow water depths. The watercourse is unlikely to provide fish habitat.

#### *4.1.2.21 Crossing Km 880.6 – Unnamed Watercourse*

Channel width at the centerline was 1.8 m with an average water depth of 0.4 m at the time of the assessment. Maximum water depth in the assessed reach was 0.6 m. A pipeline crossing exists 100 m downstream from the centerline. At this location there was some large boulders from rip rap for a wooden banks support structure that was in place. Substrate at the centerline is 30% organics and 70% fines. Fines were the dominant substrate throughout the assessed reach. Overhead cover was estimated at 80% provided mostly by shrubs. Instream cover was estimated at 40% provided mainly through woody debris. Banks at the centerline were stable while upstream and downstream of the centerline banks were predominantly moderately stable.

Fishing was conducted using a backpack electrofisher. Three forage fish species were captured: brook stickleback, finescale dace and pearl dace. Spawning habitat was rated as moderate for forage fish and none to poor for coarse and sport fish. Overwintering potential was rated as poor for all three categories of fish. Rearing habitat and fish passage were rated as good for all three categories of fish.

#### *4.1.2.22 Crossing Km 883.6 – Unnamed Watercourse*

At a location 50 m upstream from the centerline, at the crossing with the winter road, there was no defined channel. Channel width at the centerline was 1.3 m with an average water depth of 0.3 m. Maximum water depth in the assessed reach was 0.3 m at the time of the assessment. Water was tinted an orange copper colour. Substrate at the centreline was composed of organics (100%). Organics was the dominant substrate type with some fines downstream. Overhead cover was estimated at 70%

provided mainly by shrubs. Instream cover was estimated at 10% provided by woody debris. At the centerline and upstream the banks were moderately stable transitioning to unstable 200 m downstream from the centerline.

No fishing was conducted due to freezing conditions. Fish habitat was rated as poor for all fish categories for all three fish categories. The watercourse likely does not provide fish habitat.

#### *4.1.2.23 Crossing Km 884.8 – Unnamed Watercourse*

Channel width at the centerline was2.5 m with an average water depth of 0.3 m. Maximum water depth in the assessed reach was 0.6 m. Substrate at the centerline was composed of 90% fines and 10% small gravel. Fines was the dominant substrate throughout the assessed reach. Overhead cover was estimated as 30% provided mainly from shrubs however at the centerline overhead cover was estimated at 60%. Instream cover was estimated at 60% provided mainly through woody debris. Banks at the centerline and downstream were moderately stable while upstream they were unstable. The wildlife monitor mentioned that a beaver dam 50 m upstream of the centerline had blown out the year before. This may have resulted in the unstable banks upstream.

Fishing was conducted using a backpack electrofisher. Two forage fish species were captured: brook stickleback and pearl dace. Spawning habitat is rated as moderate for forage fish and poor for coarse and sportfish. Overwintering potential is rated as poor for all three categories of fish. Rearing habitat is rated as moderate to good for forage fish, poor to moderate for coarse fish and poor for sportfish. Fish passage was rated as moderate for forage fish and poor to moderate for coarse and sportfish.

#### *4.1.2.24 Crossing Km 891.4 – Unnamed Watercourse*

Channel width at the centerline was 12.5 m. A beaver dam at the centerline was impounding water upstream. Downstream from the centerline channel width decreased to between 6.0 and 5.5 m. Water depth at the centerline could only be taken at one location due to safety concerns and was recorded as 1.3 m at the time of the assessment. Maximum water depth would be greater than 1 m. Downstream of the centerline water depths decreased to approximately 0.5 m. Substrate at the centerline was composed of 100% fines. Downstream the substrate was composed of organics and fines. No substrate composition estimates were made for the upstream portion of the assessed reach. Overhead cover was estimated at 10% provided mainly from conifer trees. Instream cover was estimated at 10% largely provided by woody debris. Banks at the centerline were unstable as well as downstream but moderately stable upstream. Erosion of the banks were observed near the centerline and downstream.

No fishing was conducted due to freezing conditions and unsafe for electrofishing due to high flows and water depth. Spawning habitat is rated as moderate to good for forage fish and poor for coarse and sport fish. Overwintering potential is rated as moderate for all fish categories. Rearing habitat was rated as good and fish passage as moderate to good for all three fish categories.

#### *4.1.2.25 Crossing Km 919.9 – Unnamed Watercourse*

Channel width at the centerline was 37.0 with a water depth of 0.2 m at the time of the assessment. Maximum water depth in the assessed reach was estimated to be greater than two meters. Upstream 100 m of the centerline there was an entrance to a deep pool. Upstream 50 m the area is flooded which extends downstream of the centreline. Downstream of the centerline the channel becomes narrower and by 300 m downstream was only 1.3 m wide. Substrate at the centerline was estimated to be 30% organics 60% fines and 10% boulders. The boulders were not naturally occurring but appear to be from rip rap used for the winter road. Upstream the substrate composition was 100% organics while downstream was a mixture of organics and fines. Overhead cover was estimated at 10% with overhanging grasses. Instream cover was also estimated at 10% provided by vegetation. Banks at the centerline were stable.

Fishing was conducted using minnow traps but no fish were captured. Spawning habitat is rated as good for forage fish and none for coarse and sportfish. Overwintering potential is rated poor to moderate for forage fish and poor for coarse and sportfish. Rearing habitat is rated as good for forage fish, moderate for coarse fish and poor to moderate for sportfish. Fish passage is rated as poor to moderate for all three categories of fish.

#### *4.1.2.26 Crossing Km 940.1 – Unnamed Watercourse*

Channel width at the centerline was 1.5 m with an average water depth of 0.4 m at the time of the assessment. Maximum water depth in the assessed reach is 0.6 m. Substrate composition at the centerline was estimated to be 60% organics and 40% fines. Substrate throughout the assessed reach consisted of organics and fines. Overhead cover was estimated to be 90% provided by overhanging shrubs. Instream cover was estimated at 10% provided by undercut banks. Banks at the centerline were moderately stable. Downstream 200-300 m from the centerline were a series of cascades with 0.25 m drops which may be barriers to fish passage.

No fishing was conducted due to snow and ice conditions. Spawning habitat is rated as moderate for forage fish and none for coarse and sportfish. Overwintering potential is rated as none to poor for all three categories of fish. Rearing habitat is rated as moderate to good for forage fish and poor to moderate for coarse and sportfish. Fish passage is rate as poor to moderate for all three categories of fish.

#### *4.1.2.27 Crossing Km 981.2 – Unnamed Watercourse*

The assessment was conducted in snow and 50% ice cover. Channel width at the centerline was 2.6 m with an average water depth of 0.1m at the time of the assessment. Maximum water depth at the time of the assessment was 0.8 m. Substrate composition at the centerline was estimated to be 20% small gravel, 40% large gravel, 30% cobble and 10 % boulders. Substrate upstream of the centerline was similar to the centerline. Downstream 200 m and 300 m from the centerline substate composition changed to a mixture of fines and organics. Overhead cover was estimated at 40% provided mainly by shrubs instream cover was estimated at 25% through cobble and boulders. Banks were moderately

stable throughout the assessed reach with the exception of 300 m downstream of the centerline where the banks become unstable. Riffle and chutes occur throughout the assessed reach.

Fishing was conducted using a backpack electrofisher. No fish were captured. Spawning habitat is rated as moderate to good for all three categories of fish. Overwintering potential is ranked none to poor for all three categories of fish. Rearing habitat is rated as good for forage and coarse fish and moderate for sportfish. Fish passage is rated as moderate for all three categories of fish.

# 5 SUMMARY AND RECOMMENDATIONS

All permanent watercourses that would be crossed by the proposed Project alignment drain into the Mackenzie River. There are 33 fish species within the RSA which includes the Mackenzie River. However, not all species are expected to utilize every watercourse that would be crossed by the Project (e.g., chum salmon). Two species, Bull trout and Dolly Varden, are listed under Schedule 1 of the *Species at Risk Act* as a species of "special concern" and are also ranked as "sensitive" under the Northwest Territories Species Ranking. Inconnu and Arctic cisco are also considered "sensitive" under the Northwest Territories Species Ranking. However, no additional regulatory restrictions apply to this species because of these listings. None of these species of management concern would be expected to be found in the watercourses in the LSA assessed for this Project.

Of the 26 proposed watercourse crossings assessed within the LSA, 23 were found to either provide fish habitat or have the potential to provide fish habitat. It is unlikely that the other three watercourses at Km 872.9, Km 880.2 and Km 883.6 could provide fish habitat due to poor connectivity.

All fish captured during the fish and fish habitat assessment were forage fish. Two species, pearl dace and northern redbelly dace captured during the survey would represent northern range extensions within the Northwest Territories. Fish habitat was rated as generally poor for larger bodies fish such as coarse and sport fish.

Instream activities will be required to complete construction of the Project. Additional detailed field assessments may be required to further assess fish habitat to support the design of watercourse crossings, access requirements to quarries and proximity of quarries to waterbodies to evaluate potential residual effects related to the proposed Project. This information will also support an application to DFO for a request for review and their determination whether an authorization is required under the federal *Fisheries Ac*t to allow for construction.

# 6 CLOSURE

This report was prepared for the sole benefit of GNWT-INF to describe existing conditions related to fish and fish habitat within the Project LSA and RSA. If you have any questions, please do not hesitate to contact the undersigned.

Respectfully submitted,

**K'alo-Stantec Limited**

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# APPENDIX A

## Station Summary Sheets and Photographs

March 16, 2022

ISSUED FOR USE | REVISION 01
FILE: 704-ENG.WTRI03067-01

K'alo-Stantec Limited
PO Box 176
Tulita, NT X0E 0K0

**Attention:** Doug Chiperzak, Senior Fisheries Biologist, Stantec

**Subject:** Proposed Mackenzie Valley Highway Alignment, Sahtu Region – Fish Assessments

## 1.0 SUMMARY

Tetra Tech Canada Inc. (Tetra Tech) was subcontracted by Stantec Architecture for K'alo-Stantec Limited to complete fish and fish habitat assessments as part of the proposed Mackenzie Valley Highway alignment (Sahtu Region). Included below are figures, site cards and photographs of each site assessed for fish and fish habitat along the proposed Mackenzie Valley Highway alignment (Sahtu Region) between September 28 and October 12, 2021.

## 2.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Stantec Architecture, K'alo-Stantec, the Government of Northwest Territories, and their agents. Tetra Tech Canada Inc. (operating as Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Stantec Architecture, K'alo-Stantec, and the Government of Northwest Territories, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

## 3.0 CLOSURE

We trust this summary meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

FILE: 704-ENG.WTRI03067-01
FILE: 704-ENG.WTRI03067-01

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# APPENDIX

## TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

# LIMITATIONS ON USE OF THIS DOCUMENT

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The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

### 1.7 ENVIRONMENTAL ISSUES

The ability to rely upon and generalize from environmental baseline data is dependent on data collection activities occurring within biologically relevant survey windows.

It is incumbent upon the Client and any Authorized Party, to be knowledgeable of the level of risk that has been incorporated into the project design or scope, in consideration of the level of the environmental baseline information that was reasonably acquired to facilitate completion of the scope.

### 1.8 NOTIFICATION OF AUTHORITIES

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# FIGURE

Figure 1 Overview

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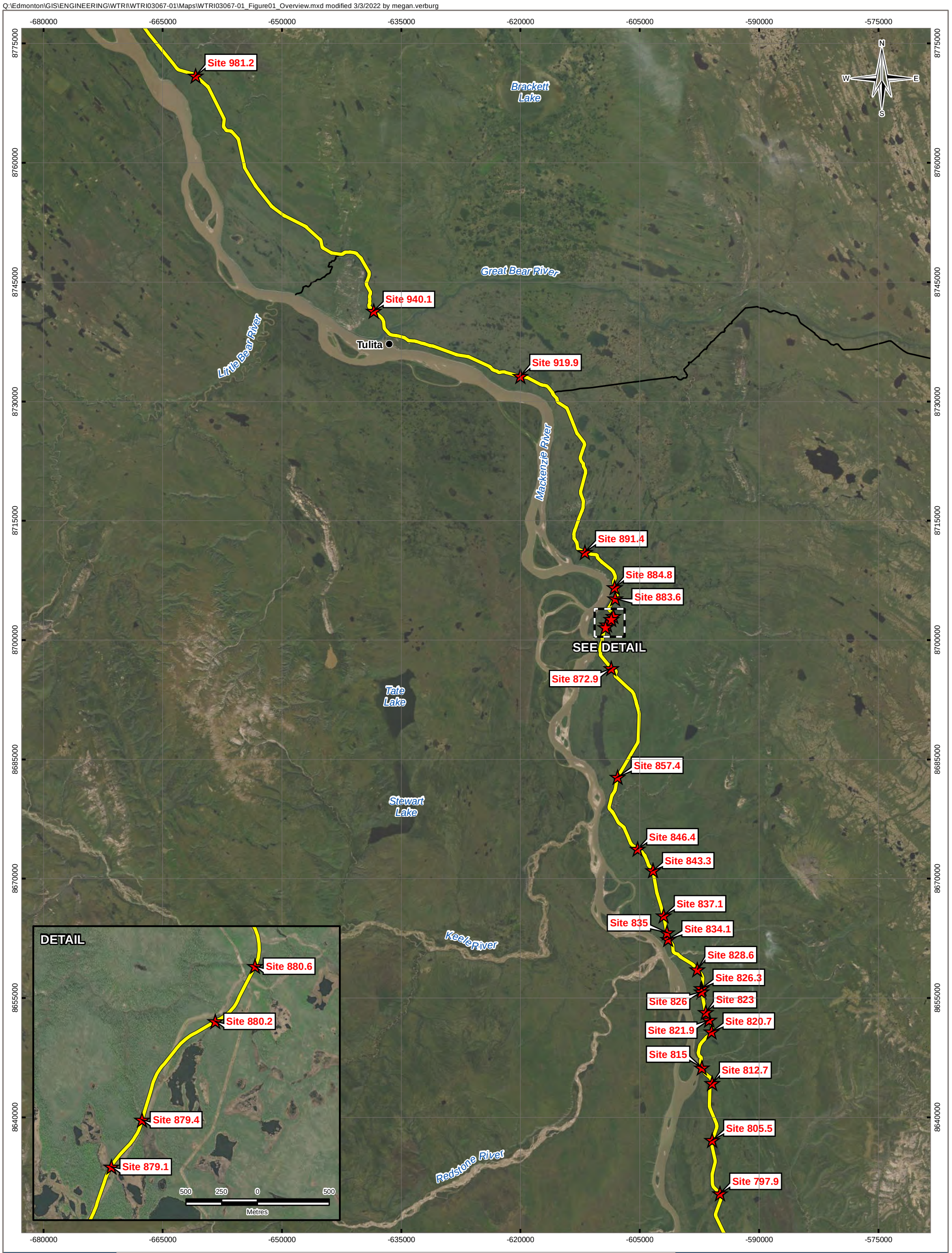
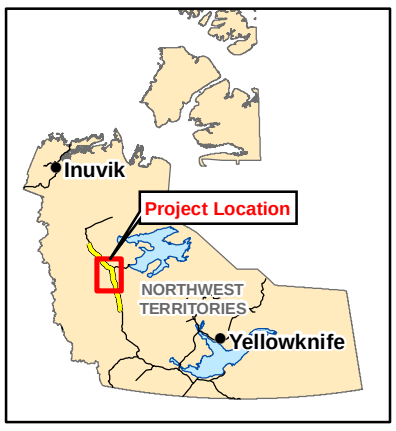



## LEGEND

- Watercourse Crossing
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Populated Place
- Mackenzie Valley Winter Road




**NOTES**
Base data source: Imagery provided by ESRI; Maxar
CanVec 1:250,000

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Overview

| | | | | |
|---|---|---|---|---|
| **PROJECTION** Northwest Territories Lambert | | **DATUM** NAD83 | | **CLIENT** Northwest Territories |
| Scale: 1:450,000 — 8 4 0 8 Kilometres | | | | TETRA TECH |
| **FILE NO.** WTRI03067-01_Figure01_Overview.mxd | | | | |
| **OFFICE** Tt-EDM | **DWN** MRV | **CKD** SL | **APVD** TM | **REV** 0 |
| **DATE** March 3, 2022 | **PROJECT NO.** ENG.WTRI03067-01 | | | **Figure 1** |

# SITE 797.9


## LEGEND

- Watercourse Crossing
- Minnow Trap
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 797.9

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,000
40 20 0 40
Metres

**FILE NO.**
WTRI03067-01_Figure28_Site7979.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE**
MARCH 3, 2022

**PROJECT NO.**
ENG.WTRI03067-01

TETRA TECH

**Figure 28**

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# Mackenzie Valley Highway

## Site 797.9 Unnamed Watercourse

**UTM Location:** 10W 437740E 7101829N **Survey Date:** 10/1/2021; 10:55

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 4.1 | 5.8 | 4.3 | 13.0 | 16.8 | - |
| Wetted Width (m) | 2.7 | 3.7 | 3.7 | 7.1 | 5.6 | - |
| Depth at LDB + 25% (m) | 0.4 | 0.3 | 0.9 | 0.9 | 0.2 | - |
| Depth at LDB + 50% (m) | 0.3 | 0.6 | 0.9 | 1.2 | 0.4 | - |
| Depth at LDB + 75% (m) | 0.3 | 0.6 | 0.5 | 0.8 | 0.4 | - |
| Max.BankfullDepth (m) | 1.3 | 1.0 | 1.2 | 0.90 | 0.72 | - |
| Gradient (%) | 1 | 1 | 1 | 1 | 1 | - |
| Dominant Habitat Unit | DD | FL | FL | FL | DD | WL |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) — Organics | 50 | 20 | 40 | 30 | 60 | 100 |
| Substrate (% of Transect Area) — Fines | 50 | 80 | 60 | 70 | 30 | 0 |
| Substrate (% of Transect Area) — Small Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Large Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Cobble | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | N | N | N | N | N | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.9 | 1.0 | 1.0 | 0.6 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.3 | - | - |
| Bank Slope (°) | 90 | 60 | 50 | 50 | 90 | 60 | 30 | 30 | 80 | 50 | - | - |
| Bank Stability | US | US | MS | MS | S | S | S | S | MS | MS | - | - |
| Dom. Bank Material | F | F | F | F | F | F | O | F | O | F | - | - |
| Subdom. Bank Material | O | O | O | O | O | O | F | O | F | BL | - | - |
| Dom. Riparian Veg. | G | G | G | G | G | G | G | G | C | M | G | G |
| Subdom. Riparian Veg. | S | S | G | D | G | G | M | C | G | G | G | G |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 30 | Overhead Cover (%): | 10 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | C |
| Subdom. Instream Cover: | G | Subdom. Overhead Cover: | S |
| Maximum Depth (m) | 1.2 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 10:55 |
| Water Temperature (°C): | 4.5 |
| Dissolved Oxygen (mg/L): | 10.49 |
| Sp. Conductivity (µs/cm): | 339 |
| pH: | 7.50 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | IR |
| Islands: | O |
| Bars: | N |
| Coupling: | PC |
| Confinement: | OC |
| Flow Stage: | Flood |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate | None-Poor | None-Poor |
| Overwintering: | Poor-Moderate | Poor-Moderate | Poor-Moderate |
| Rearing: | Good | Good | Moderate |
| Passage: | Moderate-Good | Moderate-Good | Moderate-Good |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| Minnow Trap (MT) | 72.0 | (hr) |

| Electrofisher Settings | | | |
|---|---|---|---|
| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| BROOK STICKLEBACK | - | 13 | - | 0.18 | 2.5% |
| PEARL DACE | - | 20 | - | 0.28 | 3.9% |
| UNKNOWN | - | 1 | - | 0.01 | 0.2% |
| FINESCALE DACE | - | 477 | - | 6.63 | 93.3% |

### General Comments

Grasses in stream, slight undercutting and exposed roots on left bank 100 m upstream. Logjams upstream and downstream of crossing. Occasional vegetation bars. Crossing was cleared for winter road, abundant grasses instream. Old beaver dam 300m downstream prior to wetland area. Could not measure some aspects due to flooding. The one fish (listed as UNKNOWN) was not identified due to uncertainty of species but is tentatively identified as Northern redbelly dace.

**Photo 1:** Site 797.9—Facing downstream at 100 m upstream from centerline.

**Photo 2:** Site 797.9—Facing downstream at 100 m upstream from centerline.

**Photo 3:** Site 797.9—Aerial photo facing downstream looking at Centre-line.

**Photo 4:** Site 797.9—Facing downstream at 300 m downstream from centerline.

**Photo 5:** Site 797.9— Crossing location facing north and looking upstream.

**Photo 6:** Site 797.9—Channel at crossing, looking downstream.

# SITE 805.5

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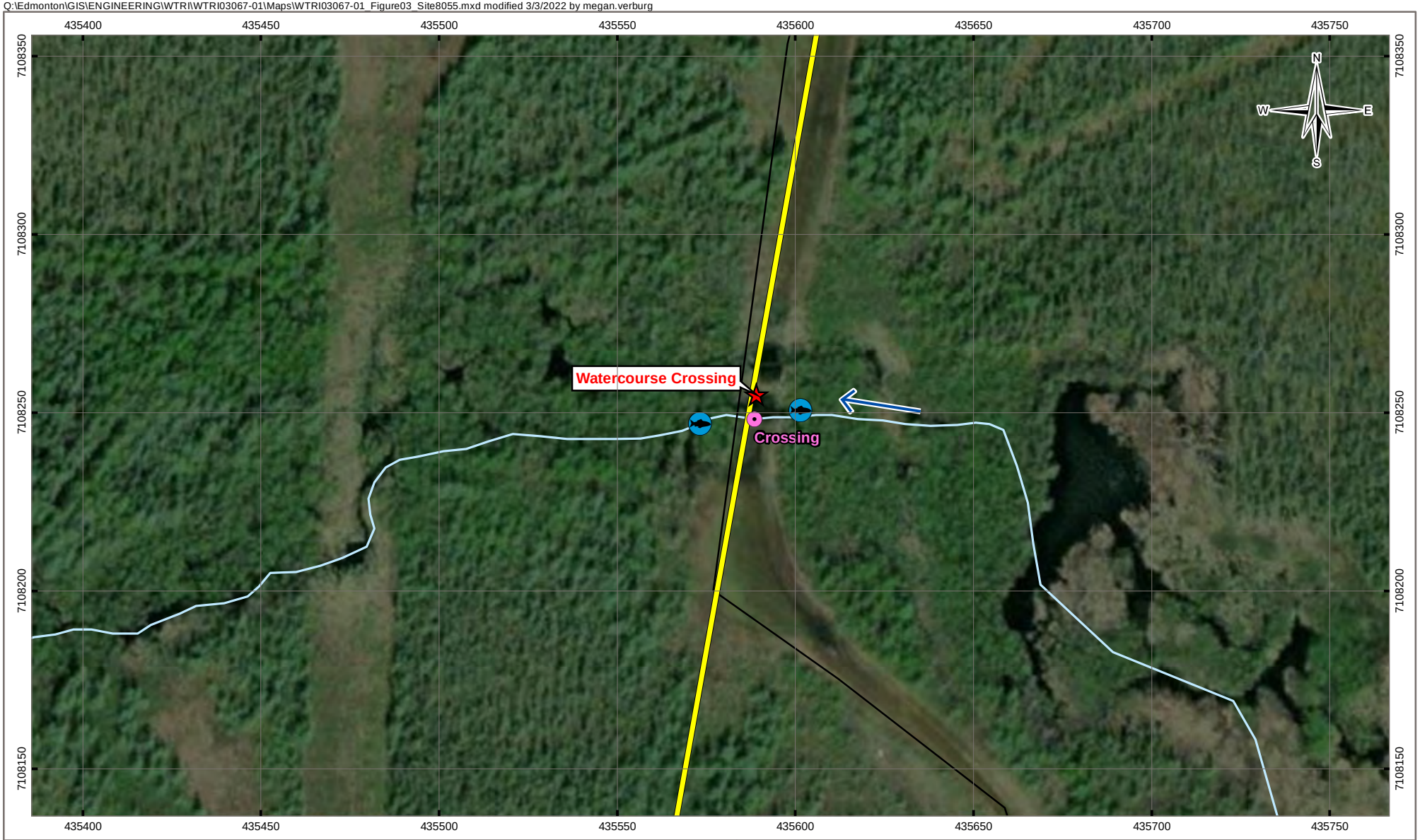



## LEGEND

- Watercourse Crossing
- Minnow Trap
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Mackenzie Valley Winter Road
- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)
CanVec 1:50,000

**STATUS**
ISSUED FOR USE

Scale: 1:1,500
30 15 0 30
Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure03_Site8055.mxd

**CLIENT** Northwest Territories

TETRA TECH

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 805.5

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

**Figure 3**

TETRA TECH

# Mackenzie Valley Highway

## Site 805.5 Unnamed Watercourse

**UTM Location:** 10W 435589E 7108255N **Survey Date:** 10/1/2021; 13:13

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 13:13 |
| Water Temperature (°C): | 4.1 |
| Dissolved Oxygen (mg/L): | 9.10 |
| Sp. Conductivity (µs/cm): | 257 |
| pH: | 7.53 |
| Turbidity (NTU): | Clear |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Good | None | None |
| Overwintering: | Poor-moderate | Poor | Poor |
| Rearing: | Good | Poor-moderate | Poor-moderate |
| Passage: | Moderate | Poor-moderate | Poor-moderate |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | - | Overhead Cover (%): | 30 |
| Dom. Instream Cover: | - | Dom. Overhead Cover: | - |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | - |
| Maximum Depth (m) | - | Dom. Aquatic Veg. Type: | - |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| Minnow Trap (MT) | 44.4 | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| BROOK STICKLEBACK | - | 106 | - | 2.39 | 67.9% |
| PEARL DACE | - | 50 | - | 1.13 | 32.1% |

### General Comments

Transect data was not obtained for this site due to site conditions. The site was a flooded wetland and only had a defined channel at the crossing location. An assessment at the crossing identified the substrate to be 20% organics and 80% fines. Channel width as it crossed the winter road was 0.3 m but was undefined upstream and downstream of the crossing due to flooding. Wetted width at the crossing was 0.14m and the average depth was 0.45 m (0.36 m to 0.62m). Dominant riparian vegetation was grasses with shrubs.

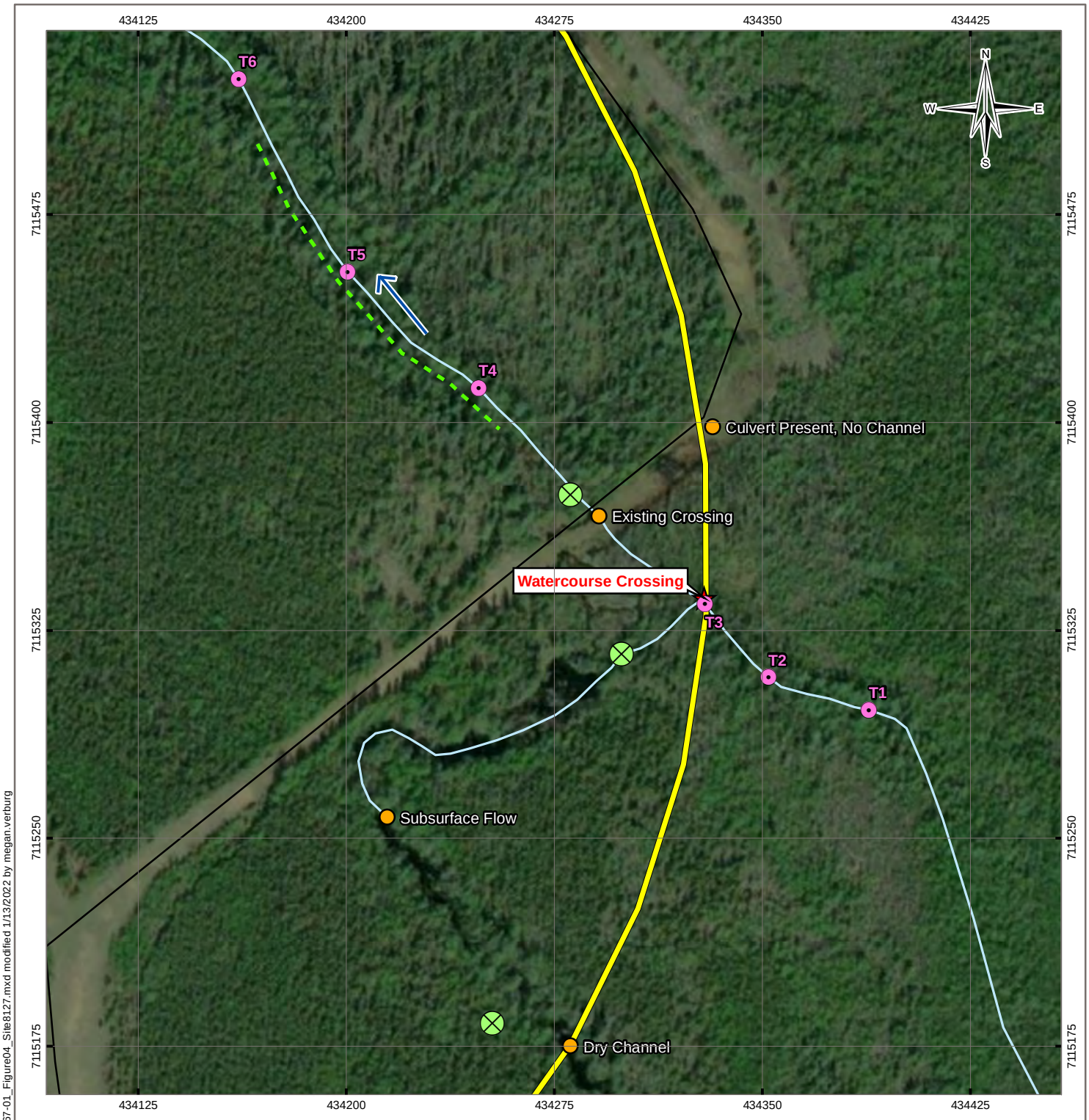
**Photo 1:** Site 805.5—Facing downstream at 50 m downstream from centerline.

**Photo 2:** Site 805.5—View of winter road crossing wetland.

**Photo 3:** Site 805.5—Aerial view of crossing and upstream habitat.

**Photo 4:** Site 805.5—Aerial photo facing the centerline.

# SITE 812.7




## LEGEND

- Watercourse Crossing
- Beaver Dam
- Site Feature
- Transect
- Flow Direction
- Electrofishing
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Mackenzie Valley Winter Road
- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)
CanVec 1:50,000

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 812.7

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,000
40 20 0 40
Metres

**FILE NO.**
WTRI03067-01_Figure04_Site8127.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| MARCH 3, 2022 | ENG.WTRI03067-01 |

TETRA TECH

**Figure 4**

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TETRA TECH

# Mackenzie Valley Highway

## Site 812.7 Unnamed Watercourse

**UTM Location:** 10W 434329E 7115337N **Survey Date:** 10/1/2021; 16:17

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | - | 1.3 | 1.37 | 1.18 | 1.6 | 1.8 |
| Wetted Width (m) | - | 0.76 | 1.12 | 0.75 | 0.75 | 1 |
| Depth at LDB + 25% (m) | - | 0.13 | 0.18 | 0.38 | 0.13 | 0.09 |
| Depth at LDB + 50% (m) | - | 0.21 | 0.14 | 0.51 | 0.17 | 0.09 |
| Depth at LDB + 75% (m) | - | 0.25 | 0.11 | 0.57 | 0.19 | 0.09 |
| Max.BankfullDepth (m) | - | 0.55 | 0.7 | 0.95 | 0.75 | 0.56 |
| Gradient (%) | 1 | 1 | 1 | 1 | 2 | 3 |
| Dominant Habitat Unit | R2 | R3 | FL | FL | R2 | RF |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) Organics | 100 | 30 | 50 | 0 | 0 | 0 |
| Fines | 0 | 20 | 50 | 30 | 10 | 20 |
| Small Gravel | 0 | 50 | 0 | 40 | 30 | 30 |
| Large Gravel | 0 | 0 | 0 | 0 | 10 | 40 |
| Cobble | 0 | 0 | 0 | 10 | 50 | 10 |
| Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Bedrock | 0 | 0 | 0 | 20 | 0 | 0 |
| Embeddedness | N | M | N | L | N | L |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | - | - | 0.3 | 0.3 | 0.5 | 0.6 | 0.5 | 0.4 | 0.6 | 0.6 | 0.43 | 0.52 |
| Bank Slope (°) | - | - | 90 | 70 | 80 | 80 | 80 | 80 | 70 | 75 | 50 | 45 |
| Bank Stability | - | - | S | S | S | S | MS | MS | MS | MS | S | S |
| Dom. Bank Material | O | O | SG | SG | O | O | F | F | SG | SG | F | F |
| Subdom. Bank Material | F | F | O | O | F | F | O | O | F | F | O | O |
| Dom. Riparian Veg. | D | D | D | D | S | S | D | D | D | D | D | D |
| Subdom. Riparian Veg. | S | S | S | S | D | D | S | S | S | S | S | S |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 30 | Overhead Cover (%): | 70 |
| Dom. Instream Cover: | Co | Dom. Overhead Cover: | M |
| Subdom. Instream Cover: | UCB | Subdom. Overhead Cover: | S |
| Maximum Depth (m) | 0.6 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 16:17 |
| Water Temperature (°C): | 0.1 |
| Dissolved Oxygen (mg/L): | 12.53 |
| Sp. Conductivity (µs/cm): | 435 |
| pH: | 7.74 |
| Turbidity (NTU): | CLEAR |

### Channel Characteristics

| | |
|---|---|
| Pattern: | IR |
| Islands: | N |
| Bars: | N |
| Coupling: | DC |
| Confinement: | FC |
| Flow Stage: | Low |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Good | Poor | Poor |
| Overwintering: | None-Poor | None-Poor | None-Poor |
| Rearing: | Good | Good | Moderate |
| Passage: | Moderate-Good | Moderate | Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| Backpack Electrofisher (EB) | 263 | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| 225 | 30 | 12 | 150 |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISH CAPTURED | - | - | - | - | - |
| | - | - | - | - | |
| | - | - | - | - | |
| | - | - | - | - | |
| | - | - | - | - | |

### General Comments

This channel had excellent spawning potential, and consisted of good fish habitat. There is a small change in grade near 300 m downstream but this would not affect fish passage. There is woody debris throughout and some minor logjam which may create partial barriers to fish passage. There is trace undercut banks upstream, and channel becomes poorly defined with low water depths at 100 m upstream. There were several beaver dams at this site. One at the crossing on the downstream side of centerline, one at a tributary to the channel approximately 50 m upstream, and one further upstream the tributary watercourse (however, this channel was dry). The second channel runs parallel to the winter road and goes subsurface near an abandoned and dry beaver dam.

**Photo 1:** Site 812.7—Facing upstream at 100 m upstream from centerline.

**Photo 2:** Site 812.7—Facing downstream at 100 m downstream from centerline.

**Photo 3:** Site 812.7—Facing downstream at 200 m downstream from centerline.

**Photo 4:** Site 812.7—Facing upstream 300 m downstream from centerline.

**Photo 5:** Site 812.7—Existing crossing with the winter road, approximately 40 m downstream from proposed line.

**Photo 6:** Site 812.7— Water in clearing approximately 50 m north of site 812.7. N

# SITE 815

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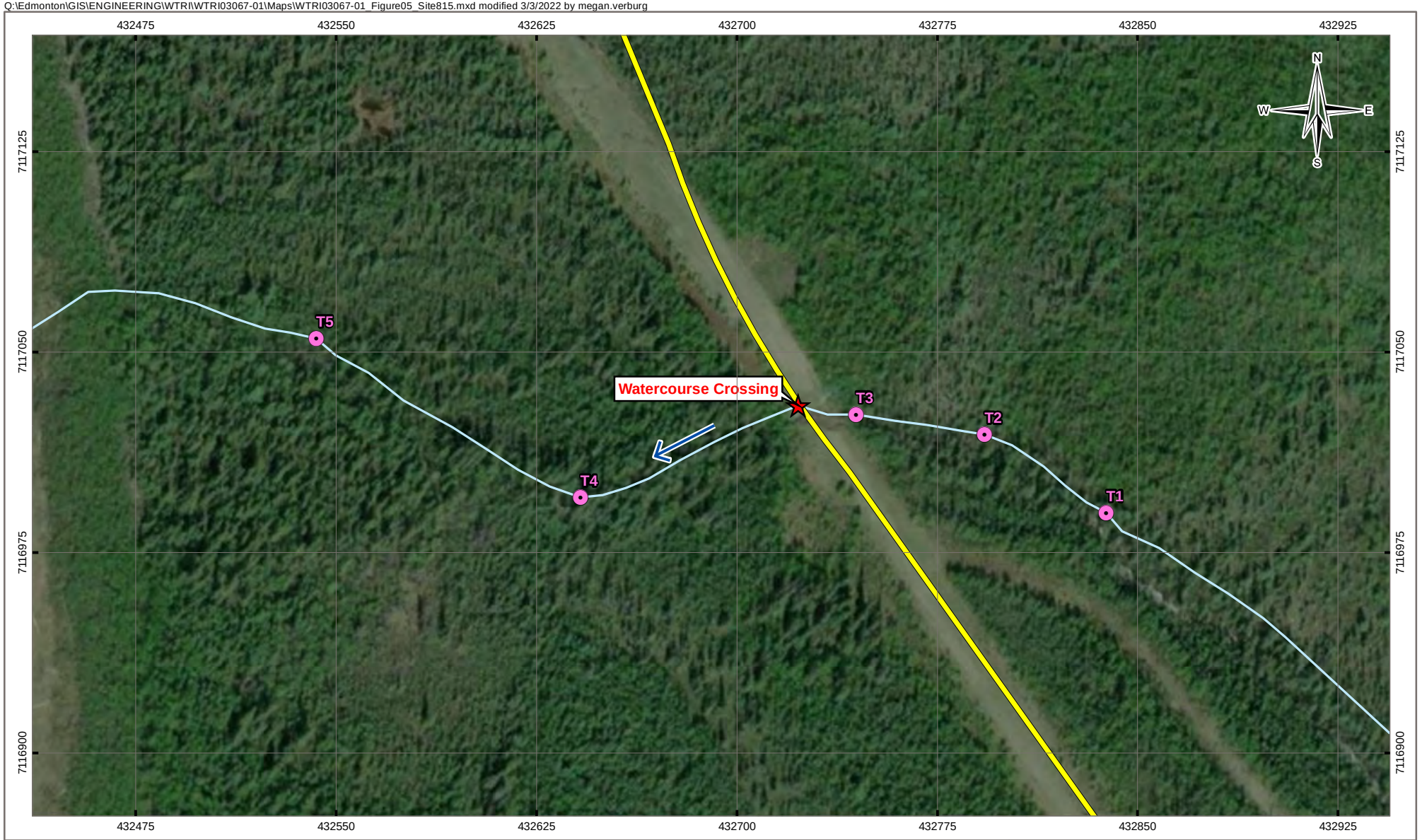



## LEGEND

- Watercourse Crossing
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

Scale: 1:2,000
40 20 0 40
Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure05_Site815.mxd

**CLIENT** Northwest Territories

TETRA TECH

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 815

**Figure 5**

TETRA TECH

# Mackenzie Valley Highway

## Site 815 Unnamed Watercourse

**UTM Location:** 10W 432721E 7117031N **Survey Date:** 10/2/2021; 13:05

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | | 2 (↑50) | | 3 (CL) | | 4 (↓100) | | 5 (↓200) | | 6 (↓300) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel Width (m) | 1.8 | | 2.4 | | 1.9 | | 1.8 | | 2.5 | | - | |
| Wetted Width (m) | 1.3 | | 1.0 | | 1.4 | | 1.0 | | 0.6 | | - | |
| Depth at LDB + 25% (m) | 0.1 | | 0.1 | | 0.1 | | 0.0 | | 0.0 | | - | |
| Depth at LDB + 50% (m) | 0.1 | | 0.1 | | 0.1 | | 0.0 | | 0.1 | | - | |
| Depth at LDB + 75% (m) | 0.1 | | 0.0 | | 0.1 | | 0.0 | | 0.0 | | - | |
| Max.BankfullDepth (m) | 0.5 | | 0.6 | | 0.4 | | 0.4 | | 0.1 | | - | |
| Gradient (%) | - | | - | | - | | - | | - | | - | |
| Dominant Habitat Unit | R2 | | DD | | R2 | | IP1 | | WL | | - | |
| **Stream Bed** | | | | | | | | | | | | |
| Substrate (% of Transect Area) Organics | 0 | | 0 | | 10 | | 10 | | 90 | | - | |
| Fines | 30 | | 0 | | 60 | | 10 | | 10 | | - | |
| Small Gravel | 30 | | 20 | | 20 | | 40 | | 0 | | - | |
| Large Gravel | 20 | | 40 | | 0 | | 20 | | 0 | | - | |
| Cobble | 20 | | 40 | | 10 | | 20 | | 0 | | - | |
| Boulder | 0 | | 0 | | 0 | | 0 | | 0 | | - | |
| Bedrock | 0 | | 0 | | 0 | | 0 | | 0 | | - | |
| Embeddedness | L | | N | | L | | M | | H | | - | |
| **Bank Measurements** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** |
| Bank Height (m) | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.3 | - | - | - | - |
| Bank Slope (°) | 70 | 60 | 30 | 80 | 50 | 30 | 90 | 90 | - | - | - | - |
| Bank Stability | MS | MS | MS | MS | MS | MS | MS | MS | - | - | - | - |
| Dom. Bank Material | O | O | F | F | O | F | SG | F | SG | F | - | - |
| Subdom. Bank Material | F | F | O | O | SG | SG | O | O | O | O | - | - |
| Dom. Riparian Veg. | S | S | S | S | S | S | D | D | D | D | - | - |
| Subdom. Riparian Veg. | C | D | G | G | G | G | S | S | S | S | - | - |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 30 | Overhead Cover (%): | 80 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | G |
| Maximum Depth (m) | - | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 13:05 |
| Water Temperature (°C): | 2.3 |
| Dissolved Oxygen (mg/L): | 12.13 |
| Sp. Conductivity (µs/cm): | 760 |
| pH: | 8.37 |
| Turbidity (NTU): | Clear |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ME |
| Islands: | N |
| Bars: | N |
| Coupling: | PC |
| Confinement: | FC |
| Flow Stage: | Moderate |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Poor-Moderate | Poor | None-Poor |
| Overwintering: | Poor | Poor | Poor |
| Rearing: | Poor-Moderate | Poor-Moderate | None-Poor |
| Passage: | Poor-Moderate | Poor | Poor |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

Fish habitat is poor, unlikely to hold fish due to lack of outlet downstream (converts to wetland) and logjams upstream. Crossing is eroded with two culverts that are not in line with watercourse. Not deep enough for minnow traps and too much woody debris/ too narrow for electrofishing. Not suitable for fish due to woody debris barriers throughout crossing section and poor connectivity. Minor undercutting of banks upstream. No fishing attempted at this site.

**Photo 1:** Site 815—Facing upstream from 100 m upstream from centerline.

**Photo 2:** Site 815—Facing upstream from 50 m upstream from centerline.

**Photo 3:** Site 815—Facing upstream at 100 m downstream from centerline.

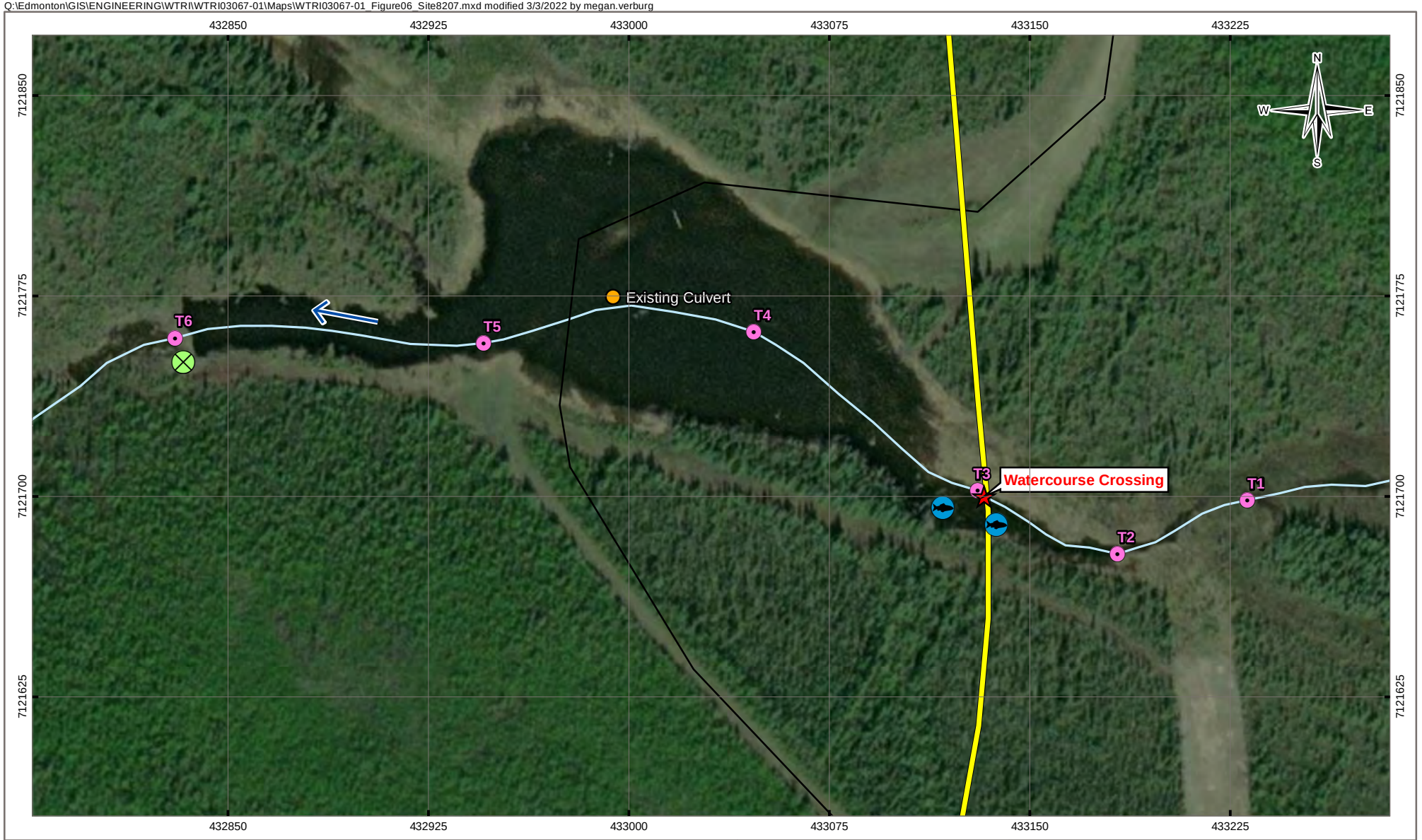
**Photo 4:** Site 815—Facing downstream from 200 m downstream from centerline.

**Photo 5:** Site 815—aerial view of centerline.

**Photo 6:** Site 815—Existing culvert, facing downstream at centerline.

# SITE 820.7

Q:\Edmonton\GIS\ENGINEERING\WTRI\WTRI03067-01\Maps\WTRI03067-01_Figure06_Site8207.mxd modified 3/3/2022 by megan.verburg




## LEGEND

- Watercourse Crossing
- Beaver Dam
- Minnow Trap
- Site Feature
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Mackenzie Valley Winter Road
- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)
CanVec 1:50,000

**STATUS**
ISSUED FOR USE

Scale: 1:2,000
40 20 0 40
Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure06_Site8207.mxd

CLIENT: Northwest Territories

TETRA TECH

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 820.7

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

**Figure 6**

# Mackenzie Valley Highway

## Site 820.7 Unnamed Watercourse

**UTM Location:** 10W 433131E 7121700N **Survey Date:** 10/6/2021; 14:00

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 3.4 | 13.5 | 15.5 | 95.0 | 7.1 | 3.2 |
| Wetted Width (m) | 3.4 | 4.9 | 11.6 | 25.0 | 4.9 | 1.2 |
| Depth at LDB + 25% (m) | 0.1 | 0.1 | 0.2 | 0.2 | 0.4 | 0.1 |
| Depth at LDB + 50% (m) | 0.2 | 0.1 | 0.2 | 0.2 | 0.5 | 0.1 |
| Depth at LDB + 75% (m) | 0.1 | 0.1 | 0.3 | 0.3 | 0.4 | 0.1 |
| Max.BankfullDepth (m) | 0.0 | 1.3 | 0.7 | 2.0 | 1.0 | 0.5 |
| Gradient (%) | 2 | 2 | 1 | 1 | 1 | 2 |
| Dominant Habitat Unit | FL | FL | IP1 | IP1 | IP1 | BD |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) Organics | 100 | 30 | 100 | 60 | 100 | 0 |
| Fines | 0 | 0 | 0 | 40 | 0 | 25 |
| Small Gravel | 0 | 30 | 0 | 0 | 0 | 20 |
| Large Gravel | 0 | 20 | 0 | 0 | 0 | 25 |
| Cobble | 0 | 10 | 0 | 0 | 0 | 10 |
| Boulder | 0 | 10 | 0 | 0 | 0 | 20 |
| Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | N | H | N | N | N | H |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.0 | 0.2 | 0.4 | 1.3 | 0.2 | 0.4 | 0.3 | 0.3 | 0.2 | 0.5 | 0.20 | 0.20 |
| Bank Slope (°) | 10 | 10 | 15 | 3 | 10 | 40 | 10 | 30 | 30 | 40 | 30 | 70 |
| Bank Stability | US | US | MS | US | MS | S | MS | MS | MS | MS | US | US |
| Dom. Bank Material | O | O | O | O | O | O | O | O | F | F | F | SG |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | O | O | O | LG |
| Dom. Riparian Veg. | S | S | G | G | G | G | G | G | G | G | G | G |
| Subdom. Riparian Veg. | G | G | S | S | S | C | M | M | D | G | G | G |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 10 | Overhead Cover (%): | 5 |
| Dom. Instream Cover: | G | Dom. Overhead Cover: | C |
| Subdom. Instream Cover: | EV | Subdom. Overhead Cover: | - |
| Maximum Depth (m) | 0.6 | Dom. Aquatic Veg. Type: | - |

| Quality Data | | Channel Characteristics | |
|---|---|---|---|
| Time of Day (HH:MM): | 14:01 | Pattern: | ME |
| Water Temperature (°C): | 2.3 | Islands: | O |
| Dissolved Oxygen (mg/L): | 10.47 | Bars: | N |
| Sp. Conductivity (µs/cm): | 731 | Coupling: | DC |
| pH: | 7.72 | Confinement: | OC |
| Turbidity (NTU): | Clear | Flow Stage: | Pooled |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Poor-Moderate | None | None |
| Overwintering: | Poor | Poor | None-Poor |
| Rearing: | Moderate | Poor | None-Poor |
| Passage: | Moderate | Poor-Moderate | Poor-Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| Minnow Trap (MT) | 50.0 | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISH CAPTURED | | | | | |

### General Comments

Poorly defined channel within floodplain with pockets of grasses throughout. Upstream of 300 m downstream is a beaver dam. There was limited crown cover due to flooded region, which likely fills during freshet. Aquatic vegetation growing throughout. Exposed culvert along winter road.

**Photo 1:** Site 820.7—Facing downstream at 50 m upstream from centerline.

**Photo 2:** Site 820.7—Facing downstream at 100 m downstream from centerline.

**Photo 3:** Site 820.7—Facing downstream from 200 m downstream from centerline.

**Photo 4:** Site 820.7—Facing upstream at 300 m downstream from centerline.

**Photo 5:** Site 820.7—Aerial view of the site looking west.

**Photo 6:** Site 820.7—Damaged culvert at existing centerline.

# SITE 821.9

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## LEGEND

- Watercourse Crossing
- Site Feature
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

Scale: 1:1,500

30 15 0 30

Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure07_Site8219.mxd

**CLIENT** Northwest Territories

TETRA TECH

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 821.9

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

**Figure 7**

TETRA TECH

# Mackenzie Valley Highway

## Site 821.9 Unnamed Watercourse

**UTM Location:** 10W 432580E 7123103N **Survey Date:** 10/9/2021; 11:13

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 1.2 | 1.5 | 1.3 | 1.4 | 1.2 | 2.1 |
| Wetted Width (m) | 1.3 | 1.3 | 0.9 | 1.0 | 0.2 | 0.9 |
| Depth at LDB + 25% (m) | 0.1 | 0.2 | 0.4 | 0.0 | 0.0 | 0.1 |
| Depth at LDB + 50% (m) | 0.3 | 0.3 | 0.4 | 0.2 | 0.0 | 0.1 |
| Depth at LDB + 75% (m) | 0.3 | 0.2 | 0.4 | 0.1 | 0.0 | 0.1 |
| Max.BankfullDepth (m) | 0.57 | 0.49 | 0.71 | 0.70 | 0.23 | 0.68 |
| Gradient (%) | 2 | 2 | 1 | 2 | 2 | 1 |
| Dominant Habitat Unit | P3 | IP3 | R2 | R2 | DR | FL |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) Organics | 20 | 40 | 0 | 0 | 40 | 30 |
| Fines | 30 | 0 | 50 | 0 | 30 | 40 |
| Small Gravel | 50 | 60 | 30 | 100 | 30 | 30 |
| Large Gravel | 0 | 0 | 20 | 0 | 0 | 0 |
| Cobble | 0 | 0 | 0 | 0 | 0 | 0 |
| Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | N | N | N | N | N | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.3 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.5 | 0.5 | 0.1 | 0.2 | 0.6 | 0.6 |
| Bank Slope (°) | 40 | 60 | 90 | 90 | 30 | 20 | 90 | 100 | 45 | 45 | 30 | 30 |
| Bank Stability | US | US | US | US | MS | MS | US | US | MS | MS | MS | MS |
| Dom. Bank Material | O | O | O | O | O | O | O | O | O | O | O | O |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | S | S | S | M | S | S | D | D | S | S | C | S |
| Subdom. Riparian Veg. | D | D | M | S | G | G | D | D | D | D | S | C |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | - | Overhead Cover (%): | 30 |
| Dom. Instream Cover: | - | Dom. Overhead Cover: | WD |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | S |
| Maximum Depth (m) | 0.4 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 11:13 |
| Water Temperature (°C): | 1.4 |
| Dissolved Oxygen (mg/L): | 7.52 |
| Sp. Conductivity (µs/cm): | 1,097 |
| pH: | 7.78 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ST |
| Islands: | N |
| Bars: | N |
| Coupling: | PC |
| Confinement: | OC |
| Flow Stage: | Moderate |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate | Moderate | Moderate |
| Overwintering: | Poor | Poor | Poor |
| Rearing: | Good | Good | Moderate |
| Passage: | Moderate-Good | Moderate-Good | Moderate-Good |

### Fish Sampling Data

| Method | Effort |
|---|---|
| No Electrofishing | - (s) |
| No Trapping | - (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Some sign of grasses under snow as well. Undercut on left bank occasionally in upstream reach. Abundant woody debris and leaves resting on top of sediment throughout, Dry channel between 100 m and 200 m downstream, frozen to bed and not enough flow. Debris buildup occasionally thoughout,the watercourse creating potential barriers to fish. Woody debris overhanging throughout. No fishing conducted due to freezing conditions.

**Photo 1:** Site 821.9—Upstream view of 100 m downstream from centerline.

**Photo 2:** Site 821.9— Downstream view of 50 m upstream from centerline.

**Photo 3:** Site 821.9— Upstream view of channel at centerline.

**Photo 4:** Site 821.9—downstream view of crossing from aerial view.

**Photo 5:** Site 821.9— View of winter road looking northwest toward watercourse crossing.

**Photo 6:** Site 821.9—view of existing crossing.

# SITE 823

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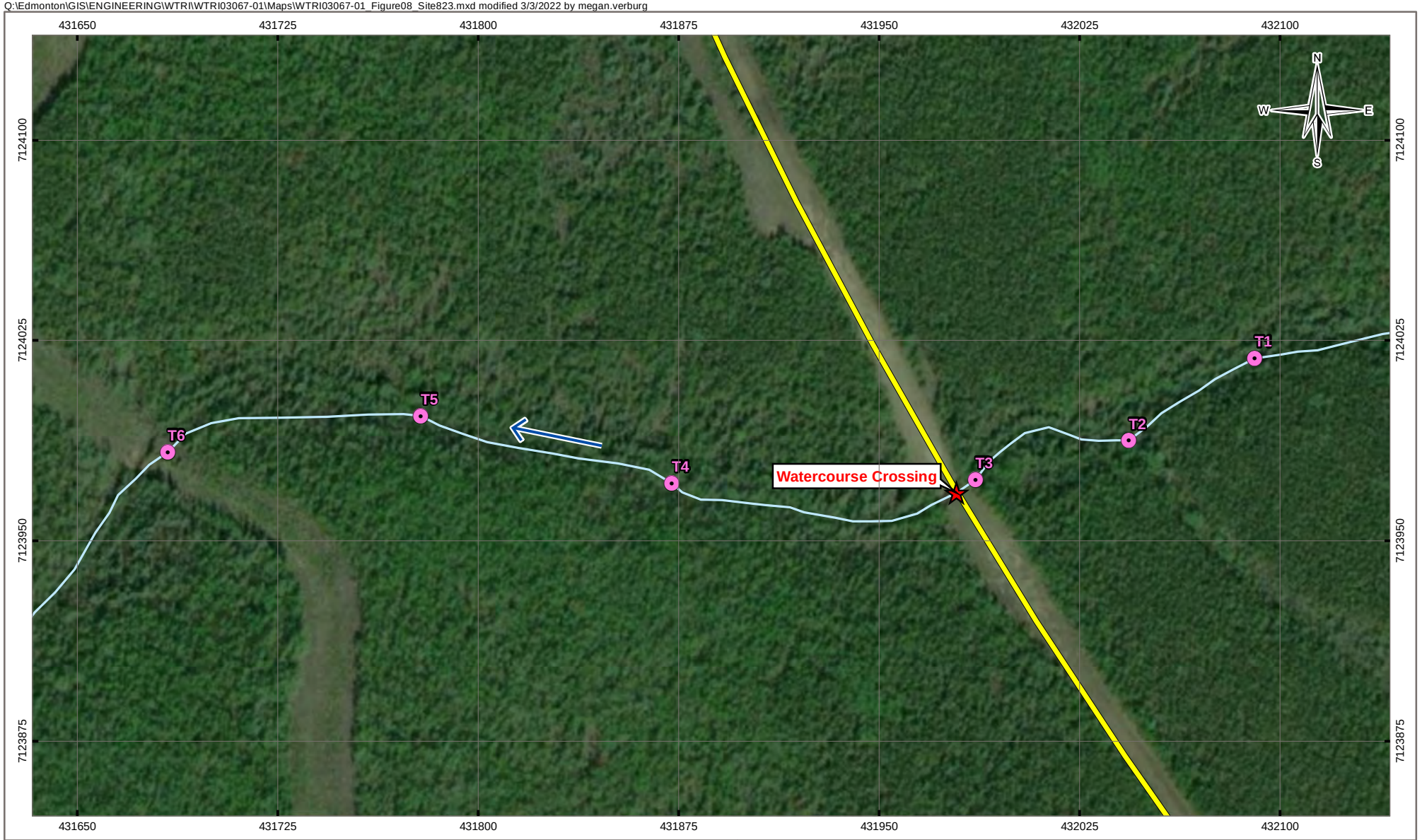


## LEGEND

- Watercourse Crossing
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

Scale: 1:2,000
40 20 0 40
Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure08_Site823.mxd

**CLIENT** Northwest Territories

TETRA TECH

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 823

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

**Figure 8**

TETRA TECH

# Mackenzie Valley Highway

## Site 823 Unnamed Watercourse

**UTM Location:** 10W 431979E 7123968N **Survey Date:** 10/6/2021; 16:00

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 1.9 | 1.3 | 0.2 | 0.2 | 0.1 | 0.0 |
| Wetted Width (m) | 2.5 | 1.0 | 0.1 | 0.0 | 0.1 | 0.0 |
| Depth at LDB + 25% (m) | 2.2 | 1.7 | 0.2 | 0.2 | 0.3 | 0.0 |
| Depth at LDB + 50% (m) | 3.0 | 1.0 | 0.1 | 0.2 | 0.1 | 0.0 |
| Depth at LDB + 75% (m) | 1.7 | 1.4 | 0.4 | 0.4 | 0.3 | 0.0 |
| Max.BankfullDepth (m) | 4.1 | 2.3 | 0.97 | 0.84 | 0.77 | 0.43 |
| Gradient (%) | 3 | 2 | 2 | 2 | 1 | 1 |
| Dominant Habitat Unit | R1 | RF | R1 | R1 | R1 | R1 |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) Organics | 0 | 0 | 0 | 0 | 0 | 0 |
| Fines | 0 | 0 | 0 | 10 | 40 | 0 |
| Small Gravel | 0 | 0 | 0 | 30 | 20 | 10 |
| Large Gravel | 20 | 30 | 30 | 40 | 30 | 20 |
| Cobble | 30 | 30 | 30 | 20 | 0 | 60 |
| Boulder | 45 | 39 | 30 | 0 | 10 | 10 |
| Bedrock | 5 | 1 | 20 | 0 | 0 | 0 |
| Embeddedness | L | L | N | L | L | L |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.8 | 1.1 | 0.6 | 0.4 | 0.6 | 0.4 | 0.4 | 0.4 | 0.5 | 0.4 | 0.4 | 0.4 |
| Bank Slope (°) | 90.0 | 80.0 | 65.0 | 40.0 | 80.0 | 80.0 | 30.0 | 60.0 | 80.0 | 60.0 | 30.0 | 70.0 |
| Bank Stability | MS | MS | MS | MS | MS | MS | MS | MS | US | US | MS | MS |
| Dom. Bank Material | F | F | O | O | F | F | F | F | O | O | O | O |
| Subdom. Bank Material | O | O | F | F | O | O | O | O | F | F | F | F |
| Dom. Riparian Veg. | D | C | S | S | S | S | S | S | S | S | S | S |
| Subdom. Riparian Veg. | S | S | C | C | C | C | M | M | C | C | C | C |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 40 | Overhead Cover (%): | 60 |
| Dom. Instream Cover: | Co | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | UCB | Subdom. Overhead Cover: | C |
| Maximum Depth (m) | 3.0 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 16:00 |
| Water Temperature (°C): | 0.3 |
| Dissolved Oxygen (mg/L): | 11.60 |
| Sp. Conductivity (µs/cm): | 1,123 |
| pH: | 8.14 |
| Turbidity (NTU): | Clear |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ST |
| Islands: | I |
| Bars: | N |
| Coupling: | CO |
| Confinement: | OC |
| Flow Stage: | Low |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate-Good | Poor-Moderate | Poor |
| Overwintering: | None-Poor | None-Poor | None-Poor |
| Rearing: | Good | Good | Moderate |
| Passage: | Moderate-Good | Moderate-Good | Moderate-Good |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Low water levels at time of assessment and was mostly frozen. Abundant woody debris and logjams throughout reach, some bank erosion and some undercut banks. No fishing was conducted due to freezing and frozen conditions.

**Photo 1:** Site 823—Upstream view of 300 m downstream from centerline, located within the pipeline clearing.

**Photo 2:** Site 823—Upstream view of 100 m downstream from centerline/

**Photo 3:** Site 823—Upstream view from crossing location.

**Photo 4:** Site 823— Upstream view of 100 m upstream from centerline.

**Photo 5:** Site 823—View of existing culvert at centerline, looking downstream.

**Photo 6:** Site 823— View of centerline from existing clearing, looking southeast.

# SITE 826

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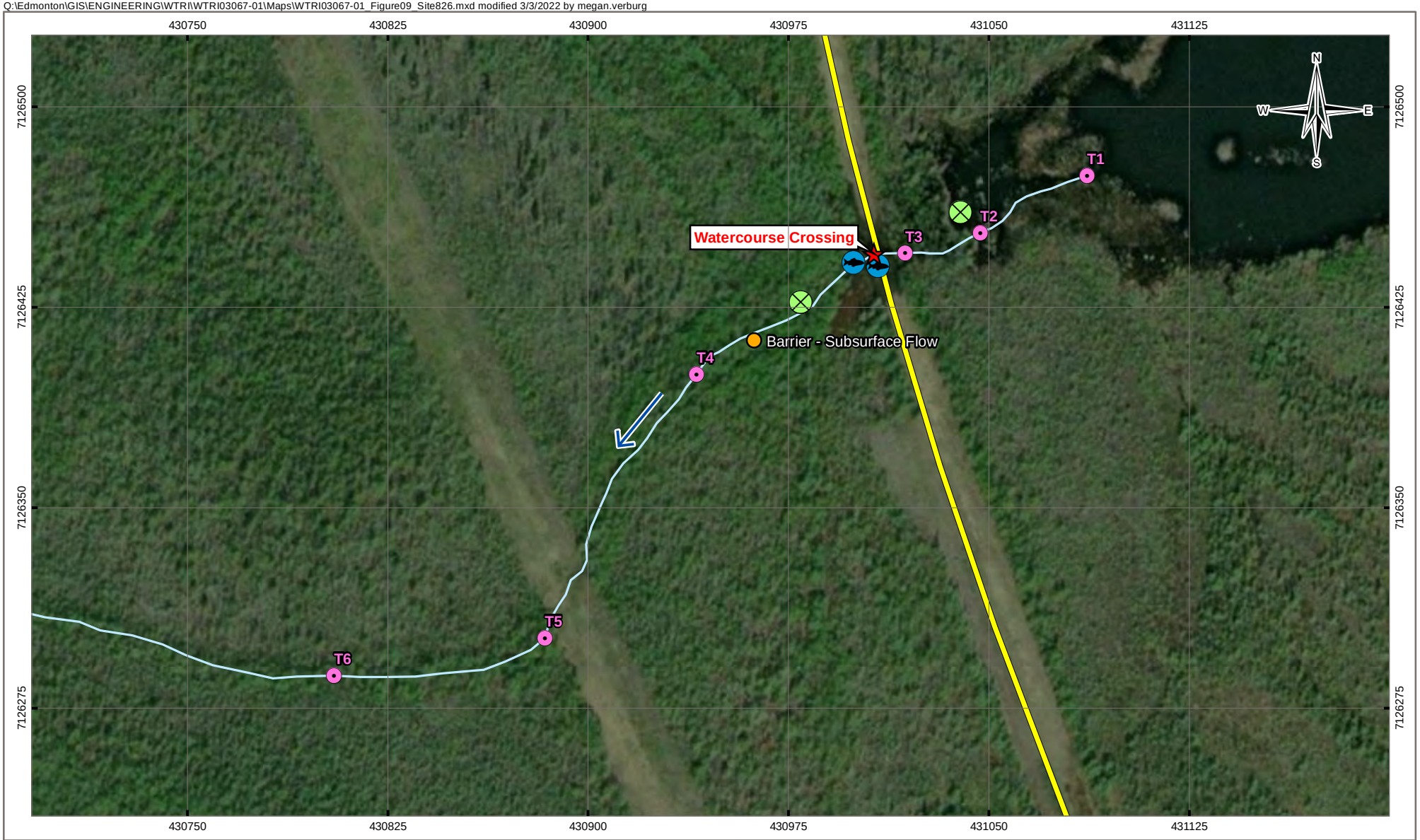


## LEGEND

- Watercourse Crossing
- Beaver Dam
- Minnow Trap
- Site Feature
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

Scale: 1:2,000

40 20 0 40

Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure09_Site826.mxd

**CLIENT** Northwest Territories

TETRA TECH

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE** March 3, 2022

**PROJECT NO.** ENG.WTRI03067-01

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 826

**Figure 9**

TETRA TECH

# Mackenzie Valley Highway

## Site 826 Unnamed Watercourse

**UTM Location:** 10W 431007E 7126445N **Survey Date:** 10/8/2021; 13:37

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 3.0 | 0.8 | 1.8 | 1.3 | 1.0 | 1.0 |
| Wetted Width (m) | 2.1 | 0.6 | 1.1 | 0.6 | 0.8 | 0.6 |
| Depth at LDB + 25% (m) | 0.2 | 0.3 | 0.3 | 0.0 | 0.2 | 0.1 |
| Depth at LDB + 50% (m) | 0.2 | 0.3 | 0.3 | 0.1 | 0.2 | 0.1 |
| Depth at LDB + 75% (m) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 |
| Max.BankfullDepth (m) | 0.54 | 0.51 | 0.69 | 0.34 | 0.46 | 0.48 |
| Gradient (%) | 2 | 2 | 2 | 3 | 4 | 4 |
| Dominant Habitat Unit | FL | R3 | R3 | DD | DD | DD |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) – Organics | 0 | 0 | 60 | 100 | 100 | 100 |
| Fines | 100 | 100 | 40 | 0 | 0 | 0 |
| Small Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Large Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Cobble | 0 | 0 | 0 | 0 | 0 | 0 |
| Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | N | N | N | N | N | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.3 | 0.4 | 0.2 | 0.2 | 0.4 | 0.4 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.4 |
| Bank Slope (°) | 45 | 60 | 45 | 45 | 80 | 90 | 10 | 10 | 80 | 50 | 50 | 50 |
| Bank Stability | MS | US | MS | MS | MS | MS | US | US | US | US | US | US |
| Dom. Bank Material | O | O | O | O | F | F | O | O | O | O | F | O |
| Subdom. Bank Material | F | F | F | F | O | O | F | F | F | F | O | F |
| Dom. Riparian Veg. | G | G | G | G | G | G | S | S | S | S | S | S |
| Subdom. Riparian Veg. | S | S | S | S | S | S | G | G | G | G | G | G |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 80 | Overhead Cover (%): | 80 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | WD |
| Subdom. Instream Cover: | DP | Subdom. Overhead Cover: | - |
| Maximum Depth (m) | 0.3 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 13:40 |
| Water Temperature (°C): | 2.0 |
| Dissolved Oxygen (mg/L): | 11.82 |
| Sp. Conductivity (µs/cm): | 439 |
| pH: | 7.82 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ME |
| Islands: | N |
| Bars: | N |
| Coupling: | PC |
| Confinement: | OC |
| Flow Stage: | Pooled |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate-Good | None | None |
| Overwintering: | Moderate-Good | Moderate | Poor-Moderate |
| Rearing: | Moderate-Good | Moderate-Good | Moderate-Good |
| Passage: | Moderate | Moderate | Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| Minnow Trap (MT) | 44.7 | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISH CAPTURED | | | | | |

### General Comments

Upstream has a ponded area that may provide good overwintering habitat. The channel is irregular with poor connectivity upstream of centerline with limited overhanging vegetation and subsurface flow around historic beaver dam. Downstream has abundant woody debris over channel and good cover from shrubs. There is evidence that there was a fire previously here. Approximately 200 m downstream, banks are unstable with occasional erosion throughout stretch. Most of the overhanging vegetation is shrubs. Two beaver dams were oberved throughout the assessed reach.

**Photo 1:** Site 826— Aerial view of crossing, looking upstream.

**Photo 2:** Site 826— Downstream view of 300 m downstream from centerline.

**Photo 3:** Site 826— Downstream view from 100 m upstream from centerline.

**Photo 4:** Site 826— Upstream view from 50 m upstream from centerline.

**Photo 5:** Site 826— View of crossing from centerline, looking downstream.

# SITE 826.3

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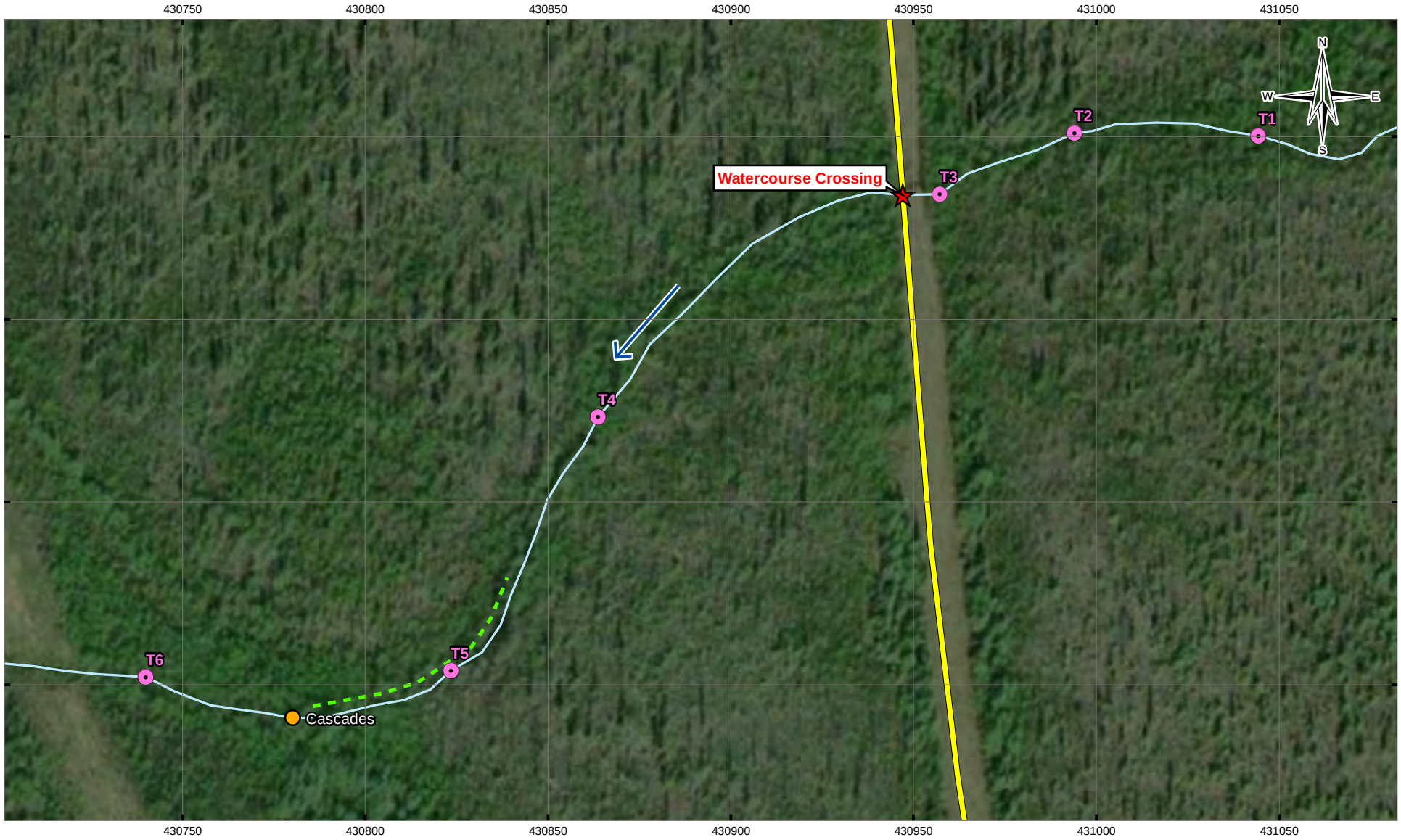



## LEGEND

- Watercourse Crossing
- Site Feature
- Transect
- Electrofishing
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

Scale: 1:1,500

30 15 0 30

Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure10_Site8263.mxd

**CLIENT**
Northwest Territories

TETRA TECH

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 826.3

**Figure 10**

# Mackenzie Valley Highway

## Site 826.3 Unnamed Watercourse

**UTM Location:** 10W 430947E 7126834N **Survey Date:** 10/8/2021; 15:17

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 4.0 | 2.7 | 1.1 | 1.6 | 2.9 | 1.1 |
| Wetted Width (m) | 4.0 | 2.3 | 0.9 | 1.1 | 1.8 | 0.8 |
| Depth at LDB + 25% (m) | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |
| Depth at LDB + 50% (m) | 0.2 | 0.3 | 0.1 | 0.2 | 0.2 | 0.2 |
| Depth at LDB + 75% (m) | 0.1 | 0.3 | 0.1 | 0.1 | 0.2 | 0.2 |
| Max.BankfullDepth (m) | 1.6 | 0.52 | 0.34 | 0.41 | 0.70 | 0.40 |
| Gradient (%) | 2 | 2 | 2 | 2 | 2 | 2 |
| Dominant Habitat Unit | DD | R3 | R3 | R3 | R3 | R3 |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) — Organics | 100 | 90 | 100 | 100 | 70 | 100 |
| Fines | 0 | 10 | 0 | 0 | 30 | 0 |
| Small Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Large Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Cobble | 0 | 0 | 0 | 0 | 0 | 0 |
| Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | N | N | N | N | N | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 1.4 | 0.3 | 0.2 | 0.2 | 0.2 | 0.1 | 0.3 | 0.1 | 0.5 | 0.4 | 0.2 | 0.2 |
| Bank Slope (°) | 85.0 | 20.0 | 30.0 | 30.0 | 70.0 | 40.0 | 50.0 | 50.0 | 60.0 | 60.0 | 40.0 | 20.0 |
| Bank Stability | US | MS | MS | MS | US | US | US | MS | US | US | MS | MS |
| Dom. Bank Material | O | O | O | O | O | O | O | O | O | O | O | O |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | S | S | G | G | S | S | S | S | S | S | S | S |
| Subdom. Riparian Veg. | C | C | S | S | C | C | C | C | D | D | D | D |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 40 | Overhead Cover (%): | 50 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | M |
| Maximum Depth (m) | 0.3 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 15:17 |
| Water Temperature (°C): | 1.2 |
| Dissolved Oxygen (mg/L): | 10.08 |
| Sp. Conductivity (µs/cm): | 663 |
| pH: | 7.81 |
| Turbidity (NTU): | Clear |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ME |
| Islands: | O |
| Bars: | BR |
| Coupling: | CO |
| Confinement: | FC |
| Flow Stage: | Low |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Poor-Moderate | None | None |
| Overwintering: | Poor | None | None |
| Rearing: | Moderate | Moderate | Poor-Moderate |
| Passage: | None-Poor | Poor | Poor |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| Backpack Electrofisher (EB) | 164 | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| 225 | 30 | 12 | 280 |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISH CAPTURED | | | | | - |

### General Comments

Braided with debris jams throughout. Inconsistent wetted width due to channel interrupted by shrub islands. Poor connectivity despite defined channels. Natural debris jam throughout. Signs of historic fire in upland area. Some erosion on left bank 100 m downtream that could couple the channel. The crossing has coupling potential as well. Upstream pond may provide limited overwintering potential for forage fish but shallow water depth and organic substrate would make it unlikely coarse or sportfish could overwinter.

**Photo 1:** Site 826.3— Aerial view of centerline and upstream.

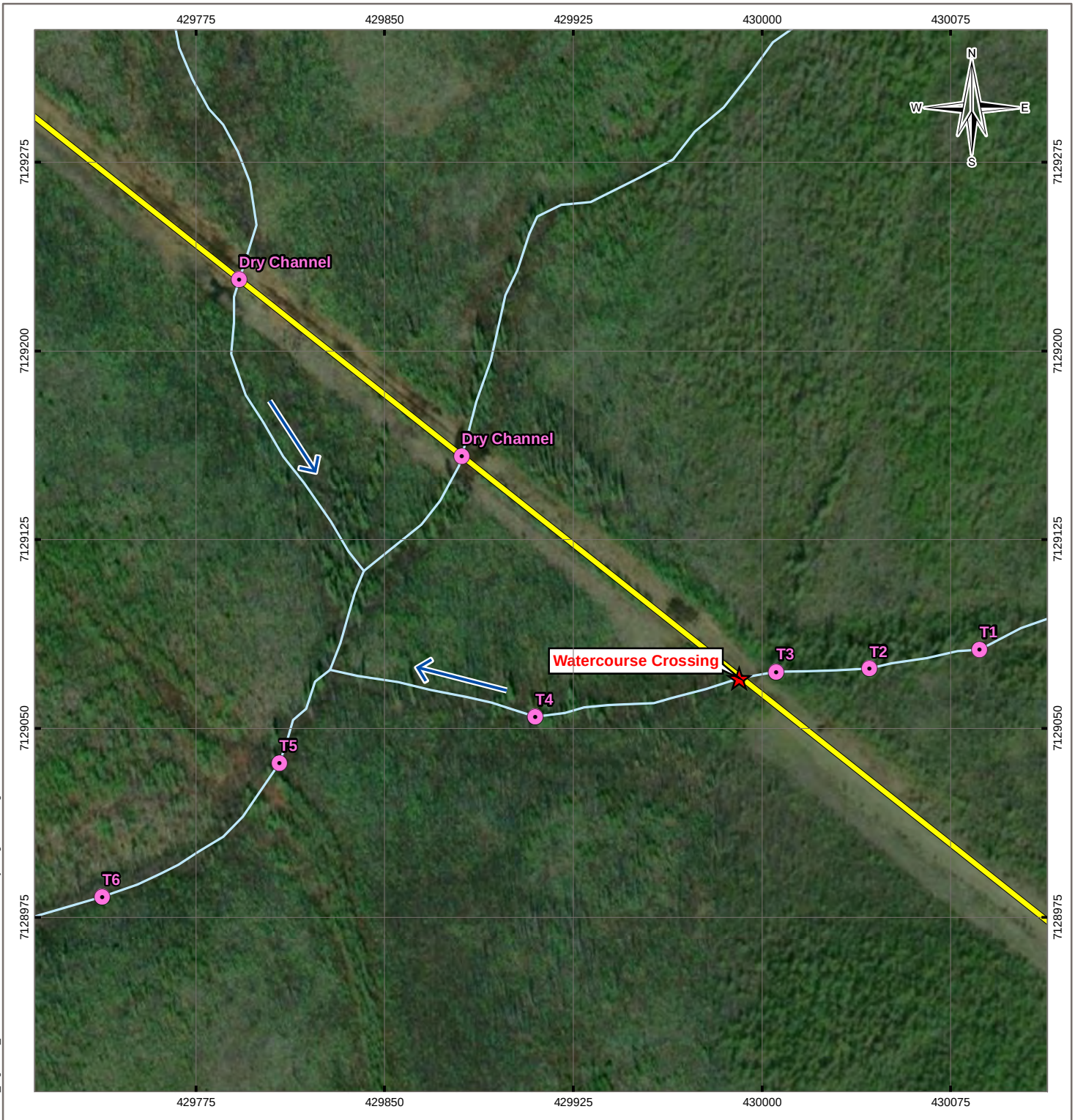
**Photo 2:** Site 826.3—Upstream view of 300 m downstream of centerline.

**Photo 3:** Site 826.3—Upstream view of 100 m upstream from centerline.

**Photo 4:** Site 826.3—Downstream view of 100 m downstream from centerline.

**Photo 5:** Site 826.3—View of watercourse crossing at centerline.

# SITE 828.6




## LEGEND

- Watercourse Crossing
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 828.6

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,200
40 20 0 40
Metres

TETRA TECH

**FILE NO.**
WTRI03067-01_Figure11_Site8286.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE**
March 3, 2022

**PROJECT NO.**
ENG.WTRI03067-01

**Figure 11**

Q:\Edmonton\GIS\ENGINEERING\WTRI\WTRI03067-01\Maps\WTRI03067-01_Figure11_Site8286.mxd modified 3/3/2022 by megan.verburg

# Mackenzie Valley Highway

## 828.6 Unnamed Watercourse

**UTM Location:** 10W 429991E 7129070N **Survey Date:** 10/9/2021; 13:30

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | | 2 (↑50) | | 3 (CL) | | 4 (↓100) | | 5 (↓200) | | 6 (↓300) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel Width (m) | 0.9 | | 0.6 | | 0.8 | | 1.8 | | 1.9 | | 1.6 | |
| Wetted Width (m) | 0.3 | | 0.6 | | 0.7 | | 0.8 | | 1.3 | | 0.6 | |
| Depth at LDB + 25% (m) | 0.1 | | 0.5 | | 0.4 | | 0.3 | | 0.4 | | 0.3 | |
| Depth at LDB + 50% (m) | 0.2 | | 0.5 | | 0.4 | | 0.4 | | 0.5 | | 0.3 | |
| Depth at LDB + 75% (m) | 0.2 | | 0.5 | | 0.3 | | 0.4 | | 0.3 | | 0.3 | |
| Max.BankfullDepth (m) | 0.76 | | 0.81 | | 0.49 | | 0.98 | | 0.83 | | 0.88 | |
| Gradient (%) | 1 | | 1 | | 3 | | 1 | | 1 | | 1 | |
| Dominant Habitat Unit | R2 | | R2 | | R2 | | R2 | | R2 | | R2 | |
| **Stream Bed** | | | | | | | | | | | | |
| Substrate (% of Transect Area) – Organics | 0 | | 0 | | 0 | | 0 | | 10 | | 0 | |
| Substrate (% of Transect Area) – Fines | 60 | | 0 | | 60 | | 40 | | 40 | | 40 | |
| Substrate (% of Transect Area) – Small Gravel | 40 | | 30 | | 30 | | 40 | | 40 | | 60 | |
| Substrate (% of Transect Area) – Large Gravel | 0 | | 40 | | 10 | | 20 | | 10 | | 0 | |
| Substrate (% of Transect Area) – Cobble | 0 | | 30 | | 0 | | 0 | | 0 | | 0 | |
| Substrate (% of Transect Area) – Boulder | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| Substrate (% of Transect Area) – Bedrock | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| Embeddedness | L | | L | | L | | L | | M | | L | |
| **Bank Measurements** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** |
| Bank Height (m) | 0.6 | 0.3 | 0.3 | 0.3 | 0.1 | 0.1 | 0.47 | 0.54 | 0.4 | 0.3 | 0.6 | 0.5 |
| Bank Slope (°) | 80 | 20 | 45 | 45 | 20 | 10 | 65 | 65 | 30 | 70 | 50 | 80 |
| Bank Stability | MS | MS | S | S | S | S | MS | MS | MS | MS | S | MS |
| Dom. Bank Material | O | O | O | O | O | O | O | O | O | O | O | O |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | C | S | M | M | S | S | S | S | D | D | D | D |
| Subdom. Riparian Veg. | S | G | G | G | C | C | G | M | S | S | S | S |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 40 | Overhead Cover (%): | 70 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | WD |
| Subdom. Instream Cover: | UCB | Subdom. Overhead Cover: | S |
| Maximum Depth (m) | 0.5 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 13:37 |
| Water Temperature (°C): | 0.3 |
| Dissolved Oxygen (mg/L): | 11.31 |
| Sp. Conductivity (µs/cm): | 733 |
| pH: | 7.92 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ST |
| Islands: | N |
| Bars: | N |
| Coupling: | PC |
| Confinement: | FC |
| Flow Stage: | Low |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate | Poor | Poor |
| Overwintering: | Poor | None | None |
| Rearing: | Poor-Moderate | Poor-Moderate | Poor-Moderate |
| Passage: | Moderate | Poor-Moderate | Poor-Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Some instream grasses in upstream reach. Woody debris overhanging throughout. Crossing is cleared, coupled area with grasses and same channel width. Downstream has moderate riffles over woody debris and trace undercut banks. New growth in upland due to historic fire. No fishing conducted due to freezing conditions.

**Photo 1:** Site 828.6– Upstream view from 100 m downstream from centerline.

**Photo 2:** Site 828.6—Upstream view of 50 m upstream from centerline.

**Photo 3:** Site 828.6—Downstream view of 300 m downstream from centerline.

**Photo 4:** Site 828.6—Downstream view of 200 m downstream from centerline.

**Photo 5:** Site 828.6—Aerial view of centerline.

**Photo 6:** Site 828.6—View of crossing at centerline.

# SITE 834.1


## LEGEND

- Watercourse Crossing
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Mackenzie Valley Winter Road
- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)
CanVec 1:50,000

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 834.1

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,000
40 20 0 40
Metres

**FILE NO.**
WTRI03067-01_Figure12_Site8341.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE**
March 3, 2022

**PROJECT NO.**
ENG.WTRI03067-01

TETRA TECH

**Figure 12**

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# Mackenzie Valley Highway

## Site 834.1 Unnamed Watercourse

**UTM Location:** 10W 425724E 7132189N **Survey Date:** 10/10/2021; 13:51

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 0.9 | 1.1 | 1.1 | 1.3 | 0.9 | 0.9 |
| Wetted Width (m) | 0.9 | 0.9 | 0.6 | 0.7 | 0.7 | 0.9 |
| Depth at LDB + 25% (m) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Depth at LDB + 50% (m) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Depth at LDB + 75% (m) | 0.1 | 0.1 | 0.1 | 0.1 | 0.6 | 0.2 |
| Max.BankfullDepth (m) | 0.20 | 0.30 | 0.49 | 0.87 | 0.76 | 0.50 |
| Gradient (%) | 1 | 1 | 1 | 1 | 1 | 1 |
| Dominant Habitat Unit | R1 | R1 | R2 | R1 | R1 | R1 |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) Organics | 20 | 20 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) Fines | 80 | 80 | 100 | 20 | 60 | 10 |
| Substrate (% of Transect Area) Small Gravel | 0 | 0 | 0 | 30 | 30 | 40 |
| Substrate (% of Transect Area) Large Gravel | 0 | 0 | 0 | 10 | 10 | 30 |
| Substrate (% of Transect Area) Cobble | 0 | 0 | 0 | 40 | 0 | 20 |
| Substrate (% of Transect Area) Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | N | N | N | L | N | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.1 | 0.1 | 0.2 | 0.1 | 0.4 | 0.4 | 0.8 | 0.5 | 0.2 | 0.1 | 0.34 | 0.24 |
| Bank Slope (°) | 20 | 20 | 20 | 20 | 90 | 90 | 70 | 70 | 30 | 30 | 80 | 80 |
| Bank Stability | US | US | US | US | US | US | US | US | MS | MS | US | US |
| Dom. Bank Material | O | O | O | O | O | O | O | O | O | O | O | O |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | G | G | S | S | D | D | S | S | S | S | S | S |
| Subdom. Riparian Veg. | S | S | D | D | G | G | D | D | D | D | D | D |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 40 | Overhead Cover (%): | 70 |
| Dom. Instream Cover: | UCB | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | C | Subdom. Overhead Cover: | M |
| Maximum Depth (m) | 0.6 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 13:50 |
| Water Temperature (°C): | 1.1 |
| Dissolved Oxygen (mg/L): | 9.42 |
| Sp. Conductivity (µs/cm): | 736 |
| pH: | 7.44 |
| Turbidity (NTU): | Clear |

### Channel Characteristics

| | |
|---|---|
| Pattern: | IR |
| Islands: | N |
| Bars: | N |
| Coupling: | PC |
| Confinement: | OC |
| Flow Stage: | Moderate |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate | Poor | Poor |
| Overwintering: | None-Poor | None-Poor | None |
| Rearing: | Moderate | Moderate | Poor-Moderate |
| Passage: | Poor-Moderate | Poor-Moderate | Poor-Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Upstream has low flow with some pooling. Thick deciduous forest throughout. Mostly overhanging vegetation and shrubs for cover. Minor undercutting downstream on both banks. Downed woody debris throughout, signs of bank erosion and logjams throughout. No fishing conducted due to freezing conditions.

**Photo 1:** Site 834.1— Upstream view of 300 m downstream from centerline.

**Photo 2:** Site 834.1—Downstream view of 100 m downstream from centerline.

**Photo 3:** Site 834.1— Downstream view of 100 m upstream from centerline.

**Photo 4:** Site 834.1—Upstream view at centerline.

**Photo 5:** Site 834.1— View of centerline, snow covering crossing.

**Photo 6:** Site 834.1—Upstream view at centerline.

# SITE 835


## LEGEND

- Watercourse Crossing
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 835

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,000

40 20 0 40

Metres

**FILE NO.**
WTRI03067-01_Figure13_Site835.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE**
March 3, 2022

**PROJECT NO.**
ENG.WTRI03067-01

TETRA TECH

**Figure 13**

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# Mackenzie Valley Highway

## Site 835 Unnamed Watercourse

**UTM Location:** 10W 425405E 7132988N **Survey Date:** 10/10/2021; 14:56

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 1.1 | 1.4 | 1.9 | 1.0 | 1.0 | 1.0 |
| Wetted Width (m) | 0.3 | 0.3 | 1.1 | 1.0 | 0.5 | 0.8 |
| Depth at LDB + 25% (m) | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 |
| Depth at LDB + 50% (m) | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 |
| Depth at LDB + 75% (m) | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 |
| Max.BankfullDepth (m) | 0.39 | 0.48 | 0.58 | 0.58 | 0.37 | 0.42 |
| Gradient (%) | 3 | 2 | 1 | 1 | 2 | 1 |
| Dominant Habitat Unit | R2 | R2 | R1 | R1 | DD | R2 |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) — Organics | 0 | 0 | 0 | 0 | 100 | 80 |
| Substrate (% of Transect Area) — Fines | 10 | 10 | 10 | 40 | 0 | 20 |
| Substrate (% of Transect Area) — Small Gravel | 30 | 30 | 40 | 20 | 0 | 0 |
| Substrate (% of Transect Area) — Large Gravel | 40 | 40 | 40 | 10 | 0 | 0 |
| Substrate (% of Transect Area) — Cobble | 20 | 20 | 10 | 30 | 0 | 0 |
| Substrate (% of Transect Area) — Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | L | N | L | M | L | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.3 | 0.3 | 0.4 | 0.3 | 0.4 | 0.4 | 0.3 | 0.2 | 0.3 | 0.3 | 0.34 | ### |
| Bank Slope (°) | 45 | 45 | 90 | 70 | 90 | 90 | 70 | 70 | 40 | 80 | 45 | 50 |
| Bank Stability | MS | MS | MS | MS | US | US | MS | MS | US | US | MS | MS |
| Dom. Bank Material | O | O | O | O | O | O | O | O | O | O | O | O |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | S | S | S | S | S | D | D | D | D | D | D | M |
| Subdom. Riparian Veg. | G | G | G | G | G | G | S | S | S | S | S | S |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 50 | Overhead Cover (%): | 70 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | UCB | Subdom. Overhead Cover: | D |
| Maximum Depth (m) | 0.8 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 15:00 |
| Water Temperature (°C): | 0.1 |
| Dissolved Oxygen (mg/L): | 11.78 |
| Sp. Conductivity (µs/cm): | 1,001 |
| pH: | 8.07 |
| Turbidity (NTU): | Clear |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ST |
| Islands: | N |
| Bars: | N |
| Coupling: | PC |
| Confinement: | CO |
| Flow Stage: | High |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate | Poor | Poor |
| Overwintering: | None-Poor | None-Poor | None-Poor |
| Rearing: | Moderate | Poor-Moderate | Poor-Moderate |
| Passage: | Poor-Moderate | Poor-Moderate | Poor-Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Fire evidence in upland. Abundant woody debris throughout. Shallow water with unstable banks at the centerline. Some undercut banks in downstream reach. Snow covering site at time of visit and mostly frozen over. No fishing conducted due to freezing conditions.

**Photo 1:** Site 835— Upstream view of 300 m downstream from centerline.

**Photo 2:** Site 835—Upstream view of 100 m upstream from centerline/

**Photo 3:** Site 835— View of crossing at centerline, looking upstream.

**Photo 4:** Site 835—View of crossing at centerline, looking downstream.

# SITE 837.1

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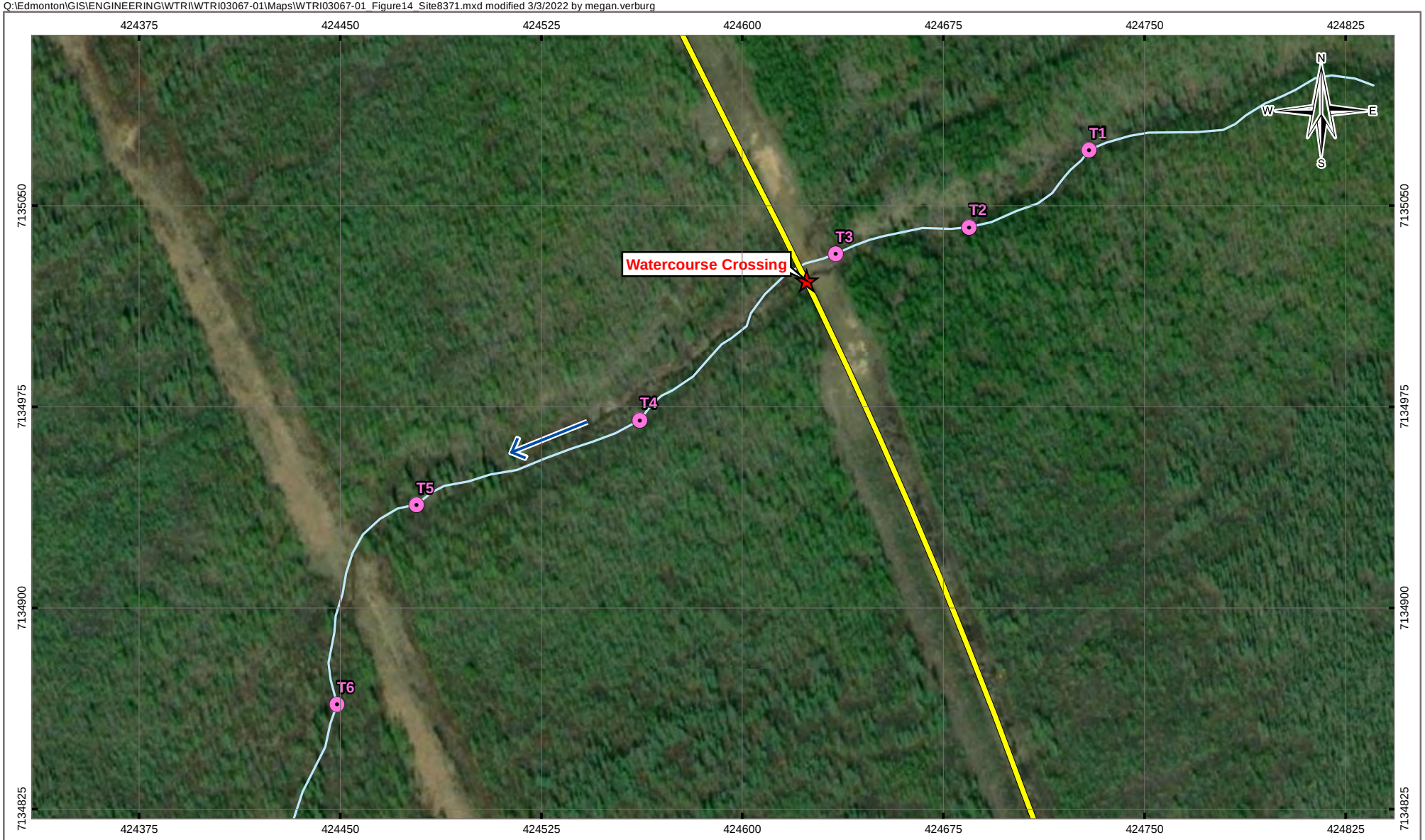



## LEGEND

- Watercourse Crossing
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

Scale: 1:2,000

40 20 0 40

Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure14_Site8371.mxd

**CLIENT** Northwest Territories

TETRA TECH

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 837.1

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

**Figure 14**

TETRA TECH

# Mackenzie Valley Highway

## Site 837.1 Unnamed Watercourse

**UTM Location:** 10W 424624E 7135022N **Survey Date:** 10/11/2021; 12:34

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 1.5 | 1.7 | 1.2 | 2.7 | 2.1 | 1.9 |
| Wetted Width (m) | 1.3 | 1.3 | 0.9 | 1.3 | 1.0 | 1.4 |
| Depth at LDB + 25% (m) | 0.2 | 0.2 | 0.1 | 0.0 | 0.1 | 0.2 |
| Depth at LDB + 50% (m) | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.2 |
| Depth at LDB + 75% (m) | 0.0 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 |
| Max.BankfullDepth (m) | 0.65 | 0.59 | 0.45 | 0.45 | 0.41 | 0.62 |
| Gradient (%) | 2 | 3 | 3 | 5 | 3 | 3 |
| Dominant Habitat Unit | R2 | R2 | R2 | RF | R2 | R2 |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) — Organics | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Fines | 0 | 0 | 0 | 0 | 0 | 10 |
| Substrate (% of Transect Area) — Small Gravel | 10 | 25 | 20 | 10 | 20 | 30 |
| Substrate (% of Transect Area) — Large Gravel | 30 | 30 | 35 | 45 | 30 | 45 |
| Substrate (% of Transect Area) — Cobble | 30 | 30 | 10 | 30 | 40 | 5 |
| Substrate (% of Transect Area) — Boulder | 30 | 10 | 25 | 20 | 10 | 0 |
| Substrate (% of Transect Area) — Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | N | N | N | N | N | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.4 | 0.4 | 0.2 | 0.4 | 0.2 | 0.3 | 0.4 | 0.3 | 0.2 | 0.3 | 0.4 | 0.3 |
| Bank Slope (°) | 90 | 90 | 70 | 70 | 70 | 70 | 10 | 10 | 30 | 20 | 60 | 55 |
| Bank Stability | MS | US | US | US | US | US | MS | MS | MS | MS | MS | MS |
| Dom. Bank Material | O | O | O | O | O | O | O | O | LG | O | O | O |
| Subdom. Bank Material | F | F | F | F | F | F | F | SG | SG | F | F | F |
| Dom. Riparian Veg. | C | S | S | S | S | C | S | S | S | S | S | S |
| Subdom. Riparian Veg. | S | C | D | D | C | S | G | G | G | G | G | G |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 30 | Overhead Cover (%): | 10 |
| Dom. Instream Cover: | C | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | - |
| Maximum Depth (m) | 0.2 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 12:34 |
| Water Temperature (°C): | 1.1 |
| Dissolved Oxygen (mg/L): | 12.27 |
| Sp. Conductivity (µs/cm): | 482 |
| pH: | 8.20 |
| Turbidity (NTU): | Clear |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ME |
| Islands: | N |
| Bars: | SD |
| Coupling: | DC |
| Confinement: | OC |
| Flow Stage: | Low |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate-Good | Moderate | Moderate |
| Overwintering: | None-Poor | None-Poor | None-Poor |
| Rearing: | Moderate | Moderate | Moderate |
| Passage: | Moderate | Poor-Moderate | Poor-Moderate |

### Fish Sampling Data

| Method | Effort |
|---|---|
| No Electrofishing | - (s) |
| No Trapping | - (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Step pools created naturally from downed woody debris in upstream reach. Downstream has emergent boulders and cobbles instream. Minor undercutting of bank in downstream. Fire history in upland. Gravel bar on left bank 200 m downstream. Limited overhanging vegetation in downstream reach. Downed trees created step pools. Challenging for forage fish but good habitat. No fishing conducted due to freezing conditions.

**Photo 1:** Site 837.1— Upstream view of 100 m downstream from centerline.

**Photo 2:** Site 837.1— Upstream view of 100 m upstream from centerline.

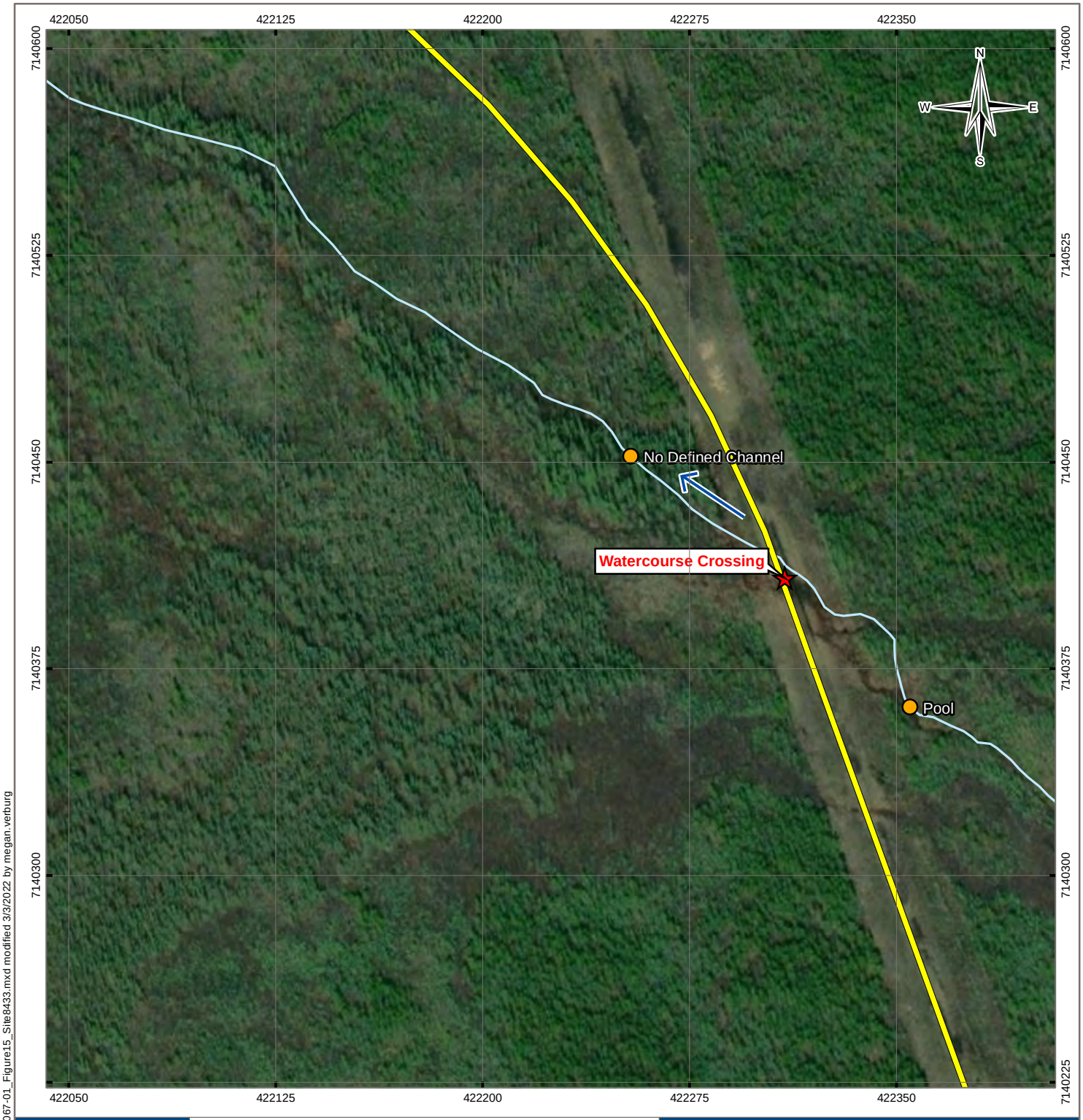
**Photo 3:** Site 837.1—Downstream view of 200 m downstream from centerline.

**Photo 4:** Site 837.1—Downstream view of 300 m downstream from centerline.

**Photo 5:** Site 837.1—View of centerline crossing.

**Photo 6:** Site 837.1—view of crossing at the cutline approximately 250 m downstream.

# SITE 843.3




## LEGEND

- Watercourse Crossing
- Site Feature
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 843.3

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,000
40 20 0 40
Metres

TETRA TECH

**FILE NO.**
WTRI03067-01_Figure15_Site8433.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE**
March 3, 2022

**PROJECT NO.**
ENG.WTRI03067-01

**Figure 15**

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TETRA TECH

# Mackenzie Valley Highway

## Site 843.3 Unnamed Watercourse

**UTM Location:** 10W 422310E 7140408N **Survey Date:** 10/11/2021; 14:20

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 14:20 |
| Water Temperature (°C): | 0.5 |
| Dissolved Oxygen (mg/L): | 11.83 |
| Sp. Conductivity (µs/cm): | 577 |
| pH: | 8.07 |
| Turbidity (NTU): | Clear |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 80 | Overhead Cover (%): | 60 |
| Dom. Instream Cover: | G | Dom. Overhead Cover: | D |
| Subdom. Instream Cover: | WD | Subdom. Overhead Cover: | S |
| Maximum Depth (m) | - | Dom. Aquatic Veg. Type: | 0 |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Maximum depth was 0.39 m. Substrate was 30% fines, 30% small gravel, 30% large gravel and 10% cobble. Snow cover at the site at time of visit, most of the downstream reach was a flooded area within the trees and no defined channel. No suitable fish habitat for any fish.

**Photo 1:** Site 843.3— upstream view from centerline.

**Photo 2:** Site 843.3— 100 m downstream from centerline.

**Photo 3:** Site 843.3— Upstream view of 100 m upstream from centerline.

**Photo 4:** Site 843.3—Centerline view of water and undefined channel.

# SITE 846.4

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## LEGEND

- Watercourse Crossing
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

Scale: 1:1,500
30 15 0 30
Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure16_Site8464.mxd

**CLIENT** Northwest Territories

TETRA TECH

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 846.4

**Figure 16**

TETRA TECH

# Mackenzie Valley Highway

## Site 846.4 Unnamed Watercourse

**UTM Location:** 10W 419947E 7142715N **Survey Date:** 10/11/2021; 15:00

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | | 2 (↑50) | | 3 (CL) | | 4 (↓100) | | 5 (↓200) | | 6 (↓300) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel Width (m) | - | | - | | - | | 2.5 | | 2.3 | | 2.1 | |
| Wetted Width (m) | - | | - | | - | | 2.3 | | 1.9 | | 1.7 | |
| Depth at LDB + 25% (m) | - | | - | | - | | 0.5 | | 0.2 | | 0.1 | |
| Depth at LDB + 50% (m) | - | | - | | - | | 0.7 | | 0.5 | | 0.5 | |
| Depth at LDB + 75% (m) | - | | - | | - | | 0.8 | | 0.2 | | 0.4 | |
| Max.BankfullDepth (m) | - | | - | | - | | 1.5 | | 0.84 | | 0.63 | |
| Gradient (%) | - | | - | | - | | 1 | | 1 | | 1 | |
| Dominant Habitat Unit | P1 | | P1 | | P1 | | P1 | | R1 | | R1 | |
| **Stream Bed** | | | | | | | | | | | | |
| Substrate (% of Transect Area) Organics | - | | - | | - | | 40 | | 40 | | 40 | |
| Substrate (% of Transect Area) Fines | - | | - | | - | | 60 | | 60 | | 60 | |
| Substrate (% of Transect Area) Small Gravel | - | | - | | - | | 0 | | 0 | | 0 | |
| Substrate (% of Transect Area) Large Gravel | - | | - | | - | | 0 | | 0 | | 0 | |
| Substrate (% of Transect Area) Cobble | - | | - | | - | | 0 | | 0 | | 0 | |
| Substrate (% of Transect Area) Boulder | - | | - | | - | | 0 | | 0 | | 0 | |
| Substrate (% of Transect Area) Bedrock | - | | - | | - | | 0 | | 0 | | 0 | |
| Embeddedness | - | | - | | - | | 0 | | 0 | | 0 | |
| **Bank Measurements** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** |
| Bank Height (m) | - | - | - | - | - | - | 0.7 | 0.3 | 0.3 | 0.2 | 0.1 | 0.1 |
| Bank Slope (°) | - | - | - | - | - | - | 90 | 90 | 70 | 20 | 5 | 40 |
| Bank Stability | - | - | - | - | - | - | MS | MS | MS | MS | MS | MS |
| Dom. Bank Material | - | - | - | - | - | - | O | O | O | O | O | O |
| Subdom. Bank Material | - | - | - | - | - | - | F | F | F | F | F | F |
| Dom. Riparian Veg. | - | - | - | - | - | - | S | S | S | S | S | S |
| Subdom. Riparian Veg. | - | - | - | - | - | - | G | G | D | D | D | D |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 30 | Overhead Cover (%): | 30 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | - |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | - |
| Maximum Depth (m) | 0.8 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 14:00 |
| Water Temperature (°C): | 0.1 |
| Dissolved Oxygen (mg/L): | 12.21 |
| Sp. Conductivity (µs/cm): | 264 |
| pH: | 7.97 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | SI |
| Islands: | S |
| Bars: | N |
| Coupling: | PC |
| Confinement: | OC |
| Flow Stage: | Moderate |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Poor | Poor | Poor |
| Overwintering: | Poor | Poor | Poor |
| Rearing: | Moderate-Good | Poor-Moderate | Poor |
| Passage: | Poor | Poor | Poor |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Transects 1-3 could not be assessed due to flooded conditions from 100 m upstream to approximately 100 m downstream. The upstream area was flooded with no defined channel and frozen over with snow cover at time of assessment. Most of the downstream reach was flooded as well until approximately 100 m downstream, where the channel banks became more defined. The channel developed sinuous meanders downstream. Current crossing is not suitable for fish passage. No fishing conducted due to freezing conditions.

**Photo 1:** Site 846.4— 100 m downstream from centerline.

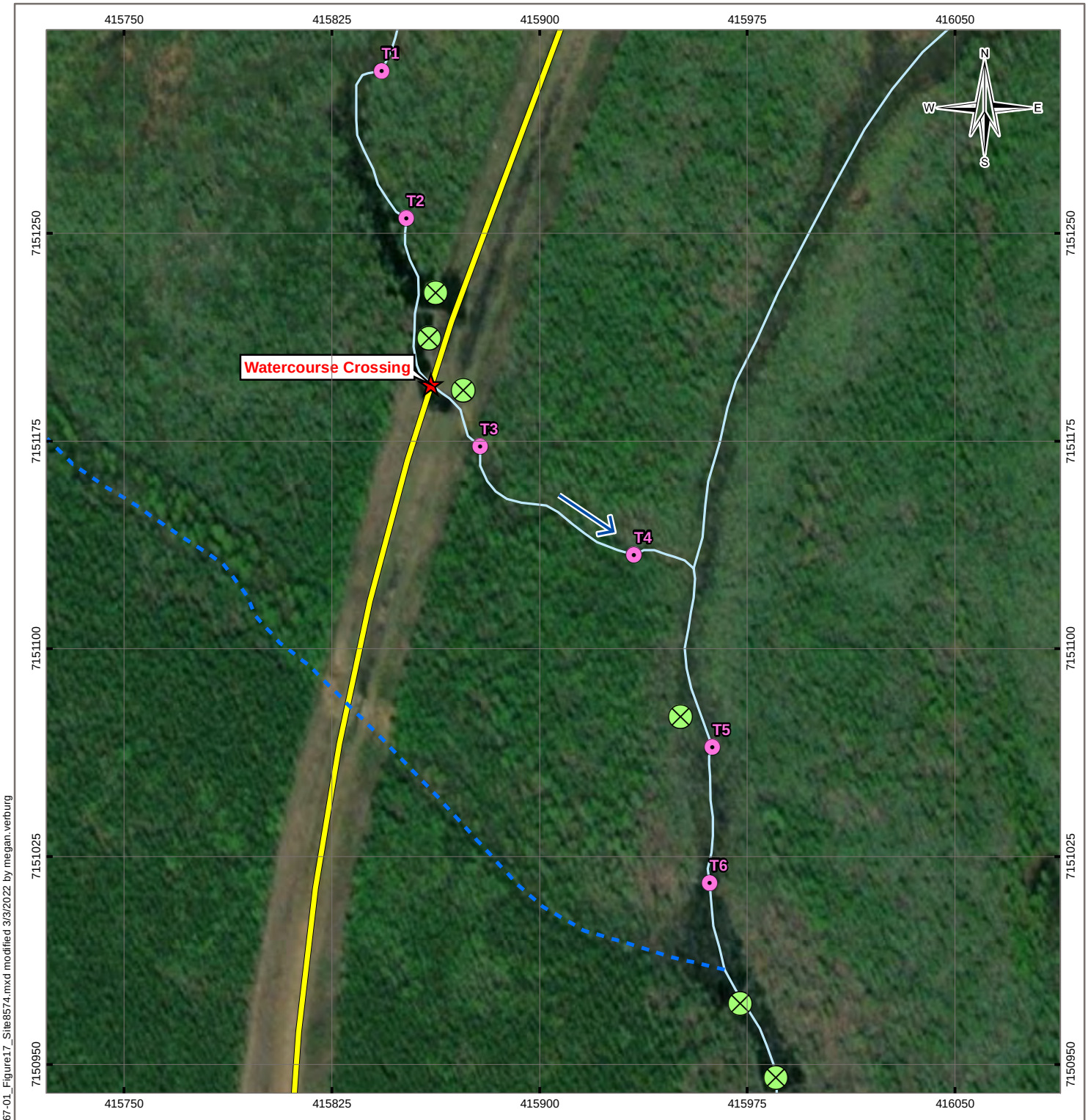
**Photo 2:** Site 846.4— Upstream view from 200 m downstream of centerline.

**Photo 3:** Site 846.4— Flooded area 50 m upstream of centerline.

**Photo 4:** Site 846.4— Upstream view of 300 m downstream of centerline.

**Photo 5:** Site 846.4— View of centerline from the cutline.

# SITE 857.4




## LEGEND

- Watercourse Crossing
- Beaver Dam
- Transect
- Dry Channel
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 857.4

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,000
40 20 0 40
Metres

**FILE NO.**
WTRI03067-01_Figure17_Site8574.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE**
March 3, 2022

**PROJECT NO.**
ENG.WTRI03067-01

TETRA TECH

**Figure 17**

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# Mackenzie Valley Highway

## Site 857.4 Unnamed Watercourse

**UTM Location:** 10W 415860E 7151196N **Survey Date:** 10/11/2021; 16:28

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 1.5 | 10.0 | 2.3 | 0.6 | 2.3 | - |
| Wetted Width (m) | 1.4 | 10.0 | 1.4 | 0.5 | 2.0 | - |
| Depth at LDB + 25% (m) | 0.2 | 0.5 | 0.2 | 0.2 | 0.5 | - |
| Depth at LDB + 50% (m) | 0.2 | - | 0.4 | 0.3 | 0.6 | - |
| Depth at LDB + 75% (m) | 0.1 | - | 0.2 | 0.2 | 0.4 | - |
| Max.BankfullDepth (m) | 0.28 | 0.50 | 0.56 | 0.40 | 0.73 | 0.00 |
| Gradient (%) | 1 | 1 | 2 | 2 | 1 | 1 |
| Dominant Habitat Unit | R1 | IP1 | BD | R3 | DD | FL |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) — Organics | 80 | 0 | 60 | 80 | 60 | 0 |
| Substrate (% of Transect Area) — Fines | 20 | 100 | 40 | 20 | 40 | 100 |
| Substrate (% of Transect Area) — Small Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Large Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Cobble | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | N | N | N | N | N | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.1 | 0.1 | - | - | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.1 | - | - |
| Bank Slope (°) | 10 | 10 | 30 | 30 | 25 | 10 | 5 | 5 | 10 | 10 | 30 | 30 |
| Bank Stability | MS | MS | US | US | MS | MS | US | MS | MS | MS | MS | MS |
| Dom. Bank Material | O | O | - | - | O | O | O | O | O | O | - | - |
| Subdom. Bank Material | F | F | - | - | F | F | F | F | F | F | - | - |
| Dom. Riparian Veg. | S | S | S | S | S | S | S | S | S | S | M | M |
| Subdom. Riparian Veg. | G | G | G | G | G | G | G | C | G | G | C | C |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 40 | Overhead Cover (%): | 10 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | C |
| Subdom. Instream Cover: | G | Subdom. Overhead Cover: | S |
| Maximum Depth (m) | 0.6 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 16:28 |
| Water Temperature (°C): | 0.5 |
| Dissolved Oxygen (mg/L): | 9.45 |
| Sp. Conductivity (µs/cm): | 163 |
| pH: | 7.92 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | IR |
| Islands: | I |
| Bars: | N |
| Coupling: | PC |
| Confinement: | FC |
| Flow Stage: | Pooled |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate | None | None |
| Overwintering: | Moderate | Poor | Poor |
| Rearing: | Moderate-Good | Poor-Moderate | Poor |
| Passage: | Poor | Poor | Poor |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

The upstream reach was mostly low shrubs and grasses as it was likely flooded in past due to downstream beaver dam, poorly defined channel. Some grasses instream at the crossing. There were two beaver dams, just upstream of the centerline crossing over the winter road. There was a smaller beaver dam at the winter road. Watercourse converged with larger channel approximately 130 m downstream. There were multiple beaver dams downstream as well. Could not assess parts of T2 and T6 locations because the water was frozen over and was unsafe to assess. Channel width for T6 was measured from aerial imagery. At 200 m downstream, the second channel was flooded and meandered around debris dams (likely from previous backflooding from impoundment). The downstream area would be more suitable fish habitat than in the channel that crosses the proposed highway alignment. No fishing conducted due to freezing conditions.

**Photo 1:** Site 857.4—Upstream of centerline, beaver dam impoundment.

**Photo 2:** Site 857.4—View of beaver dam at centerline.

**Photo 3:** Site 857.4— Downstream view of 200 m downstream from centerline.

**Photo 4:** Site 857.4— View of downstream watercourse 300 m downstream of centerline. Photo is downstream of confluence with larger watercourse and is of that water-course.

**Photo 5:** Site 857.4— View of the centerline looking south.

# SITE 872.9


## LEGEND

- Watercourse Crossing
- Minnow Trap
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2020)

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 872.9

| | | | | |
|---|---|---|---|---|
| **PROJECTION** UTM Zone 10 | | | **DATUM** NAD83 | **CLIENT** Northwest Territories |
| Scale: 1:1,000 — 20 10 0 20 — Metres | | | | TETRA TECH |
| **FILE NO.** WTRI03067-01_Figure18_Site8729.mxd | | | | |
| **OFFICE** Tt-EDM | **DWN** MRV | **CKD** SL | **APVD** TM | **REV** 0 |
| **DATE** March 3, 2022 | **PROJECT NO.** ENG.WTRI03067-01 | | | **Figure 18** |

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# Mackenzie Valley Highway

## Site 872.9 Unnamed Watercourse

**UTM Location:** 10W 412679E 7164554N **Survey Date:** 10/2/2021; 15:17

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 15:17 |
| Water Temperature (°C): | 0.1 |
| Dissolved Oxygen (mg/L): | 12.53 |
| Sp. Conductivity (µs/cm): | 435 |
| pH: | 7.74 |
| Turbidity (NTU): | Clear |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 60 | Overhead Cover (%): | 10 |
| Dom. Instream Cover: | AQ | Dom. Overhead Cover: | - |
| Subdom. Instream Cover: | G | Subdom. Overhead Cover: | - |
| Maximum Depth (m) | 0.6 | Dom. Aquatic Veg. Type: | - |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| Minnow Trap (MT) | 1.0 | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISH CAPTURED | | | | | |

### General Comments

Wetland habitat, poor connectivity with rigmat over the crossing. Exposed pipe from a pipeline in the channel. One minnow trap was set but pulled after 1 hr when it was noted that there was no connectivity and no defined channel. The downstream area is flooded wetland with submerged aquatic vegetation. Substrate was all fines and organics. Not fish habitat.

**Photo 1:** Site 872.9—Facing upstream from centerline.

**Photo 2:** Site 872.9—Facing upstream from 50 m upstream of centerline.

**Photo 3:** Site 872.9—Facing upstream from aerial view.

**Photo 4:** Site 872.9—Facing downstream at 100 m downstream from centerline.

**Photo 5:** Site 872.9— View of crossing from ground.

# SITE 879.1

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## LEGEND

- Watercourse Crossing
- Minnow Trap
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Mackenzie Valley Winter Road
- Watercourse
- Waterbody

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)
CanVec 1:50,000

**STATUS**
ISSUED FOR USE

Scale: 1:2,000

40 20 0 40

Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure19_Site8791.mxd

CLIENT: Northwest Territories

TETRA TECH

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 879.1

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

**Figure 19**

TETRA TECH

# Mackenzie Valley Highway

## Site 879.1 Unnamed Watercourse

**UTM Location:** 10W 411064E 7169505N **Survey Date:** 10/9/2021; 16:16

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 16:16 |
| Water Temperature (°C): | 0.6 |
| Dissolved Oxygen (mg/L): | 0.68 |
| Sp. Conductivity (µs/cm): | 151 |
| pH: | 6.44 |
| Turbidity (NTU): | Lightly Turbid |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 0 | Overhead Cover (%): | 30 |
| Dom. Instream Cover: | - | Dom. Overhead Cover: | G |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | C |
| Maximum Depth (m) | 0.6 | Dom. Aquatic Veg. Type: | - |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| Minnow Trap (MT) | 36.5 | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISH CAPTURED | | | | | |

### General Comments

Very low dissolved oxygen - was measured multiple times in multiple locations and got same result. Frozen cover throughout, generally a marshy bog. This wetland was connected to the watercourse crossing at Site 879.4. Beaver activity in the upstream and a beaver lodge and impoundment downstream. Potential good habitat for forage fish but low DO levels may not make it suitable for larger bodied fish. No fishing conducted due to frozen conditions.

**Photo 1:** Site 879.1—Aerial view of upstream habitat.

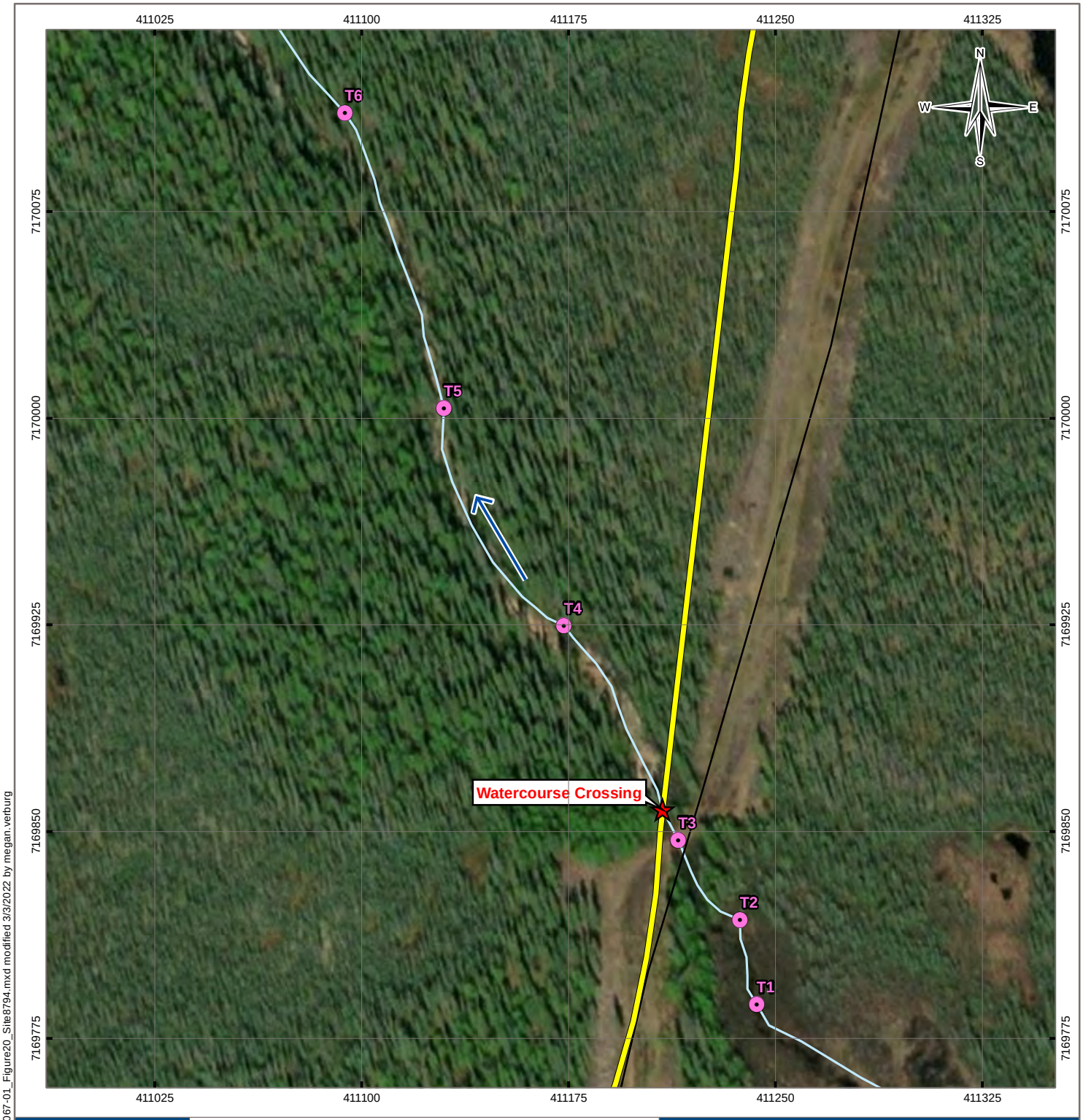
**Photo 2:** Site 879.1—Aerial view of downstream habitat.

**Photo 3:** Site 879.1— Looking towards right bank 100 m upstream of centerline.

**Photo 4:** Site 879.1 —View of pond approximately 100 m downstream from centerline.

**Photo 5:** Site 879.1— View of crossing location, looking southwest.

# SITE 879.4




## LEGEND

- Watercourse Crossing
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Mackenzie Valley Winter Road
- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)
CanVec 1:50,000

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 879.4

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,000
40 20 0 40
Metres

**FILE NO.**
WTRI03067-01_Figure20_Site8794.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE**
March 3, 2022

**PROJECT NO.**
ENG.WTRI03067-01

TETRA TECH

**Figure 20**

Q:\Edmonton\GIS\ENGINEERING\WTRI\WTRI03067-01\Maps\WTRI03067-01_Figure20_Site8794.mxd modified 3/3/2022 by megan.verburg

TETRA TECH

# Mackenzie Valley Highway

## Site 879.4 Unnamed Watercourse

**UTM Location:** 10W 411209E 716858N **Survey Date:** 10/9/2021; 16:34

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | | 2 (↑50) | | 3 (CL) | | 4 (↓100) | | 5 (↓200) | | 6 (↓300) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel Width (m) | 1.5 | | 2.9 | | 5.2 | | 1.2 | | 1.9 | | 1.0 | |
| Wetted Width (m) | 1.3 | | 2.5 | | 5.2 | | 0.9 | | 1.9 | | 1.0 | |
| Depth at LDB + 25% (m) | 0.3 | | 0.5 | | 0.2 | | 0.2 | | 0.1 | | 0.0 | |
| Depth at LDB + 50% (m) | 0.3 | | 0.5 | | 0.4 | | 0.2 | | 0.2 | | 0.1 | |
| Depth at LDB + 75% (m) | 0.3 | | 0.4 | | 0.5 | | 0.2 | | 0.1 | | 0.2 | |
| Max.BankfullDepth (m) | 0.31 | | 0.54 | | 0.46 | | 0.39 | | 0.56 | | 0.59 | |
| Gradient (%) | 1 | | 1 | | 2 | | 3 | | 1 | | 1 | |
| Dominant Habitat Unit | IP1 | | IP1 | | IP1 | | R2 | | R1 | | R1 | |
| **Stream Bed** | | | | | | | | | | | | |
| Substrate (% of Transect Area) Organics | 100 | | 100 | | 100 | | 0 | | 0 | | 0 | |
| Fines | 0 | | 0 | | 0 | | 90 | | 100 | | 100 | |
| Small Gravel | 0 | | 0 | | 0 | | 10 | | 0 | | 0 | |
| Large Gravel | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| Cobble | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| Boulder | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| Bedrock | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| Embeddedness | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| **Bank Measurements** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** |
| Bank Height (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.1 | 0.4 | 0.2 | 0.4 | 0.4 |
| Bank Slope (°) | 0 | 0 | 0 | 0 | 10 | 10 | 40 | 40 | 20 | 40 | 75 | 40 |
| Bank Stability | S | S | S | S | S | S | US | US | MS | US | MS | MS |
| Dom. Bank Material | O | O | O | O | O | O | O | O | O | O | O | O |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | G | G | G | G | G | G | S | S | S | S | S | M |
| Subdom. Riparian Veg. | S | S | S | S | S | S | M | M | C | C | M | S |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 50 | Overhead Cover (%): | 60 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | UC | Subdom. Overhead Cover: | M |
| Maximum Depth (m) | 0.5 | Dom. Aquatic Veg. Type: | G |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 16:36 |
| Water Temperature (°C): | 0.6 |
| Dissolved Oxygen (mg/L): | 10.81 |
| Sp. Conductivity (µs/cm): | 193 |
| pH: | 7.37 |
| Turbidity (NTU): | Clear |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ME |
| Islands: | N |
| Bars: | N |
| Coupling: | CO |
| Confinement: | FC |
| Flow Stage: | Flood |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Poor-Moderate | None | None |
| Overwintering: | Poor-Moderate | Poor | Poor |
| Rearing: | Moderate | Poor-Moderate | Poor-Moderate |
| Passage: | Moderate-Good | Moderate | Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Some instream aquatic vegetation and grasses instream in upstream reach, within the flooded area. The upstream area is flooded throughout trees and downstream is confined to valley. Some undercut banks 300 m downstream. Aerial imagery of the area shows the watercourse is connected to Site 879.1 on the upstream side, and appears to have wetland characteristics upstream of T1 (100 m upstream) based on the aerial imagery. The area was snow covered at the time of the assessment. No fishing was conducted due to unsafe conditions for electrofishing and freezing conditions.

**Photo 1:** Site 879.4— Upstream view of 100 m upstream from centerline.

**Photo 2:** Site 879.4—Upstream view of 50 m upstream from centerline.

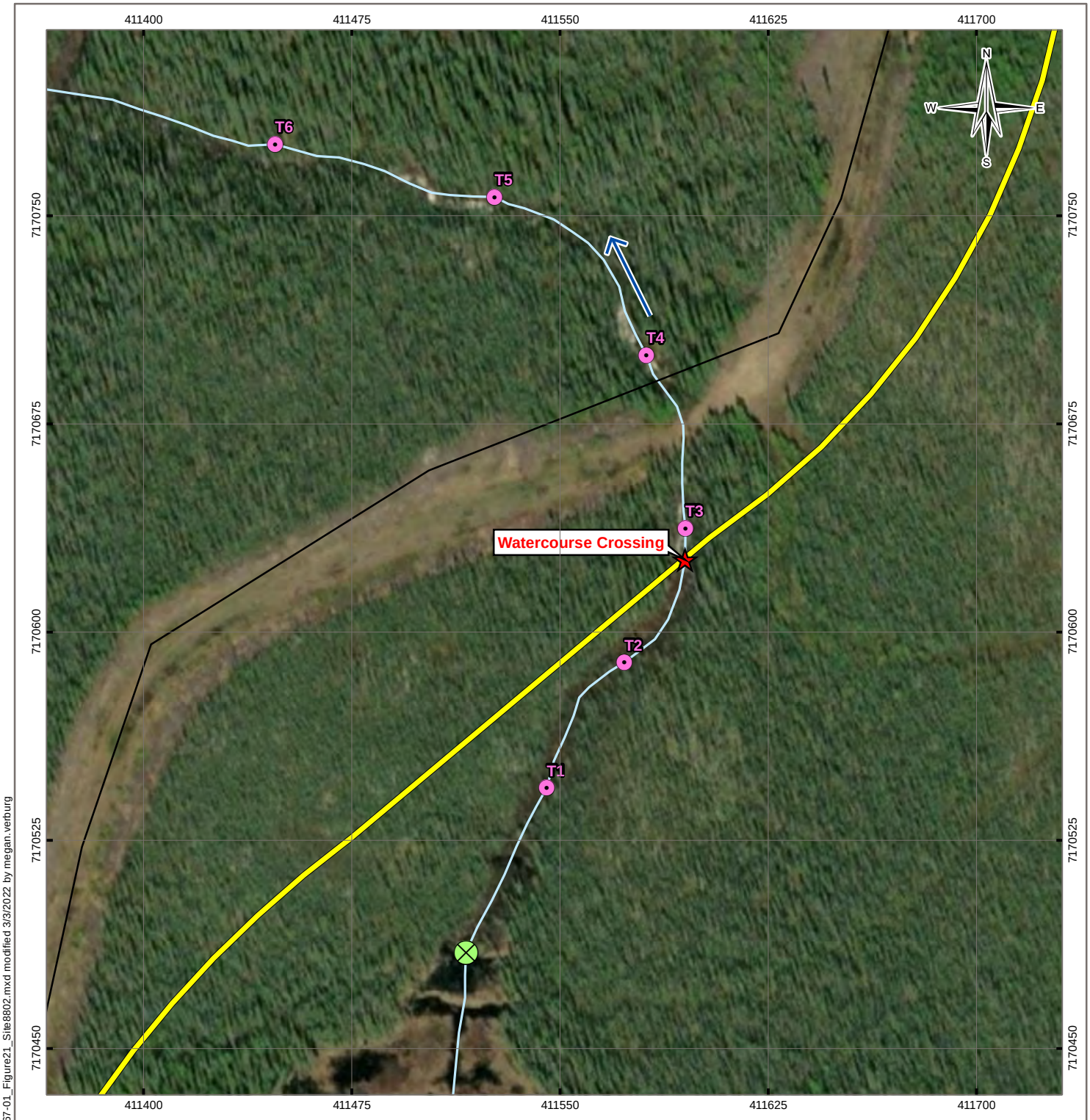
**Photo 3:** Site 879.4—Looking upstream at 200 m downstream from centerline.

**Photo 4:** Site 879.4—Looking upstream at 300 m downstream from centerline.

**Photo 5:** Site 879.4— View of crossing at centerline, looking north.

**Photo 6:** Site 879.4— Inlet side of centerline, snow covered.

# SITE 880.2




## LEGEND

- Watercourse Crossing
- Beaver Dam
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Mackenzie Valley Winter Road
- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)
CanVec 1:50,000

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 880.2

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,000
40 20 0 40
Metres

**FILE NO.**
WTRI03067-01_Figure21_Site8802.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE**
March 3, 2022

**PROJECT NO.**
ENG.WTRI03067-01

TETRA TECH

**Figure 21**

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# Mackenzie Valley Highway

## Site 880.2 Unnamed Watercourse

**UTM Location:** 10W 411595E 7170626N **Survey Date:** 10/1/2021; 16:23

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|---|
| Channel Width (m) | | - | 1.2 | 2.7 | 2.6 | 3.2 | 0.9 |
| Wetted Width (m) | | - | 0.8 | 0.7 | 1.0 | 0.7 | 0.5 |
| Depth at LDB + 25% (m) | | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Depth at LDB + 50% (m) | | - | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 |
| Depth at LDB + 75% (m) | | - | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 |
| Max.BankfullDepth (m) | | - | 0.4 | 1.0 | 0.5 | 0.5 | 0.6 |
| Gradient (%) | | - | 1.0 | 2.0 | 2.0 | 8.0 | 8.0 |
| Dominant Habitat Unit | | WL | R2 | R2 | R2 | R2 | R2 |
| **Stream Bed** | | | | | | | |
| Substrate (% of Transect Area) | Organics | - | 90 | 0 | 60 | 10 | 10 |
| | Fines | - | 10 | 100 | 40 | 80 | 90 |
| | Small Gravel | - | 0 | 0 | 0 | 10 | 0 |
| | Large Gravel | - | 0 | 0 | 0 | 0 | 0 |
| | Cobble | - | 0 | 0 | 0 | 0 | 0 |
| | Boulder | - | 0 | 0 | 0 | 0 | 0 |
| | Bedrock | - | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | | - | N | N | N | L | N |

| Bank Measurements | 1 (↑100) | | 2 (↑50) | | 3 (CL) | | 4 (↓100) | | 5 (↓200) | | 6 (↓300) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
| Bank Height (m) | - | - | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Bank Slope (°) | - | - | 20 | 20 | 45 | 80 | 45 | 50 | 10 | 80 | 45 | 45 |
| Bank Stability | - | - | MS | MS | S | MS | US | MS | US | US | MS | MS |
| Dom. Bank Material | - | - | O | O | O | O | O | O | F | F | O | O |
| Subdom. Bank Material | - | - | F | F | F | F | F | F | O | O | F | F |
| Dom. Riparian Veg. | - | - | S | S | S | S | S | S | S | S | C | C |
| Subdom. Riparian Veg. | - | - | C | C | C | C | C | C | C | C | S | S |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 20 | Overhead Cover (%): | 30 |
| Dom. Instream Cover: | - | Dom. Overhead Cover: | - |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | - |
| Maximum Depth (m) | 0.2 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 16:23 |
| Water Temperature (°C): | 2.5 |
| Dissolved Oxygen (mg/L): | 9.47 |
| Sp. Conductivity (µs/cm): | 195 |
| pH: | 7.87 |
| Turbidity (NTU): | Clear |

### Channel Characteristics

| | |
|---|---|
| Pattern: | IR |
| Islands: | N |
| Bars: | N |
| Coupling: | DC |
| Confinement: | OC |
| Flow Stage: | Low |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | None | None | None |
| Overwintering: | None | None | None |
| Rearing: | None | Poor | None |
| Passage: | None-Poor | None-Poor | None-Poor |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

100 m upstream is a flooded area and no defined channel. Poor connectivity all the way to 100 m downstream of crossing. Abundant grasses instream and woody debris blocking channel. 100 m downstream of proposed alignment is just upstream of existing winter road. There is a soft organic bottom with minor undercuts. Some underground flow where banks have coupled previously. 200 m downstream looks like it was flooded a few years ago but has since had new growth. 300 m downstream is a narrow channel with steep grade and several logjams. Woody debris throughout. No fishing conducted due to shallow water depths.

**Photo 1:** Site 880.2—Upstream view of ponded area 150 m upstream from centreline.

**Photo 2:** Site 880.2— View of substrate at crossing location.

**Photo 3:** Site 880.2—Facing downstream from 100 m upstream from centerline.

**Photo 4:** Site 880.2—Facing downstream at 100 m downstream from centerline.

**Photo 5:** Site 880.2—View of existing crossing along the winter road, approximately 60 m downstream of the proposed alignment. View looking southwest.

# SITE 880.6

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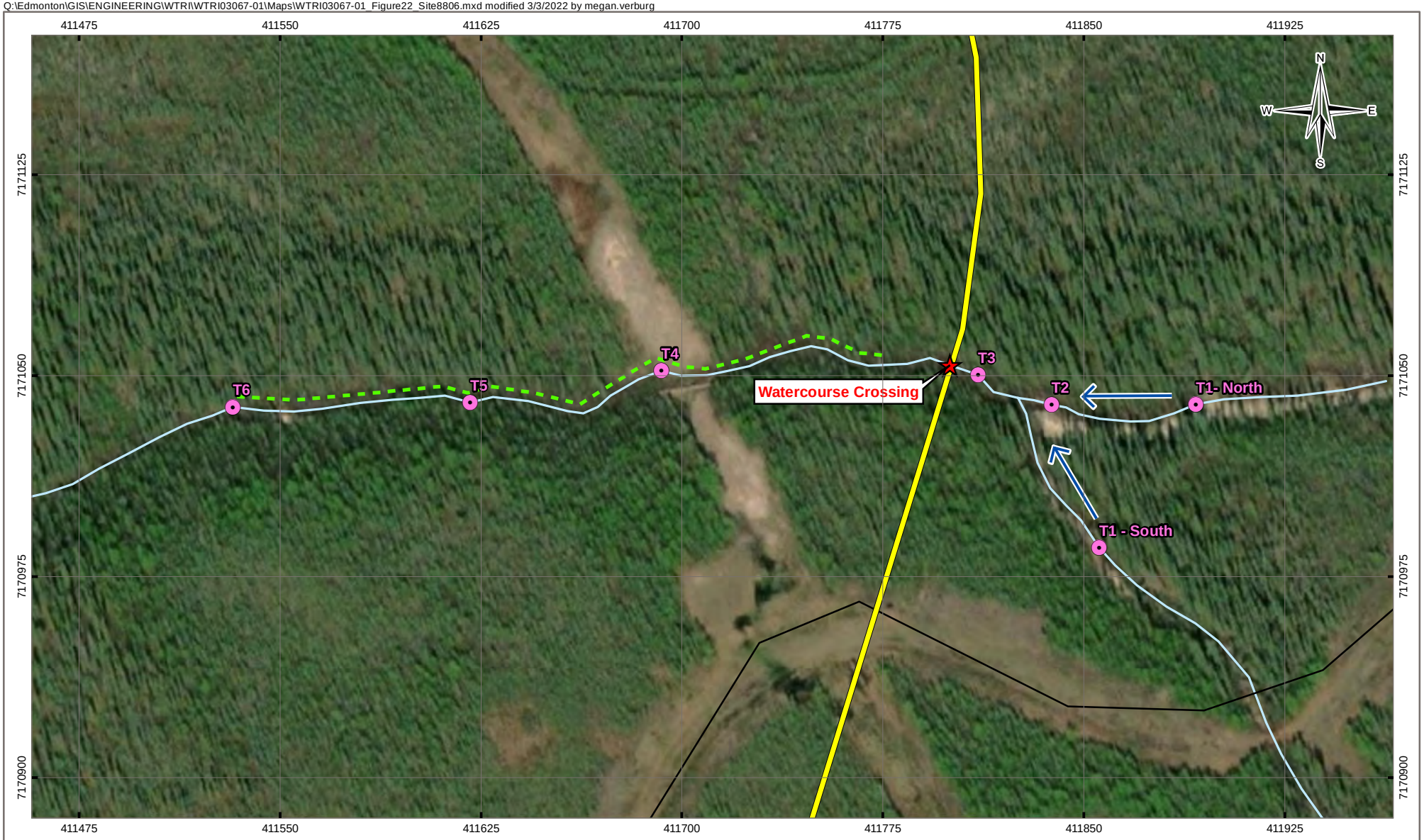



## LEGEND

- Watercourse Crossing
- Transect
- Electrofishing
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Mackenzie Valley Winter Road
- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)
CanVec 1:50,000

**STATUS**
ISSUED FOR USE

Scale: 1:2,000
40 20 0 40
Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure22_Site8806.mxd

**CLIENT** Northwest Territories

TETRA TECH

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 880.6

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

**Figure 22**

TETRA TECH

# Mackenzie Valley Highway

## Site 880.6 Unnamed Watercourse

**UTM Location:** 10W 411800E 7171054N | **Survey Date:** 10/5/2021; 16:30

**Legal Location:** - | **Zone:**

**Crew Initials:** TM & MAN | **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 South (↑100) | 1 North (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|---|
| Channel Width (m) | 1.8 | 2.5 | 2.2 | 1.8 | 2.8 | 2.7 | 1.9 |
| Wetted Width (m) | 1.4 | 2.3 | 1.6 | 1.5 | 1.9 | 2.0 | 1.1 |
| Depth at LDB + 25% (m) | 0.3 | 0.2 | 0.3 | 0.2 | 0.3 | 0.3 | 0.5 |
| Depth at LDB + 50% (m) | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 |
| Depth at LDB + 75% (m) | 0.2 | 0.4 | 0.2 | 0.6 | 0.3 | 0.2 | 0.4 |
| Max.BankfullDepth (m) | 0.60 | 0.67 | 0.65 | 0.78 | 0.66 | 0.83 | 1.1 |
| Gradient (%) | 1 | 1 | 1 | 2 | 4 | 5 | 5 |
| Dominant Habitat Unit | FL | FL | FL | R1 | CA | R1 | R1 |
| **Stream Bed** | | | | | | | |
| Substrate (% of Transect Area) Organics | 0 | 0 | 10 | 30 | 10 | 10 | 10 |
| Fines | 100 | 100 | 90 | 70 | 80 | 70 | 90 |
| Small Gravel | 0 | 0 | 0 | 0 | 0 | 20 | 0 |
| Large Gravel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cobble | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Boulder | 0 | 0 | 0 | 0 | 10 | 0 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.3 | 0.3 | 0.3 | 0.2 | 0.3 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.4 | 0.2 | 0.3 | 0.5 |
| Bank Slope (°) | 30 | 30 | 25 | 70 | 10 | 20 | 30 | 10 | 10 | 25 | 60 | 10 | 60 | 80 |
| Bank Stability | MS | MS | MS | US | MS | MS | S | S | MS | MS | MS | MS | S | MS |
| Dom. Bank Material | O | O | O | F | F | O | O | O | F | F | F | F | F | O |
| Subdom. Bank Material | F | F | F | O | O | F | F | F | O | O | SG | O | O | F |
| Dom. Riparian Veg. | S | S | S | S | S | S | S | S | S | S | S | S | S | S |
| Subdom. Riparian Veg. | C | C | C | C | G | G | D | G | S | S | M | M | D | C |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 40 | Overhead Cover (%): | 80 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | C |
| Maximum Depth (m) | 0.6 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 16:30 |
| Water Temperature (°C): | 1.6 |
| Dissolved Oxygen (mg/L): | 13.61 |
| Sp. Conductivity (µs/cm): | 240 |
| pH: | 7.66 |
| Turbidity (NTU): | Moderately Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ST |
| Islands: | N |
| Bars: | N |
| Coupling: | PC |
| Confinement: | CO |
| Flow Stage: | High |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate | None-Poor | None-Poor |
| Overwintering: | Poor | Poor | Poor |
| Rearing: | Good | Good | Good |
| Passage: | Good | Good | Good |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| Backpack Electrofisher (EB) | 246 | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| 200 | 30 | 12 | 200 |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | tel. Abundanc (% of total) |
|---|---|---|---|---|---|
| BROOK STICKLEBACK | 2 | - | 2.86 | - | 40.0% |
| FINESCALE DACE | 1 | - | 1.43 | - | 20.0% |
| PEARL DACE | 2 | - | 2.86 | - | 40.0% |

### General Comments

100 m downstream is located along pipeline, some large boulders in transect from riprap for wooden bank support that was in place. Some in stream grass throughout. Lots of woody debris in water. High flow rate wth occasional riffle sections. Occasional natural small debris dams. At approximatley 50 m upstream, two channels converge to form the unnamed watercourse at Site 880.6. Both channels had water at the time of the assessment (1 South and 1 North).

**Photo 1:** Site 880.6—Looking downstream at 100 m downstream from centerline.

**Photo 2:** Site 880.6—Looking downstream at 200 m downstream from centerline.

**Photo 3:** Site 880.6—Looking downstream at 300 m downstream from centerline.

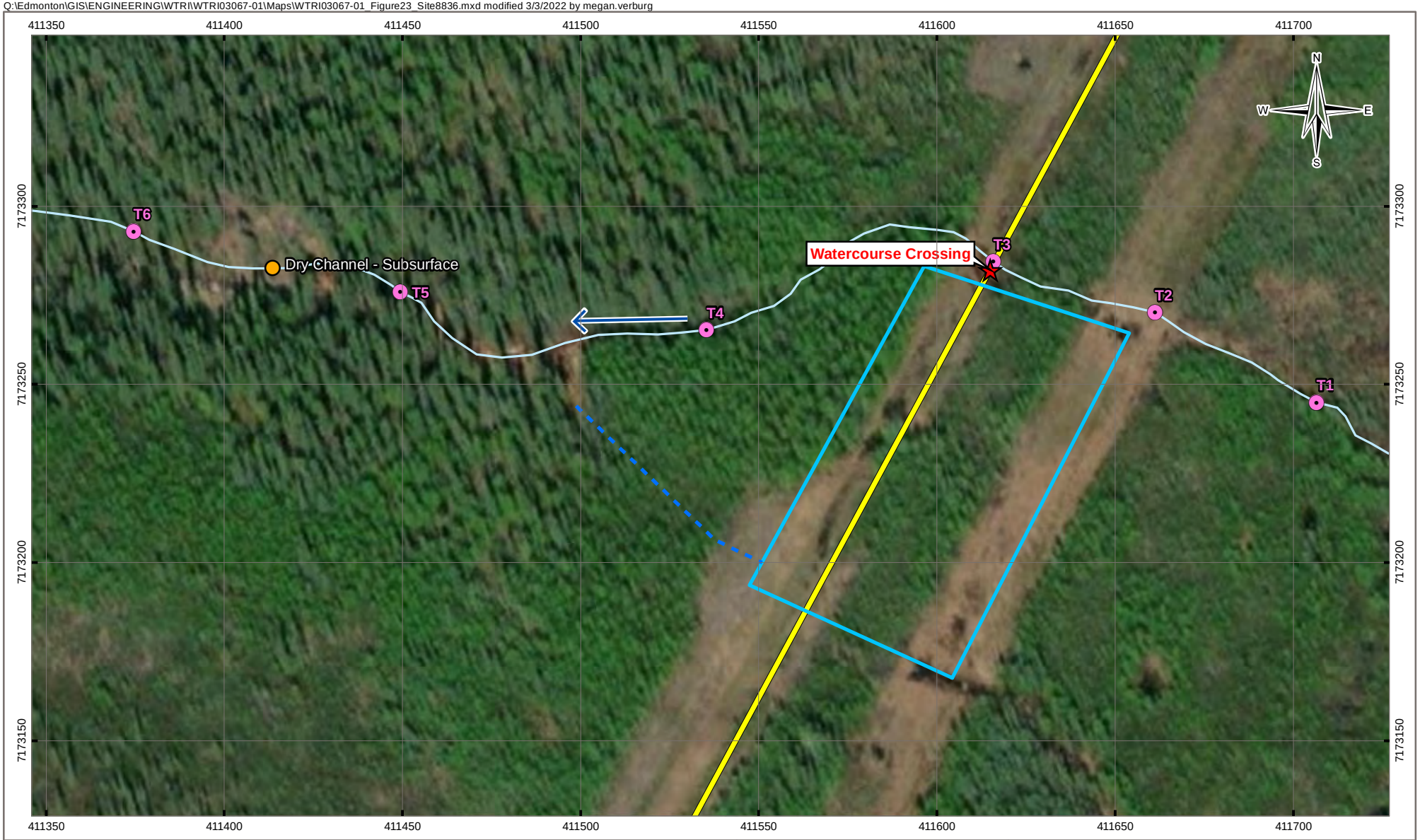
**Photo 4:** Site 880.6—Looking upstream at 50 m upstream from centerline.

**Photo 5:** Site 880.6—Aerial view of watercourse crossing existing winter road.

**Photo 6:** Site 880.6—View of channel at the proposed centerline of the new alignment.

# SITE 883.6

Q:\Edmonton\GIS\ENGINEERING\WTRI\WTRI03067-01\Maps\WTRI03067-01_Figure23_Site8836.mxd modified 3/3/2022 by megan.verburg




## LEGEND

- Watercourse Crossing
- Site Feature
- Transect
- Dry Channel
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment
- Wet Throughout

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

Scale: 1:1,500

30 15 0 30

Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 10 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure23_Site8836.mxd

**CLIENT**
Northwest Territories

TETRA TECH

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 883.6

**Figure 23**

TETRA TECH

# Mackenzie Valley Highway

## Site 883.6 Unnamed Watercourse

**UTM Location:** 10W 411615E 7173282N **Survey Date:** 10/5/2021; 11:53

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 2.4 | - | 1.3 | 2.1 | 3.1 | 3.4 |
| Wetted Width (m) | 2.0 | - | 1.3 | 1.3 | 0.5 | 1.1 |
| Depth at LDB + 25% (m) | 0.0 | - | 0.3 | 0.2 | 0.1 | 0.1 |
| Depth at LDB + 50% (m) | 0.1 | - | 0.3 | 0.1 | 0.1 | 0.1 |
| Depth at LDB + 75% (m) | 0.2 | - | 0.2 | 0.1 | 0.1 | 0.0 |
| Max.BankfullDepth (m) | 0.46 | - | 0.41 | 0.44 | 1.1 | 2.0 |
| Gradient (%) | 1 | - | 2 | 2 | 6 | 8 |
| Dominant Habitat Unit | WL | - | R1 | R1 | RF | RF |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) Organics | 100 | 100 | 100 | 90 | 0 | 60 |
| Fines | 0 | 0 | 0 | 10 | 0 | 40 |
| Small Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Large Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Cobble | 0 | 0 | 0 | 0 | 0 | 0 |
| Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | N | N | N | N | N | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.2 | 0.3 | - | - | 0.1 | 0.1 | 0.3 | 0.2 | 0.9 | 1.1 | 0.7 | 1.9 |
| Bank Slope (°) | 5 | 45 | - | - | 5 | 5 | 20 | 25 | 60 | 70 | 80 | 90 |
| Bank Stability | MS | MS | - | - | MS | MS | MS | MS | US | US | US | US |
| Dom. Bank Material | O | O | - | - | O | O | O | O | O | O | O | O |
| Subdom. Bank Material | F | F | - | - | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | G | D | - | - | S | S | S | S | S | S | C | C |
| Subdom. Riparian Veg. | S | S | - | - | C | D | M | M | C | D | S | S |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 10 | Overhead Cover (%): | 70 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | M |
| Maximum Depth (m) | 0.3 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 11:56 |
| Water Temperature (°C): | 2.8 |
| Dissolved Oxygen (mg/L): | 2.54 |
| Sp. Conductivity (µs/cm): | 355 |
| pH: | 7.16 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | IR |
| Islands: | O |
| Bars: | N |
| Coupling: | PC |
| Confinement: | OC |
| Flow Stage: | Moderate |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Poor | Poor | Poor |
| Overwintering: | Poor | Poor | Poor |
| Rearing: | Poor | Poor | Poor |
| Passage: | Poor | Poor | Poor |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

50 m upstream was the winter road and no defined channel was present (depths recorded at deep pools). The water was snow covered and had low flow upstream. Some overhanging vegetation and abundant downed woody debris. Orange copper look to water, flow is low with occasional pool pockets to the side, dominated by organic debris (leaves and sticks).Slope increased at 300 m downstrea, with steep slopes, riffles with minor cascades and organic islands. Abundant moss throughout. Flowing water, significant left bank erosion around 250 m downstream. No fishing conducted due to freezing conditions.

**Photo 1:** Site 883.6— Looking downstream at 100 m downstream from centerline.

**Photo 2:** Site 883.6—Looking downstream at centerline.

**Photo 3:** Site 883.6— Upstream view of 50 m upstream from centerline.

**Photo 4:** Site 883.6—View of existing winter road, 50 m upstream from centerline.

# SITE 884.8


## LEGEND

- Watercourse Crossing
- Transect
- Electrofishing
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 884.8

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:1,500
30 15 0 30
Metres

**FILE NO.**
WTRI03067-01_Figure24_Site8848.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE**
March 3, 2022

**PROJECT NO.**
ENG.WTRI03067-01

TETRA TECH

**Figure 24**

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# Mackenzie Valley Highway

## Site 884.8 Unnamed Watercourse

**UTM Location:** 10W 411300E 7174635N **Survey Date:** 09/30/2021; 14:24

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 10.5 | 8.4 | 2.5 | 2.3 | 3.1 | 2.0 |
| Wetted Width (m) | 3.0 | 2.2 | 1.0 | 0.8 | 1.3 | 1.3 |
| Depth at LDB + 25% (m) | 0.5 | 0.1 | 0.3 | 0.3 | 0.2 | 0.2 |
| Depth at LDB + 50% (m) | 0.6 | 0.1 | 0.4 | 0.2 | 0.2 | 0.3 |
| Depth at LDB + 75% (m) | 0.3 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 |
| Max.BankfullDepth (m) | 2.0 | 2.1 | 0.82 | 0.97 | 0.72 | 1.0 |
| Gradient (%) | - | - | - | - | - | - |
| Dominant Habitat Unit | IP1 | FL | R2 | R2 | R1 | R1 |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) — Organics | 0 | 0 | 0 | 20 | 20 | 60 |
| Substrate (% of Transect Area) — Fines | 0 | 90 | 90 | 80 | 80 | 40 |
| Substrate (% of Transect Area) — Small Gravel | 0 | 10 | 10 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Large Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Cobble | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Substrate (% of Transect Area) — Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | VH | M | H | N | N | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.5 | 1.4 | 0.5 | 2.0 | 0.4 | 0.4 | 0.5 | 0.7 | 0.5 | 0.3 | 0.60 | 0.70 |
| Bank Slope (°) | 45 | 45 | 60 | 60 | 90 | 90 | 80 | 80 | 70 | 70 | 60 | 60 |
| Bank Stability | US | US | US | US | MS | MS | MS | MS | MS | US | MS | MS |
| Dom. Bank Material | F | F | F | F | F | F | O | O | F | F | F | F |
| Subdom. Bank Material | O | O | O | O | O | O | F | F | O | O | O | O |
| Dom. Riparian Veg. | G | G | G | G | D | D | G | G | S | C | G | G |
| Subdom. Riparian Veg. | S | S | C | C | S | S | S | C | G | S | D | D |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 60 | Overhead Cover (%): | 30 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | G |
| Maximum Depth (m) | 0.6 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 14:22 |
| Water Temperature (°C): | 3.2 |
| Dissolved Oxygen (mg/L): | - |
| Sp. Conductivity (µs/cm): | 338 |
| pH: | 7.70 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | IR |
| Islands: | O |
| Bars: | BR |
| Coupling: | CO |
| Confinement: | CO |
| Flow Stage: | Low |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate | Poor | Poor |
| Overwintering: | Poor | Poor | Poor |
| Rearing: | Moderate-Good | Poor-Moderate | Poor |
| Passage: | Moderate | Poor-Moderate | Poor-Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| Backpack Electrofisher (EB) | 471 | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| 190 | 30 | 12 | 300 |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| BROOK STICKLEBACK | 3 | - | 0.64 | - | 9.4% |
| PEARL DACE | 29 | - | 6.16 | - | 90.6% |

### General Comments

No crown cover from crossing to 100 m upstream, and no overhanging vegetation. Significant erosion on banks. Partially coupled. The wildlife monitor mentioned that a beaver dam approximately 50 m upstream of centerline was blown out a year ago. A lot of bank instability at that location. Ice scarring is 2 m high at 50 m upstream and at the crossing. Crown cover is 60% at crossing. In downstream reach, there is woody debris throughout.

**Photo 1:** Site 884.8—Aerial photo looking downstream from upstream of existing Mackenzie Valley Highway Winter Road. Photo is taken upstream of transects.

**Photo 2:** Site 884.8—Upstream view from 100 m upstream of proposed alignment centerline.

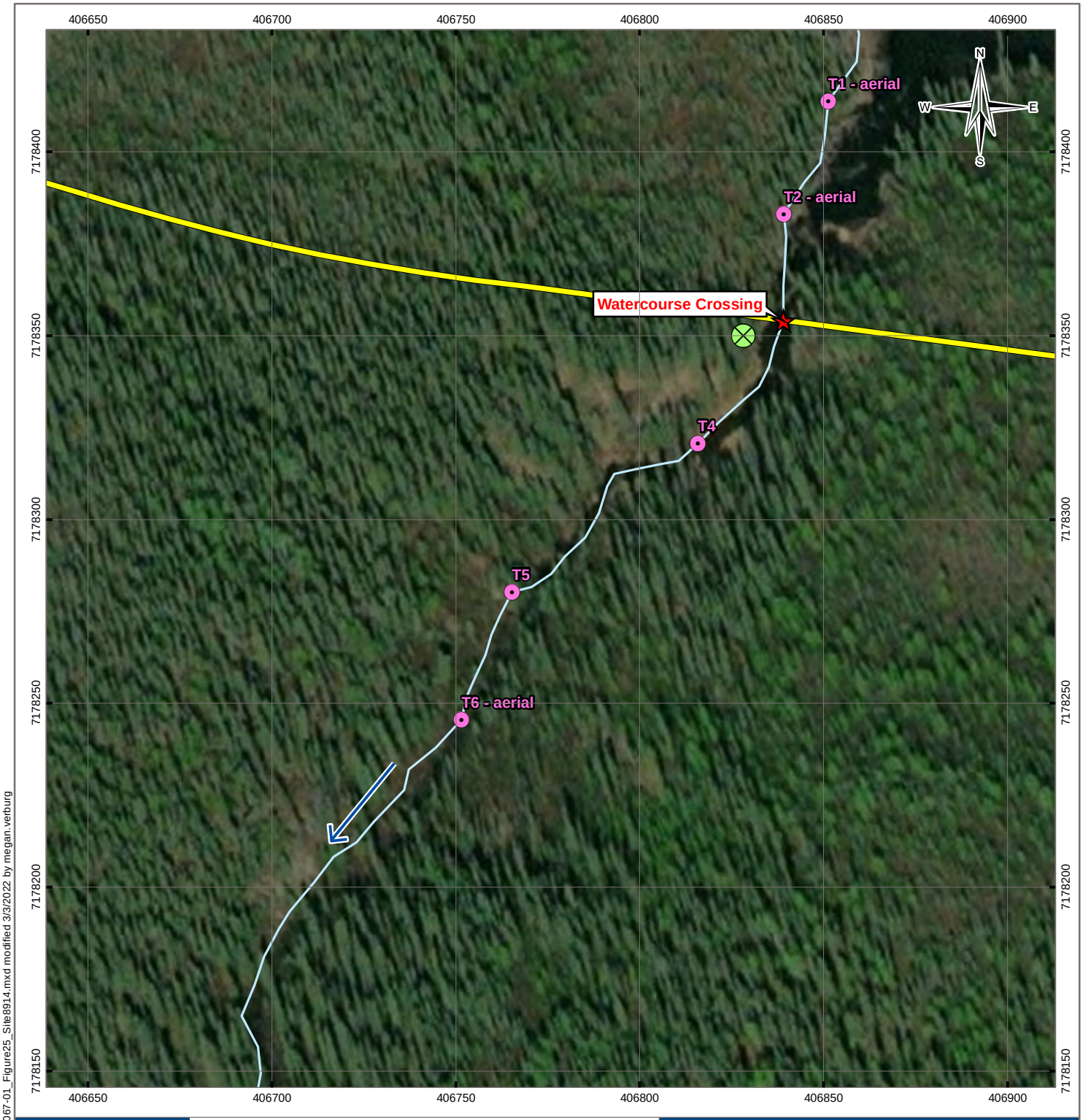
**Photo 3:** Site 884.8— View of proposed alignment centerline, looking upstream.

**Photo 4:** Site 884.8—Bank instability approximately 60 m upstream from centerline.

**Photo 5:** Site 884.8—Facing upstream at 200 m downstream from centerline.

**Photo 6:** Site 884.8—Facing upstream at 300 m downstream from centerline.

# SITE 891.4




## LEGEND

- Watercourse Crossing
- Beaver Dam
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2017)

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 891.4

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:1,500
30 15 0 30
Metres

**FILE NO.**
WTRI03067-01_Figure25_Site8914.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE**
March 3, 2022

**PROJECT NO.**
ENG.WTRI03067-01

TETRA TECH

**Figure 25**

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# Mackenzie Valley Highway

## Site 891.4 Unnamed Watercourse

**UTM Location:** 10W 406839E 7178354N **Survey Date:** 10/11/2021; 11:00

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | | 2 (↑50) | | 3 (CL) | | 4 (↓100) | | 5 (↓200) | | 6 (↓300) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel Width (m) | 17.0 | | 15.0 | | 12.5 | | 5.5 | | 5.8 | | 6.0 | |
| Wetted Width (m) | - | | - | | - | | 5.0 | | 5.0 | | - | |
| Depth at LDB + 25% (m) | - | | - | | 1.3 | | 0.5 | | 0.5 | | - | |
| Depth at LDB + 50% (m) | - | | - | | - | | 0.5 | | 0.5 | | - | |
| Depth at LDB + 75% (m) | - | | - | | - | | 0.3 | | 0.7 | | - | |
| Max.BankfullDepth (m) | - | | - | | | | 0.52 | | 0.65 | | - | |
| Gradient (%) | 3 | | 3 | | 3 | | 3 | | 3 | | 3 | |
| Dominant Habitat Unit | R1 | | RF | | BD | | R1 | | R1 | | FL | |
| **Stream Bed** | | | | | | | | | | | | |
| Substrate (% of Transect Area) Organics | - | | - | | 0 | | 30 | | 30 | | - | |
| Fines | - | | - | | 100 | | 40 | | 70 | | - | |
| Small Gravel | - | | - | | 0 | | - | | - | | - | |
| Large Gravel | - | | - | | 0 | | - | | - | | - | |
| Cobble | - | | - | | 0 | | 30 | | - | | - | |
| Boulder | - | | - | | 0 | | - | | - | | - | |
| Bedrock | - | | - | | 0 | | - | | - | | - | |
| Embeddedness | - | | - | | N | | M | | M | | - | |
| **Bank Measurements** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** |
| Bank Height (m) | - | - | - | - | 1.3 | - | - | - | - | - | - | - |
| Bank Slope (°) | 80 | 80 | 70 | 70 | 65 | 65 | 50 | 50 | 50 | 50 | 50 | 50 |
| Bank Stability | MS | MS | MS | US | US | US | US | US | US | US | US | US |
| Dom. Bank Material | LG | LG | LG | LG | LG | LG | LG | LG | LG | LG | LG | LG |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | C | C | C | C | C | C | C | C | C | C | C | C |
| Subdom. Riparian Veg. | G | G | G | G | G | G | G | G | G | G | G | G |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 10 | Overhead Cover (%): | 10 |
| Dom. Instream Cover: | WD | Dom. Overhead Cover: | C |
| Subdom. Instream Cover: | C | Subdom. Overhead Cover: | S |
| Maximum Depth (m) | >1 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 11:00 |
| Water Temperature (°C): | 3.3 |
| Dissolved Oxygen (mg/L): | 10.25 |
| Sp. Conductivity (µs/cm): | 340 |
| pH: | 8.04 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ST |
| Islands: | N |
| Bars: | N |
| Coupling: | CO |
| Confinement: | CO |
| Flow Stage: | High |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate-Good | Poor | Poor |
| Overwintering: | Moderate | Moderate | Moderate |
| Rearing: | Good | Good | Good |
| Passage: | Moderate-Good | Moderate-Good | Moderate-Good |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Upstream of the centerline was a slightly impounded area as a result of the beaver dam at the centerline. The channel was wide providing moderate to good fish habitat. Steep banks on either side made access not possible for assessment of 100 m and 50 m upstream as well as 300 m downstream, therefore aerial assessments were completed instead. No barriers were observed with the exception of the beaver dam. Erosion of bank was more significant near the centerline and downstream, with increasing bank stability upstream. No fishing conducted due to freezing conditions an.d unsafe conditions for electrofishing due to high flows and water depth.

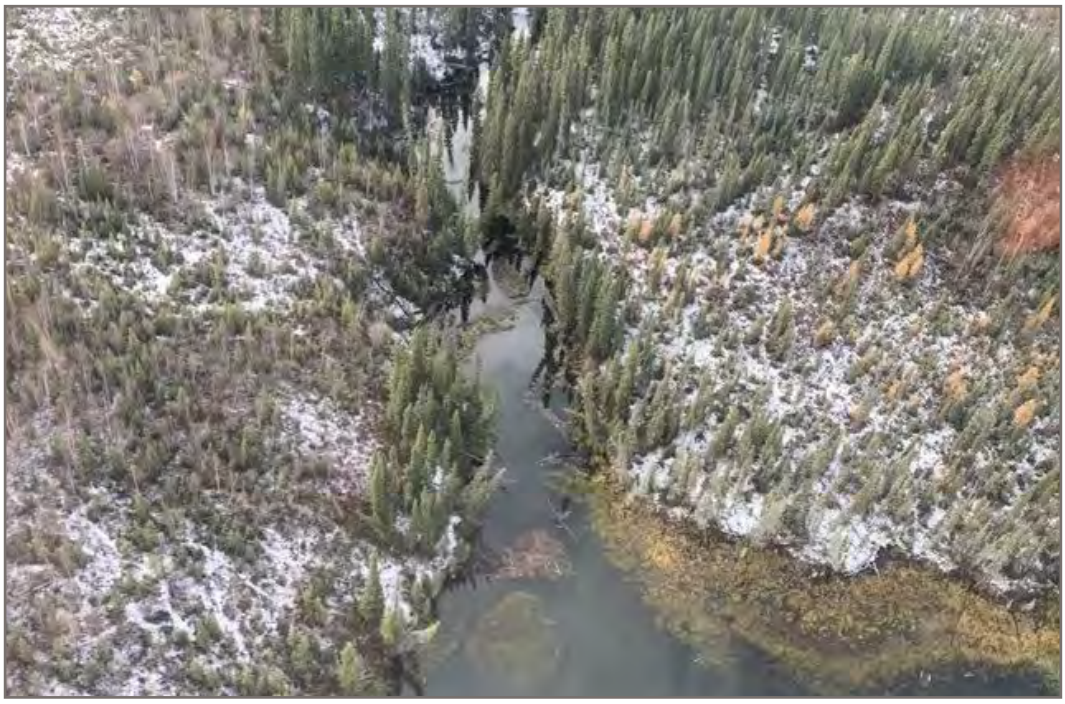


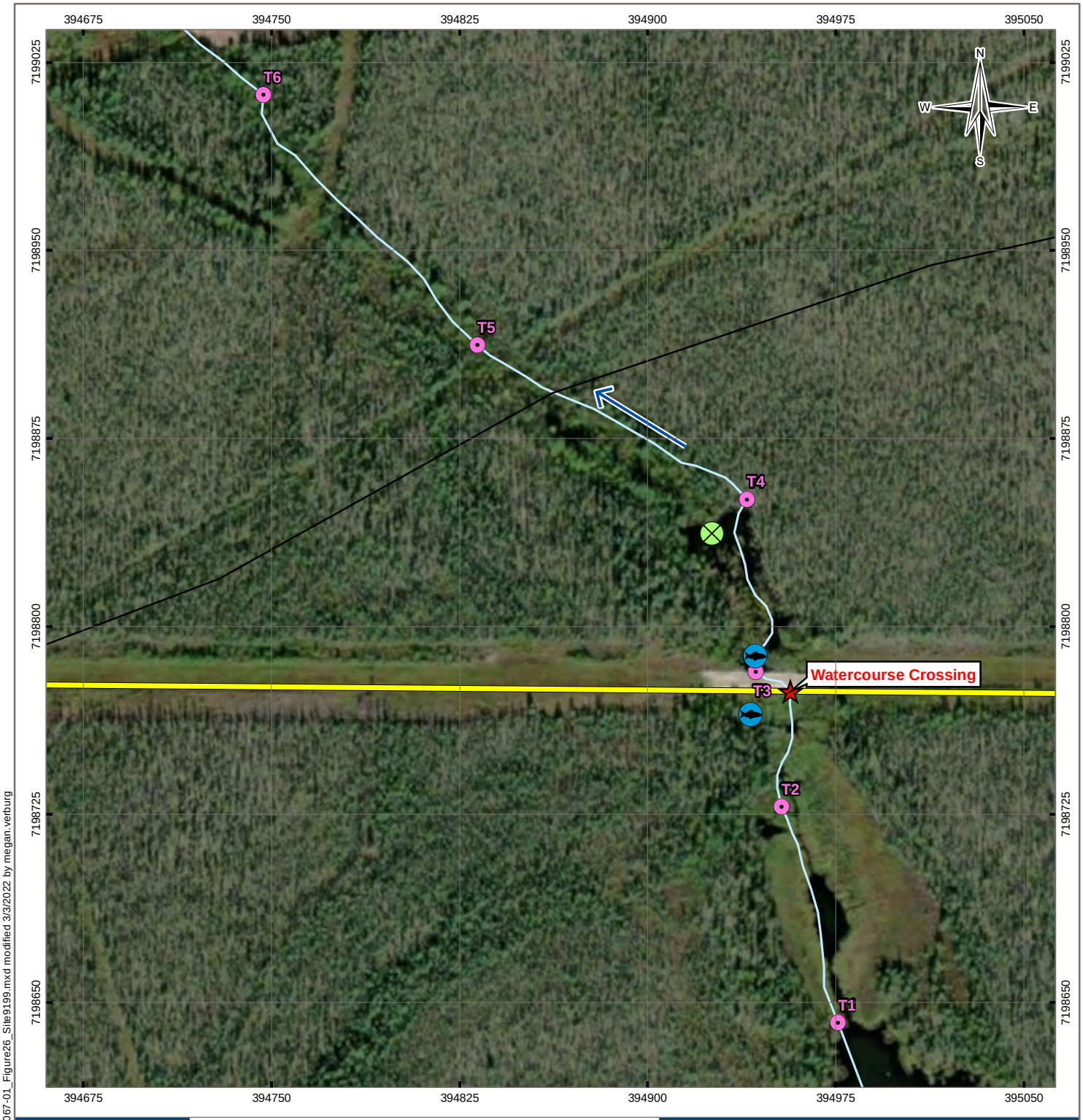
**Photo 1:** Site 891.4— Aerial view looking downstream at 100 m upstream to centerline.

**Photo 2:** Site 891.4— Looking upstream at the centerline.

**Photo 3:** Site 891.4— Looking upstream at 50 m upstream from centerline.

**Photo 4:** Site 891.4— Upstream view at 100 m downstream from centerline.

# SITE 919.9




## LEGEND

- Watercourse Crossing
- Beaver Dam
- Minnow Trap
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Mackenzie Valley Winter Road
- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2018)
CanVec 1:50,000

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 919.9

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,200
40 20 0 40
Metres

**FILE NO.** WTRI03067-01_Figure26_Site9199.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE** March 3, 2022
**PROJECT NO.** ENG.WTRI03067-01

TETRA TECH

**Figure 26**

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# Mackenzie Valley Highway

## Site 919.9 Unnamed Watercourse

**UTM Location:** 10W 394956E 7198775N **Survey Date:** 9/30/2021; 10:27

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 43.0 | 44.0 | 37.0 | 18.0 | 3.1 | 1.3 |
| Wetted Width (m) | 27.0 | 44.0 | 37.0 | 18.0 | 1.8 | 0.6 |
| Depth at LDB + 25% (m) | 0.7 | 0.6 | 0.2 | 1.1 | 0.3 | 0.3 |
| Depth at LDB + 50% (m) | 1.1 | 1.4 | 0.2 | 1.2 | 0.3 | 0.4 |
| Depth at LDB + 75% (m) | 0.8 | 0.4 | 0.2 | 1.1 | 0.2 | 0.3 |
| Max.BankfullDepth (m) | 1.5 | 1.9 | 0.29 | 1.3 | 0.70 | 0.77 |
| Gradient (%) | - | - | - | - | - | - |
| Dominant Habitat Unit | IP1 | WL | WL | WL | WL | IP1 |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) Organics | 100 | 100 | 30 | 30 | 60 | 60 |
| Fines | 0 | 0 | 60 | 70 | 40 | 40 |
| Small Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Large Gravel | 0 | 0 | 0 | 0 | 0 | 0 |
| Cobble | 0 | 0 | 0 | 0 | 0 | 0 |
| Boulder | 0 | 0 | 10 | 0 | 0 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | VH | VH | L | H | H | H |

| Bank Measurements | 1 (↑100) Left | 1 (↑100) Right | 2 (↑50) Left | 2 (↑50) Right | 3 (CL) Left | 3 (CL) Right | 4 (↓100) Left | 4 (↓100) Right | 5 (↓200) Left | 5 (↓200) Right | 6 (↓300) Left | 6 (↓300) Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.3 | 0.5 | 0.6 | 0.6 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.4 | 0.37 | 0.23 |
| Bank Slope (°) | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 10 | 10 | 10 | 70 | 70 |
| Bank Stability | S | S | S | S | S | S | S | S | MS | MS | MS | MS |
| Dom. Bank Material | O | O | O | O | O | O | O | O | O | O | O | O |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | C | C | G | C | G | S | G | S | S | C | D | D |
| Subdom. Riparian Veg. | S | S | C | S | S | G | S | G | S | G | G | G |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 10 | Overhead Cover (%): | 10 |
| Dom. Instream Cover: | OHV | Dom. Overhead Cover: | G |
| Subdom. Instream Cover: | G | Subdom. Overhead Cover: | S |
| Maximum Depth (m) | >2 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 10:27 |
| Water Temperature (°C): | 2.9 |
| Dissolved Oxygen (mg/L): | 5.96 |
| Sp. Conductivity (µs/cm): | 182 |
| pH: | 6.50 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ME |
| Islands: | O |
| Bars: | BR |
| Coupling: | DC |
| Confinement: | UN |
| Flow Stage: | Flood |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Good | None | None |
| Overwintering: | Poor-Moderate | Poor | Poor |
| Rearing: | Good | Moderate | Poor-Moderate |
| Passage: | Poor-Moderate | Poor-Moderate | Poor-Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| Minnow Trap (MT) | 46.6 | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISH CAPTURED | | | | | |

### General Comments

100 m upstream is the entrance of a deep pool flooded in floodplain. at 50 m upstream is a flooded area that crosses downstream of centerline. Downstream is braided with organic islands in the middle throughout to 100 m downstream, where beaver dam is present. An existing culvert is present at crossing with pooling on either side with vegetation islands. Entire reach had poorly defined channel taht was largely flooded.Two minnow traps were set on either side of the crossing.

**Photo 1:** Site 919.9—Upstream view at centreline.

**Photo 2:** Site 919.9—Looking upstream 100m upstream from centerline.

**Photo 3:** Site 919.9—Channel facing downstream at 300 m downstream from centerline.

**Photo 4:** Site 919.9— Beaver dam 100 m downstream of centerline.

**Photo 5:** Site 919.9—View of centerline looking down the existing winter road.

**Photo 6:** Site 919.9— Water pooling upstream of centerline gravel road.

# SITE 940.1


## LEGEND

- Watercourse Crossing
- Transect
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Mackenzie Valley Winter Road
- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2017)
Hydrology provided by Government of NT CanVec 1:50,000

**STATUS**
ISSUED FOR USE

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 940.1

| PROJECTION | DATUM | CLIENT |
|---|---|---|
| UTM Zone 10 | NAD83 | Northwest Territories |

Scale: 1:2,000
40 20 0 40
Metres

**FILE NO.** WTRI03067-01_Figure27_Site9401.mxd

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

**DATE** March 3, 2022
**PROJECT NO.** ENG.WTRI03067-01

TETRA TECH

**Figure 27**

Q:\Edmonton\GIS\ENGINEERING\WTRI\WTRI03067-01\Maps\WTRI03067-01_Figure27_Site9401.mxd modified 3/3/2022 by megan.verburg

# Mackenzie Valley Highway

## Site 940.1 Unnamed Watercourse

**UTM Location:** 10W 375325E 7203625N **Survey Date:** 10/8/2021; 18:00

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | 2 (↑50) | 3 (CL) | 4 (↓100) | 5 (↓200) | 6 (↓300) |
|---|---|---|---|---|---|---|
| Channel Width (m) | 1.9 | 2.2 | 1.5 | 1.4 | 1.0 | 1.3 |
| Wetted Width (m) | 1.1 | 1.7 | 1.0 | 1.1 | 0.9 | 1.0 |
| Depth at LDB + 25% (m) | 0.2 | 0.3 | 0.4 | 0.4 | 0.2 | 0.1 |
| Depth at LDB + 50% (m) | 0.4 | 0.3 | 0.4 | 0.3 | 0.1 | 0.2 |
| Depth at LDB + 75% (m) | 0.3 | 0.2 | 0.3 | 0.5 | 0.3 | 0.2 |
| Max.BankfullDepth (m) | 0.51 | 0.47 | 0.93 | 0.68 | 0.40 | 0.32 |
| Gradient (%) | 1 | 1 | 1 | 1 | 5 | 8 |
| Dominant Habitat Unit | R1 | R1 | R1 | R1 | P2 | SP |
| **Stream Bed** | | | | | | |
| Substrate (% of Transect Area) Organics | 40 | 40 | 60 | 100 | 30 | 60 |
| Fines | 60 | 60 | 40 | 0 | 70 | 30 |
| Small Gravel | 0 | 0 | 0 | 0 | | 0 |
| Large Gravel | 0 | 0 | 0 | 0 | 0 | 10 |
| Cobble | 0 | 0 | 0 | 0 | 0 | 0 |
| Boulder | 0 | 0 | 0 | 0 | 0 | 0 |
| Bedrock | 0 | 0 | 0 | 0 | 0 | 0 |
| Embeddedness | N | N | N | N | N | N |

| Bank Measurements | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bank Height (m) | 0.1 | 0.1 | 0.2 | 0.1 | 0.4 | 0.5 | 0.2 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 |
| Bank Slope (°) | 20 | 5 | 25 | 30 | 20 | 20 | 10 | 10 | 10 | 10 | 10 | 10 |
| Bank Stability | MS | MS | MS | MS | MS | MS | US | MS | S | MS | MS | MS |
| Dom. Bank Material | O | O | O | O | O | O | O | O | O | O | O | O |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | S | S | S | S | S | S | S | S | D | D | S | S |
| Subdom. Riparian Veg. | G | G | G | G | G | G | D | D | S | S | D | D |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 10 | Overhead Cover (%): | 90 |
| Dom. Instream Cover: | UC | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | - | Subdom. Overhead Cover: | G |
| Maximum Depth (m) | 0.6 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 18:09 |
| Water Temperature (°C): | 0.2 |
| Dissolved Oxygen (mg/L): | 12.54 |
| Sp. Conductivity (µs/cm): | 597 |
| pH: | 8.29 |
| Turbidity (NTU): | Lightly Turbid |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ME |
| Islands: | N |
| Bars: | N |
| Coupling: | PC |
| Confinement: | OC |
| Flow Stage: | Moderate |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate | None | None |
| Overwintering: | None-Poor | None-Poor | None-Poor |
| Rearing: | Moderate-Good | Poor-Moderate | Poor-Moderate |
| Passage: | Poor-Moderate | Poor-Moderate | Poor-Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| No Electrofishing | - | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| - | - | - | - |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISHING ATTEMPTED | | | | | |

### General Comments

Snow and ice cover throughout at time of assessment. Overhanging shrubs cover 90-100% of stream throughout. Grasses compressed by snow. Uplands show signs of fire in past, with abundant woody debris throughout. No instream vegetation. 200 DS: Significant flow with several cascades. Upstream passage, along with the increased gradient, would be difficult for all fish species.Step pools are present downstream 300 m and cascade drops 0.25m with 0.36m pool depth (i.e. natural barriers). No fishing conducted due to snow and ice conditions.

**Photo 1:** Site 940.1—Upstream view from new alignment centerline.

**Photo 2:** Site 940.1—Downstream view of 100 m downstream from centerline.

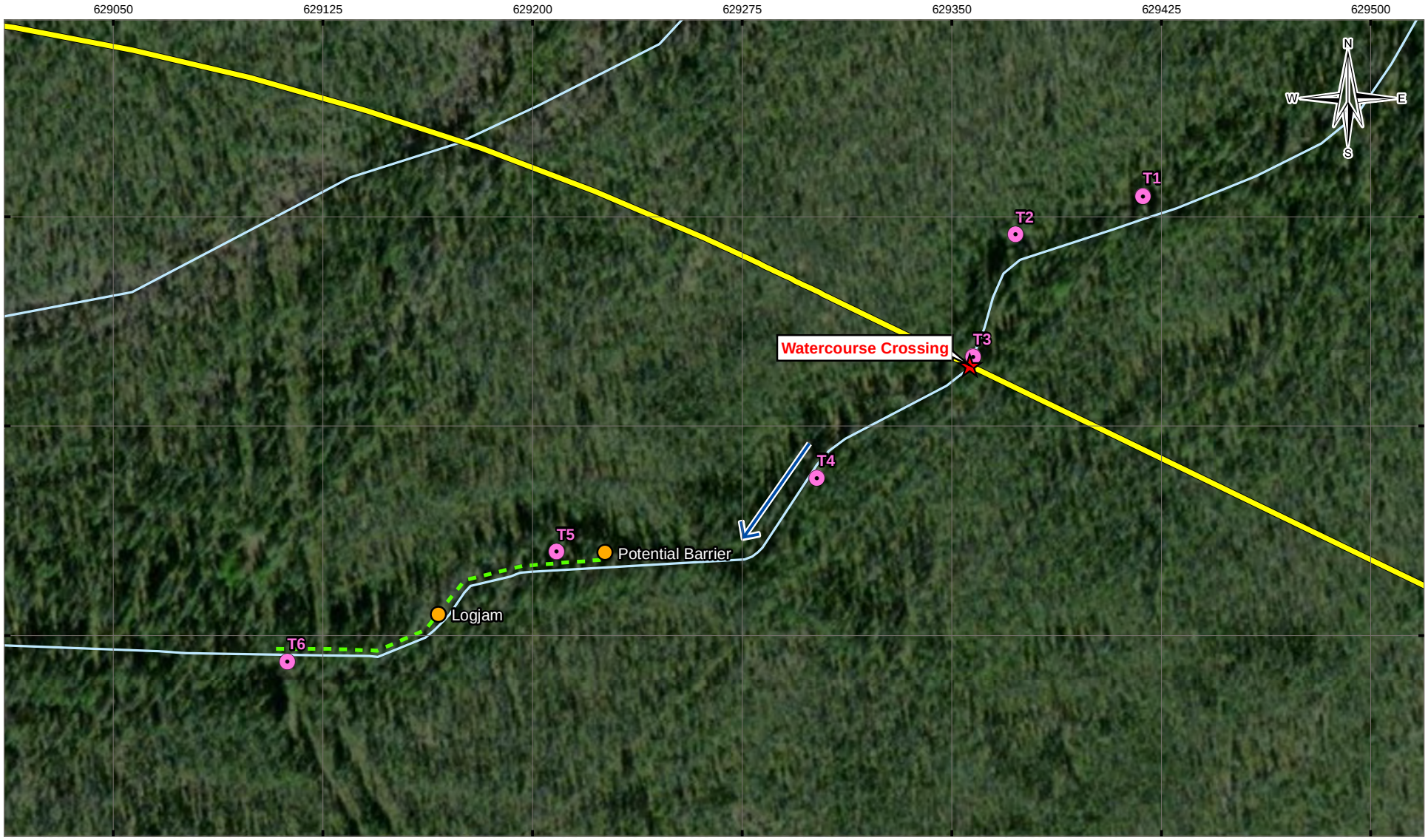
**Photo 3:** Site 940.1—Downstream view of 50 m upstream from centerline.

**Photo 4:** Site 940.1—upstream view of 300 m downstream from centerline.

**Photo 5:** Site 940.1—Aerial view of existing channel, looking northeast (upstream).

# SITE 981.2

Q:\Edmonton\GIS\ENGINEERING\WTRI\WTRI03067-01\Maps\WTRI03067-01_Figure28_Site9812.mxd modified 3/3/2022 by megan.verburg




## LEGEND

- Watercourse Crossing
- Site Feature
- Transect
- Electrofishing
- Flow Direction
- Proposed Mackenzie Valley Highway Alignment

**Base Data**

- Watercourse

**NOTES**
Base data source: Imagery provided by ESRI; Maxar (2017)
Hydrology provided by Government of NT

**STATUS**
ISSUED FOR USE

Scale: 1:2,000
40 20 0 40
Metres

| PROJECTION | DATUM |
|---|---|
| UTM Zone 9 | NAD83 |

**FILE NO.**
WTRI03067-01_Figure28_Site9812.mxd

**CLIENT**
Northwest Territories

TETRA TECH

# MACKENZIE VALLEY HIGHWAY FISHERIES ASSESSMENT

## Site 981.2

| OFFICE | DWN | CKD | APVD | REV |
|---|---|---|---|---|
| Tt-EDM | MRV | SL | TM | 0 |

| DATE | PROJECT NO. |
|---|---|
| March 3, 2022 | ENG.WTRI03067-01 |

**Figure 28**

TETRA TECH

# Mackenzie Valley Highway

## Site 981.2 Unnamed Watercourse

**UTM Location:** 10W 629352E 7227768N **Survey Date:** 10/7/2021; 15:30

**Legal Location:** - **Zone:**

**Crew Initials:** TM & MAN **Restricted Activity Period:** -

### Physical Channel Transect Data

| Transect # (Location) | 1 (↑100) | | 2 (↑50) | | 3 (CL) | | 4 (↓100) | | 5 (↓200) | | 6 (↓300) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel Width (m) | 1.4 | | 2.2 | | 2.6 | | 2.0 | | 4.0 | | 1.4 | |
| Wetted Width (m) | 0.9 | | 1.1 | | 1.4 | | 1.5 | | 1.4 | | 0.7 | |
| Depth at LDB + 25% (m) | 0.1 | | 0.1 | | 0.0 | | 0.2 | | 0.5 | | 0.2 | |
| Depth at LDB + 50% (m) | 0.1 | | 0.1 | | 0.1 | | 0.1 | | 0.4 | | 0.2 | |
| Depth at LDB + 75% (m) | 0.1 | | 0.1 | | 0.2 | | 0.1 | | 0.4 | | 0.2 | |
| Max.BankfullDepth (m) | 0.45 | | 0.71 | | 1.0 | | 0.52 | | 0.86 | | 0.57 | |
| Gradient (%) | 4 | | 4 | | 4 | | 2 | | 2 | | 2 | |
| Dominant Habitat Unit | RF | | RF | | RF | | R1 | | R1 | | R2 | |
| **Stream Bed** | | | | | | | | | | | | |
| Substrate (% of Transect Area) Organics | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| Fines | 10 | | 10 | | 0 | | 0 | | 30 | | 20 | |
| Small Gravel | 40 | | 10 | | 20 | | 40 | | 70 | | 80 | |
| Large Gravel | 30 | | 25 | | 40 | | 50 | | 0 | | 0 | |
| Cobble | 20 | | 50 | | 30 | | 10 | | 0 | | 0 | |
| Boulder | 0 | | 5 | | 10 | | 0 | | 0 | | 0 | |
| Bedrock | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| Embeddedness | N | | N | | N | | N | | N | | N | |
| **Bank Measurements** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** | **Left** | **Right** |
| Bank Height (m) | 0.3 | 0.3 | 0.6 | 0.5 | 0.9 | 0.7 | 0.3 | 0.3 | 0.3 | 0.4 | 0.3 | 0.4 |
| Bank Slope (°) | 70 | 90 | 50 | 90 | 90 | 90 | 35 | 50 | 20 | 30 | 90 | 70 |
| Bank Stability | MS | MS | MS | MS | MS | MS | MS | MS | MS | MS | US | US |
| Dom. Bank Material | O | O | O | O | O | O | O | O | O | O | O | O |
| Subdom. Bank Material | F | F | F | F | F | F | F | F | F | F | F | F |
| Dom. Riparian Veg. | S | S | S | S | S | S | S | S | S | S | S | S |
| Subdom. Riparian Veg. | G | G | S | C | G | G | C | C | G | G | C | C |

### Habitat Inventory / Reach Data

| | | | |
|---|---|---|---|
| Instream Cover (%): | 25 | Overhead Cover (%): | 40 |
| Dom. Instream Cover: | Co | Dom. Overhead Cover: | S |
| Subdom. Instream Cover: | Bo | Subdom. Overhead Cover: | C |
| Maximum Depth (m) | 0.8 | Dom. Aquatic Veg. Type: | - |

### Water Quality Data

| | |
|---|---|
| Time of Day (HH:MM): | 15:30 |
| Water Temperature (°C): | 0.2 |
| Dissolved Oxygen (mg/L): | 12.77 |
| Sp. Conductivity (µs/cm): | 961 |
| pH: | 8.54 |
| Turbidity (NTU): | Clear |

### Channel Characteristics

| | |
|---|---|
| Pattern: | ME |
| Islands: | I |
| Bars: | N |
| Coupling: | CO |
| Confinement: | OC |
| Flow Stage: | Moderate |

### Fish Habitat Assessment Ratings

| | Forage Fish | Coarse Fish | Sport Fish |
|---|---|---|---|
| Spawning: | Moderate-Good | Moderate-Good | Moderate-Good |
| Overwintering: | None-Poor | None-Poor | None-Poor |
| Rearing: | Good | Good | Moderate |
| Passage: | Moderate | Moderate | Moderate |

### Fish Sampling Data

| Method | Effort | |
|---|---|---|
| Backpack Electrofisher (EB) | 485 | (s) |
| No Trapping | - | (hr) |

**Electrofisher Settings**

| Volts | Freq. (Hz) | Duty Cycle (%) | Dist. (m) |
|---|---|---|---|
| 235 | 30 | 12 | 100 |

| Species | Efish Catch (n) | Trap Catch (n) | Efish CPUE (#fish/100s) | Trap CPUE (#fish/hr) | Rel. Abundance (% of total) |
|---|---|---|---|---|---|
| NO FISH CAPTURED | | | | | |

### General Comments

Assessment done in snow and 50% ice cover frozen. Upstream has some undercutbanks and large cobbles present under banks. There are riffle sections throughout with chutes abundant. Some step pools upstream from woody debris. Some logjams downstream that may be fish passage barriers. Good flow 300 m downstream, some woody debris causing riffling with minor undercutting and exposed roots on bank. Grasses covered in snow on bank.

**Photo 1:** Site 981.2—Downstream view of 100 m upstream from centerline.

**Photo 2:** Site 981.2— Looking upstream at 300 m downstream from centerline.

**Photo 3:** Site 981.2— Upstream view of 200 m downstream from centerline.

**Photo 4:** Site 981.2—Upstream view of 100 m downstream from centerline.

**Photo 5:** Site 981.2— Upstream view of from centerline of proposed alignment.