MANITOBA-MINNESOTA TRANSMISSION PROJECT

Biophysical Technical Data Reports

1.4 Fish and Fish Habitat

Manitoba-Minnesota Transmission Project: Fish and Fish Habitat – Technical Data Report

FINAL REPORT

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Sign-off Sheet

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Acronyms and Abbreviations

AHCD	Assiniboine Hills Conservation District
CCME	Canadian Council of Ministers of the Environment
CD	conservation district
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CEC	Clean Environment Commission
CRA	commercial, recreational and Aboriginal
D604I	Dorsey to Iron Range 500 kV Transmission Line
DFO	Fisheries and Oceans Canada
DO	dissolved oxygen
EA	environmental assessment
EIS	environmental impact statement
EnvPP	environmental protection plan
ESEA	*The Endangered Species and Ecosystems Act*
ESS	environmentally sensitive site
FIHCS	Fisheries Inventory and Habitat Classification System
GIS	geographic information system
HWM	high water mark
IWMP	Integrated Watershed Management Plan
kV	kilovolt

LAA	local assessment area
m	metre
m^2	square metre
MB	Manitoba
MBCDC	Manitoba Conservation Data Centre
MCWS	Manitoba Conservation and Water Stewardship
mg/L	milligrams per litre
MMTP	Manitoba-Minnesota Transmission Project
MR	Manitoba regulation
MWQSOG	Manitoba Water Quality Standards, Objectives, and Guidelines
NDC	no defined channel
NEB	National Energy Board
NTU	nephelometric turbidity unit
PDA	project development area
PTH	provincial trunk highway
RAA	regional assessment area
RAP	restricted activity period
RM	rural municipality
ROW	right-of-way
SAR	Species at Risk
SARA	*Species at Risk Act*
SLTC	Southern Loop Transmission Corridor
SOCC	Species of Conservation Concern

SOP	standard operating procedure
SRRCD	Seine-Rat River Conservation District
SVTC	St. Vital Transmission Corridor
TDR	Technical Data Report
TSS	total suspended solids
µS/cm	microsiemens per centimetre
VC	valued component
WQG	water quality guideline

Glossary of Technical Terms

Aboriginal Fishery	Fish harvested by an Aboriginal organization or any of its members for the purpose of using the fish as food, for social or ceremonial purposes or for purposes set out in a land claims agreement entered into with the Aboriginal organization, as defined in the *Fisheries Act*.
Allochthonous	Material imported into an ecosystem from outside of it. This includes leaves that fall or are washed into the water, and branches and trees that topple into the stream.
Benthic Invertebrate	An animal lacking a backbone that lives on or in the bottom sediments of a watercourse or water body (*e.g.,* mayfly, clam, aquatic earthworm, crayfish).
Benthic	The ecological area at the deepest level of a water body, such as a lake or river, including the sediment surface and some sub-surface layers.
Coarse Fish	Fish species often not sought for recreational angling, but which may be valuable for commercial or subsistence fisheries. Coarse fish typically include large-bodied fish, such as suckers and carp, and are often caught using nets.
Commercial Fishery	Fish harvested under license for the purpose of sale, trade or barter, as defined in the *Fisheries Act*.
Commercial, Recreational, Aboriginal Fishery (CRA)	Fish that "are part of" a CRA fishery are those fish that are within the scope of federal or provincial fisheries regulations and/or can be fished by Aboriginal peoples. Fish that "support" a CRA fishery are those fish that contribute to the productivity of a fishery (often as prey species), may reside in water bodies that contain CRA fisheries, and/or may reside in water bodies that are connected by a watercourse to such water bodies, as defined in the *Fisheries Act*.
Critical Habitat	Habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species, as defined in the *Species At Risk Act*, 2002.

Deleterious Substance	Any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered, or is likely to be rendered, deleterious to fish or fish habitat or to the use by man of fish that frequent that water.
Direct Fish Habitat	Watercourses where fish can complete any of their life processes, *i.e.*, spawning, rearing, feeding, migration or overwintering (Milani 2013).
Fish	As defined in the *Fisheries Act,* fish includes: a) Parts of fish. b) Shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals. c) The eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.
Fishery	The area, locality, place or station in or on which a pound, seine, net, weir or other fishing appliance is used, set, placed or located, and the area, tract or stretch of water in or from which fish may be taken by the said pound, seine, net, weir or other fishing appliance, and also the pound, seine, net, weir, or other fishing appliance used in connection therewith, as defined in the *Fisheries Act*.
Fish Habitat	Spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirect to carry out their life processes, as defined in the *Fisheries Act*.
Forage Fish	Fish species that are generally small-bodied and typically not harvested for subsistence. These fish may be harvested as bait, so they might support a commercial fishery. Additionally, they can constitute a significant portion of the diet for sport fish, so they may also support recreational fisheries.
Groundwater	Water that occurs beneath the land surface and fills the pore spaces of soil or rock below the saturated zone.
High Water Mark	The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the adjacent land.

Indicator Species	Include large-bodied species with commercial, domestic, or sport fishery value. Indicator species also include any fish listed in Schedule 1 of the *Species at Risk Act* (Milani 2013).
Indirect Fish Habitat	Ephemeral watercourses that typically have insufficient flow volume or flow duration to allow fish to complete one or more of their life processes, but may provide flow and nutrients to downstream areas (Milani 2013).
Integrated Watershed Management Plan	A document developed cooperatively by government, Aboriginal groups and stakeholders (watershed residents, interest groups) aimed at creating shared goals to manage land, water and related resources on a watershed basis. The development of these plans is usually led by Conservation Districts.
Machine-Free Zone	A zone located adjacent to the riparian area in which no ground disturbance will take place but where harvesting may be permitted by reaching in with harvesting equipment (approximate reach is 7 m). No harvesters, skidders, site preparation or scarification equipment are permitted in the Machine-Free Zone.
Permanent Alteration	A permanent change to fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use such habitats as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes, as defined in the *Fisheries Act*.
Periphyton	A combination of algae, cyanobacteria, heterotropic microbial organisms, and decomposing organic matter that is attached to most submerged surfaces in aquatic ecosystems.
Recreational Fishery	Fish targeted by licensed anglers for personal use or sport, as well as coarse and forage fish that support these fisheries, as defined in the *Fisheries Act*.
Reserve Zone	Located adjacent to the riparian area. No harvest, mechanical or ground disturbance are permitted in the reserve zone.
Riparian	Refers to terrain, vegetation or simply a position adjacent to or associated with a watercourse, water body, or flood plain.

Serious Harm	The death of fish or any permanent alteration to, or destruction of, fish habitat.
Simple Habitat	Linear channel having a trapezoidal cross-section, with a fine, uniform substrate and grassed banks or dikes (Milani 2013).
Species at Risk (SAR)	An extirpated, endangered or threatened species or a species of special concern, as defined by the *Species at Risk Act*.
Species of Conservation Concern (SOCC)	Species that are rare, disjunct, or at risk throughout their range, or in Manitoba, and in need of further research. The term also encompasses species that are listed under *The Endangered Species and Ecosystems Act of Manitoba*, or that have a special designation by the Committee on the Status of Endangered Wildlife In Canada.
Sport Fish	Fish species that are targeted by recreational anglers and desired in commercial and Aboriginal fisheries. Generally, there are specific regulations in each jurisdiction regarding the recreational harvest and pursuit of these species (*e.g.,* trout, pike, bass).
Sub-watershed	A smaller geographic sub-unit of a watershed that consists of smaller drainage areas.
Type A Habitat	Provides direct fish habitat for one or more of the following life processes: spawning, rearing, feeding, overwintering, migrating; supports complex habitat with indicator species (*i.e.,* CRA fishery and/or SOCC); flows are intermittent or perennial (Milani 2013).
Type B Habitat	Provides direct fish habitat for one or more of the following life processes: spawning, rearing, feeding, overwintering, migrating; supports simple habitat with indicator species (*i.e.,* CRA fishery and/or SOCC); flows are intermittent or perennial (Milani 2013).
Type C Habitat	Provides direct fish habitat for one or more of the following life processes: spawning, rearing, feeding, overwintering, migrating; supports complex habitat with non-indicator (forage) fish species (*i.e.,* fish species that support a CRA fishery); flows are intermittent or perennial (Milani 2013).

Type D Habitat	Provides direct fish habitat for one or more of the following life processes: spawning, rearing, feeding, overwintering, migrating; supports simple habitat with non-indicator (forage) fish species (*i.e.,* fish species that support a CRA fishery); flows are intermittent or perennial (Milani 2013).
Type E Habitat	Watercourse that does not provide direct fish habitat; flows are typically ephemeral (Milani 2013).
Watercourse	A channel that conveys flowing water for at least part of the year, such as a river, brook or creek.
Watershed	An area of land where surface water drainage converges to a single point at a lower elevation, where the waters join another water feature, such as a river, creek, wetland, lake or ocean. Watersheds, also known as drainage basins, are typically divided into sub-watersheds that consist of smaller drainage areas.

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1.0 INTRODUCTION

1.1 BACKGROUND

1.1.1 Project Overview

The Project's primary component is the construction of a 500 kV ac transmission line named Dorsey to Iron Range Transmission Line with a line identification code of "D604I". D604I will originate at the Dorsey Converter Station, located near Rosser, northwest of Winnipeg, and travel south around Winnipeg within the existing Southern Loop Transmission Corridor (SLTC) then head east within the existing Riel to Vivian Transmission Corridor (RVTC) to just south of Anola. From south of Anola, the transmission line will continue southeast in a new Right-of-Way (ROW), crossing the Manitoba-Minnesota border near Piney. It will then connect to the Great Northern Transmission Line, which will be constructed by Minnesota Power, and ultimately terminate at a new station called Iron Range Station adjacent to the existing Blackberry Station located northwest of Duluth, Minnesota. The Project also includes additions and modifications to associated existing stations at Dorsey, Riel and Glenboro South in Manitoba (Appendix A, Map 1-1 – Project Infrastructure).

1.1.2 Project Area

The Project is described in three general components: the additional transmission line constructed in the existing planned transmission corridors extending from Dorsey Converter Station to just east of PTH 12, the new transmission line extending south from the Anola area to the border by Piney, Manitoba, and the upgrade work to the three stations.

1.1.2.1 Existing Transmission Corridor

Manitoba Hydro has been planning, acquiring and easing land for dedicated transmission corridors that contain multiple transmission lines since the early 1960s in an effort to minimize the effects of multiple independent ROWs in an area subject to extensive development surrounding the City of Winnipeg. For MMTP, Manitoba Hydro will utilize two existing corridors; the Southern Loop Transmission Corridor which traverses from Dorsey Converter Station to southeast Winnipeg and the Riel – Vivian Transmission Corridor which traverses from Riel Converter Station eastward (Appendix A, Map 1-1 – Project Infrastructure).

Southern Loop Transmission Corridor

The Southern Loop Transmission Corridor (SLTC) is a utility corridor that extends from Dorsey Converter Station south and then east circumventing the City of Winnipeg and ending at the

Riel Converter Station located on the east side of the City adjacent to the Red River Floodway (Appendix A, Map 1-1 – Project Infrastructure).

The existing Southern Loop transmission corridor is up to 245 m wide and is designed to accommodate multiple transmission lines necessary for system reliability and to meet future energy demands in southern Manitoba. There are currently two 230 kV ac lines in this corridor, with additional transmission lines planned including a 230 kV line from La Verendrye to St. Vital Station. With the addition of the Dorsey to Iron Range (D604I) 500 kV transmission line, there will be four lines in this corridor. However, the corridor can house additional lines. D604I will travel 68 km from Dorsey Converter Station to the Riel Converter Station within the SLTC where it will exit and enter the Riel–Vivian Transmission Corridor.

Riel-Vivian Transmission Corridor

The Riel–Vivian Transmission Corridor (RVTC) is a utility corridor that extends from Riel Converter Station east to just south of Vivian, MB (Appendix A, Map 1-1 – Project Infrastructure). The existing Riel–Vivian transmission corridor is 177 m wide. There is currently one 500 kV ac Riel to Forbes (M602F) and (1) 500 kV dc (Bipole III) line under construction in this corridor. With the addition of the Dorsey to Iron Range (D604I) 500 kV transmission line there will be three lines in this corridor.

The proposed transmission line within the existing transmission corridors crosses two major basins, the Assiniboine River Basin and the Red River Basin. The Project extends across one sub-watershed within the Assiniboine River Basin, the Lower Assiniboine River (05MJ) sub-watershed, and six sub-watersheds of the Red River Basin including: the La Salle (05OG), Red River (05OC), Seine River (05OH), Cooks Creek/Devils Creek (05OJ), Rat River (05OE), and the Roseau River (05OD) sub-watersheds (Appendix A, Map 1-2 – Sub-Watersheds). The Project crosses 75 watercourses, including rivers, streams, creeks and agricultural drains. Approximately 23 of these watercourses are potentially fish-bearing waters. There are nine aquatic Species of Conservation Concern (SOCC) that potentially inhabit the area encompassed by these 23 watercourses. There are no-fish bearing watercourses within 30 m of the Dorsey, Riel or Glenboro stations.

A discussion of aquatic conditions in each sub-watershed follows.

1.1.2.1.1 The Lower Assiniboine River Sub-Watershed (05MJ)

The Lower Assiniboine River Sub-watershed is approximately 2,485 km^2 in area and contains an extensive network of agricultural drains as well as Sturgeon Creek and the Assiniboine River (Stantec 2011). Many of the waterways have been influenced by agricultural practices (North/South Consultants 2010), including a loss of riparian cover and additional nutrient and sediment loading.

Within this sub-watershed the Project will cross Sturgeon Creek, Third Creek (a tertiary drain within the RM of Headingly) and the Assiniboine River. Riparian vegetation is heavily impacted, and is mowed at the proposed crossing location on both Sturgeon and Third Creek to aid in

agricultural drainage. There is intact riparian vegetation along both the north and south sides of the Assiniboine River with a mixture of Manitoba maple, ash, basswood, cattail, cottonwood, dogwood, elm, grass/sedge, and poplar species (Benke and Cushing 2010).

Long-term water quality monitoring stations are located in the Assiniboine River, along the Lower Assiniboine Sub-watershed. Water quality and flow data are available for the Assiniboine River since 1965.

1.1.2.1.2 The La Salle River Sub-watershed (05OG)

The southern portion of the SLTC runs through the La Salle River sub-watershed. The drainage area in this basin is approximately 2,426 km^2, and approximately 60% of the land use is for agriculture with an added 16% for drainage canals (Graveline and Larter 2006). Urban and residential land use accounts for approximately 6% of the La Salle sub-watershed area, and 8% is deciduous forest. Aquatic habitats in this watershed are moderately to severely impacted by anthropogenic activities (Graveline and Larter 2006), including cultivation practices, livestock operations, wastewater lagoon discharges and urban storm water drains (Bourne *et al.* 2002; Manitoba Phosphorus Expert Committee [MPEC] 2006). The Project crosses only one watercourse in this sub-watershed, the La Salle River, and the riparian area consists of grasses and shrubs with oak, poplar, dogwood and willow (Benke and Cushing 2010). The river bank is steep in many areas and is stabilized by grasses.

1.1.2.1.3 The Red River Sub-watershed (05OC)

The drainage area of the Red River sub-watershed is approximately 96,716 km^2. The Project crosses two watercourses–the Red River itself and the Red River Floodway.

The riparian area and banks of the Red River crossing are generally covered in grasses/sedge with a few shrubs and deciduous trees along the southwestern bank. The river itself is characterized by a wide, deep channel with very turbid water and little in-water vegetation. This area of the river receives an upstream point source input from the Winnipeg South End Wastewater Pollution Control Centre. Due to the number of dams created on the upper reaches of the river, flow rates and substrate types have become homogenous along the Red River (KGS Group 2008).

The Red River Floodway is a 48 km man-made channel with long sloping banks. The Red River Floodway was completed in 1968 to protect the City of Winnipeg against spring flooding. Land now occupied by the floodway was previously used as agricultural cropland. Water flow is intermittent in the channel. For example, spring flows are typically higher when the floodway gates are opened to manage high water levels of the Red River, but lower in late summer and early fall when the gates are closed. Because the Red River Floodway becomes part of the Red River when the Inlet Control Structure is open, species present in the Red River have the potential to inhabit the floodway and surface water quality can be considered the same in the floodway. During the fall 2014 field assessment, the Red River Floodway at the MMTP crossing location was

dry. There were both terrestrial and aquatic plant species present along the banks, which are mowed regularly by the City of Winnipeg. Some areas are also used for growing hay.

Long-term water quality monitoring stations are located along the Red River on both sides of the border. Provincial water quality and flow data are available for the Red River since 1967. The Canadian Wateroffice website has accessible water level and flow data dating from 1912 (Government of Canada [GOC]-Wateroffice 2014).

1.1.2.1.4 The Seine River Sub-watershed (05OH)

The Seine River sub-watershed is similar to the La Salle River sub-watershed in that over 60% of the 1,196 km^2 area is dominated by agricultural land use. There are six watercourses crossed by the Project in this sub-watershed, including the Seine River, three unnamed tributaries, Fish Creek and La Broquerie Drain. Urban development in the sub-watershed includes the southeastern corner of the City of Winnipeg, the City of Steinbach, and the towns of Ste. Anne and Niverville. This sub-watershed contains an extensive network of waterways, including over 600 km of Provincial drains. The Seine River Diversion was completed in 1960 as a flood control measure. Regular flow has been reduced throughout the year in the main channel of the Seine River because of the Diversion. Over half of the riparian area in this sub-watershed is heavily impacted from cultural development such as cities, towns, golf courses and other urban impacts. The remaining portion of the sub-watershed's riparian area land cover has been classified as native grassland shrubs and trees (SRRCD 2009). There are 11 long-term water level and flow stations along the Seine River (GOC Wateroffice 2015) and the City of Winnipeg has been monitoring the quality of this watercourse since 2007 (City of Winnipeg 2007-2015).

1.1.2.1.5 The Cooks Creek/Devils Creek Sub-watersheds (05OJ)

From the Seine River sub-watershed, the project extends east and briefly crosses into the Cooks-Devils Creek sub-watershed. The Project will cross both Cooks Creek and Edie Creek twice. The Cooks-Devils watershed area is 4,251 km^2, and approximately 90% of the land is privately owned. The land use in this area is predominantly forage and grain agriculture. Riparian vegetation of watercourses within the Project area is predominantly agriculture and thick grasses with some forested areas. There are 440 km of provincial drains and 850 km in municipal drains within this watershed, however key surface water issues in this area still include flooding, drainage and water retention (MWS 2013a). The Cooks Creek Diversion was constructed in 1984 to divert the flow from Cooks Creek's upper reaches into the Red River Floodway during periods of high water. Several other diversions, erosion control structures and dam/retention structures have been constructed to improve surface water management within this sub-watershed (MWS 2013b). There are five long-term monitoring stations along Cooks Creek that measure water levels and flow (GOC Wateroffice 2015).

1.1.2.2 New Right-of-Way

From the existing Transmission Corridor south of Anola, MB, the D604I transmission line will proceed southeast within a new Right-of-Way (ROW) as shown on Appendix A, Map 1-1 – Project Infrastructure.

As the preferred route turns south it passes through the Seine River sub-watershed again, then travels through the Rat River and Roseau River Sub-watersheds to the Canada/US border. A discussion of aquatic conditions in these two sub-watersheds follows.

1.1.2.2.1 The Rat River Sub-watershed (05OE)

The Rat River sub-watershed covers 3,193 km^2 and has an expansive natural floodplain which frequently floods in the spring. Water is retained in the watershed by wetlands, and the construction of dams and retention projects developed by Ducks Unlimited (SRRCD 2012). The eastern portion of the sub-watershed is poorly drained and contains many wetlands (AAFC-PFRA 2005). Riparian areas are vegetated with slough grass, marsh reed grass, sedge, cattail and shrubby willow. Land use in the western portion of the Rat River sub-watershed is primarily agriculture, including both crop and livestock practices. Annual crops and forages account for approximately 33% of land use but this proportion has been declining since the late 1990s. Trees and grasslands account for over 50% of the land cover in this sub-watershed (AAFC-PFRA 2005). There is only one watercourse crossed by the Project in this sub-watershed, the Rat River itself. There are 5 long-term monitoring stations along the Rat River that measure water levels and flow (GOC Wateroffice 2015).

1.1.2.2.2 The Roseau River Sub-watershed (05OD)

As the MMTP extends to the south, it enters the Roseau River sub-watershed and the Rural Municipality of Piney. The total sub-watershed drainage area is approximately 5,350 km^2; with the Canadian portion accounting for about 2,500 km^2 or 44% (Roseau River International Watershed 2007a). The predominant land uses in the RM of Piney are agriculture and forestry, with approximately 6% as annual crops and 50% forested. Much of this portion of the sub-watershed is undisturbed; 7% is native grassland and wetlands account for 29% of the area (Roseau River International Watershed 2007a). At the eastern section of the Roseau River sub-watershed within the Pine Creek and Sprague Creek drainage areas there are a total of 37 km of Provincial waterways and 185 km of municipal drains. Increases in both the frequency and duration of flooding events have been observed throughout the watershed (RRIW 2007b). The Project crosses seven watercourses in the Roseau River sub-watershed; three of these watercourses (*i.e.*, Pine Creek, Pine Creek Diversion and Pine Creek Arm) are assumed to be fish-bearing watercourses. The riparian vegetation along these watercourses range from extensive agriculture (Pine Creek Diversion) to a mixture of deciduous forest and grasses (Pine Creek Arm). Activities along the riparian areas including river channel modifications, cattle wading into watercourses, increased use of fertilizers and land use practices that increase erosion, have

been suggested as factors for water quality degradation in this area (RRIW 2007b). There are six long-term monitoring stations along the western portion of the Roseau River that measure water levels and flow (GOC Wateroffice 2015).

1.1.3 Spatial Boundaries

- **Project Development Area (PDA):** The PDA encompasses the Project footprint and is the anticipated area of physical disturbance associated with the construction and operation and maintenance of the Project (see Appendix A, Maps 100-1 to 100-9 – Stream Crossings).

- **Local Assessment Area (LAA):** includes the PDA. Due to their size and high volume of flow, the LAA for the Red and Assiniboine Rivers extends 200 m upstream and 600 m downstream from the centerline of the transmission line crossing, and 30 m upbank from the high water mark (HWM). For all other watercourses crossed by the Project, the LAA extends 100 m upstream and 300 m downstream beyond the centerline, and 30 m up-bank from the HWM (see Appendix A, Maps 100-01 to 100-09 – Stream Crossings). The LAA also includes a 30 m buffer around station components. This 30 m distance is listed in Table A-1 of the NEB Filing Manual (NEB 2015) and is recommended as an acceptable distance to protect the riparian area and to buffer effects that construction could have on fish and fish habitat (Alberta ESRD 2012). The LAA represents the area where direct effects on fish and fish habitat are likely to be most pronounced or identifiable.

  Manitoba does not currently provide guidance on the spatial study area boundaries related to transmission line construction. Therefore, the LAA boundaries for the Project were derived from the Alberta *Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body* (AENV 2001, Alberta ESRD 2013). The Code of Practice guidelines establish an expected zone of impact for watercourse crossings. The zone of impact is the area of direct disturbance at the watercourse crossing site (*i.e.,* the PDA) plus the area where 90% of the sediment potentially generated during construction would be expected to be deposited. The LAA downstream distances of 300 and 600 m for small and large streams, respectively, include the potential zones of impact. The Alberta guidelines address the information requirements for a full review pursuant to the *Fisheries Act*.

- **Regional Assessment Area (RAA):** includes the PDA and the LAA. The RAA is the area within which any cumulative environmental effects for fish and fish habitat are likely to occur. This includes all portions of a watercourse or water body where the zone of influence of other projects within the watershed could interact with the Project. The RAA encompasses the boundaries of the seven sub-watersheds crossed by the Project (Appendix A, Map 1-2 – Sub-Watersheds). Based on the individual hydrological regimes and biophysical characteristics within each drainage basin, this sub-watershed-based RAA boundary was selected to encompass regional ecological health.

1.2 PURPOSE

The purpose of this TDR is to describe the existing conditions for fish and fish habitat within the proposed Project area. This TDR contains information collected during desktop analysis, outlines data gaps and describes methods used in subsequent field studies. Results of these studies were used to guide the transmission line route selection process and support the Environmental Assessment of the Project.

Fish and fish habitat, specifically commercial, recreational and Aboriginal (CRA) fisheries, are protected under the federal *Fisheries Act*. The definition of fish includes both fish and shellfish (*e.g.,* molluscs), during all of their life stages (egg, sperm, spawn, larvae, spat, juveniles). Commercial fish are species harvested under license for the purpose of sale, trade or barter. Recreational fish are species targeted by licensed anglers for personal use or sport, as well as coarse and forage fish that support these fisheries. Aboriginal fish are species caught by Aboriginal organizations or members for food, social or ceremonial purposes.

Fish habitat comprises areas that fish depend on directly or indirectly to carry out their life processes (*e.g.,* spawning, rearing, migrating, overwintering), including in-water habitat and associated surface water quality and riparian vegetation (*i.e.,* food supply areas). Quality of fish habitat incorporates a variety of biophysical parameters, including hydrology, channel characteristics, substrate, bank material, cover, water quality, aquatic vegetation, organic matter and microorganisms (*e.g.,* periphyton) and benthic invertebrate communities (*e.g.,* mayfly, clam, crayfish). Surface water quality parameters that influence fish habitat suitability include temperature, dissolved oxygen (DO), turbidity, pH and total suspended solids (TSS).

Key potential issues for Fish and Fish Habitat related to Project construction, operation and maintenance are identified using Fisheries and Oceans Canada's (DFO's) Pathways of Effects diagrams (DFO 2014). These diagrams describe mechanisms through which projects near water could have an effect on fish and fish habitat. These are summarized in Table 1-1.

Table 1-1: Key Issues Identified for Fish and Fish Habitat

Key Issues	Comments
Loss or damage to riparian vegetation at stream crossings	Loss or damage to habitat during construction and maintenance of the ROW during riparian clearing or fording streams. Alterations or removal of riparian vegetation can decrease the quality and availability of fish habitat. Loss of riparian vegetation can also increase erosion causing negative effects on fish habitat by increasing sediment deposition and turbidity.
Erosion and sedimentation from construction	Erosion and sedimentation can degrade water quality by altering pH, increasing turbidity, reducing light penetration, and decreasing oxygen in the water. Erosion and sedimentation can also affect fish habitat by damaging spawning and nursery grounds (smothering), covering algal and benthic

Table 1-1: Key Issues Identified for Fish and Fish Habitat

Key Issues	Comments
	invertebrate food sources (Birtwell 1999; Osmundson *et al.* 2002) and filling in pool habitats used for overwintering (Cunjack 1996).
Increased resource access/harvest from workers	Project infrastructure can increase access to areas, potentially increasing fishing pressure on resident fish populations.
Temporary stream crossings	Temporary stream crossings can increase sedimentation and erosion during installation and removal, affecting surface water quality and fish habitat. They can also change channel and shoreline morphometry (DFO 2014).
Changes in surface water quality parameters including dissolved oxygen, pH, turbidity, and temperature	Changes in surface water quality parameters can lead to changes in fish health and mortality. Changes to fish health can also lead to lower productivity levels in fish, such as reduced reproductive success. Water quality is subject to federal and provincial guidelines. For example, increased erosion in agricultural areas can elevate nutrient loads entering watercourses causing algal blooms. When the algae dies and decomposes it can deplete oxygen concentrations and decrease pH.
Changes to stream water depth and flow	Temporary crossings can decrease water flow and depth which can cause temperatures to increase to lethal levels for some species. Winter construction that reduces water depth in wetlands or watercourses may endanger overwintering habitat for fish, and affect under ice spawning species (*e.g.,* burbot).
Fish mortality	Herbicides used for ROW maintenance and vegetation control have the potential to enter streams with rainwater runoff. These herbicides can cause fish mortality, particularly in the sensitive early life stages of fish. Increased sedimentation can smother developing fish eggs.

2.0 METHODS

Field and desktop data were analyzed to characterize the existing in-water and riparian physical environment, surface water quality, and habitat suitability for fish. Fish species potentially inhabiting watercourses in the Project area were identified and their seasonal ranges, sensitive periods, and habitat use were described with special attention to relevant SOCC. Known and potential CRA fisheries were also identified. The data collected were also used to recommend restricted activity periods and windows for in-water work.

The data collected from the field and desktop studies, together with input from the other Project VCs, were used to determine the habitat sensitivity for each of the watercourses crossed by the project. Only sites identified as moderate or highly sensitive were moved forward for potential Project component interaction assessment in the EIS. Low sensitivity watercourses contain limited fish habitat where standard mitigation measures can be applied to protect aquatic and riparian areas (Figure 2-1).

2.1 REVIEW OF EXISTING DATA SOURCES

A review was conducted of existing fish and fish habitat data for the Project area. Based on a review of desktop mapping, 75 MMTP watercourse crossings were identified within the PDA (Appendix A, Map 1-3 – Stream Crossings). Additionally, the three station sites, Dorsey, Riel and Glenboro South, were reviewed to confirm that they were not within 30 m of a watercourse (ESRD 2013). Because no proximate watercourses were identified, an assessment of effects on fish and fish habitat was not carried forward to the EIS for these stations.

Spatial data were examined for each of the 75 Project watercourse crossings, including information for fish habitat and land cover in the LAA and RAA. A document published by DFO (*Fish community and fish habitat inventory of streams and constructed drains throughout agricultural area of Manitoba (Milani 2013)*) was used as a primary data source to identify watercourses with the potential to support high or moderate sensitivity habitat (as defined in Section 2.2.2.2). Based on DFO's habitat classification system, watercourses identified as Type A, B, and C fish habitat have this potential. Of the 75 watercourse crossings, 23 were identified as Type A-C habitat, and were carried forward to the field program for further assessment (Figure 2-1). An additional 8 Type D habitat crossings were assessed by reviewing aerial imagery and Land Cover Classes (Vegetation and Wetlands TDR) to confirm that they likely provide simple habitat that would be of low sensitivity. The remaining 44 Type E habitat watercourse crossings, by definition, do not support direct fish habitat. Therefore, an assessment of effects on fish and fish habitat was not carried forward to the EIS for Type D and E watercourse crossings (Figure 2-1).

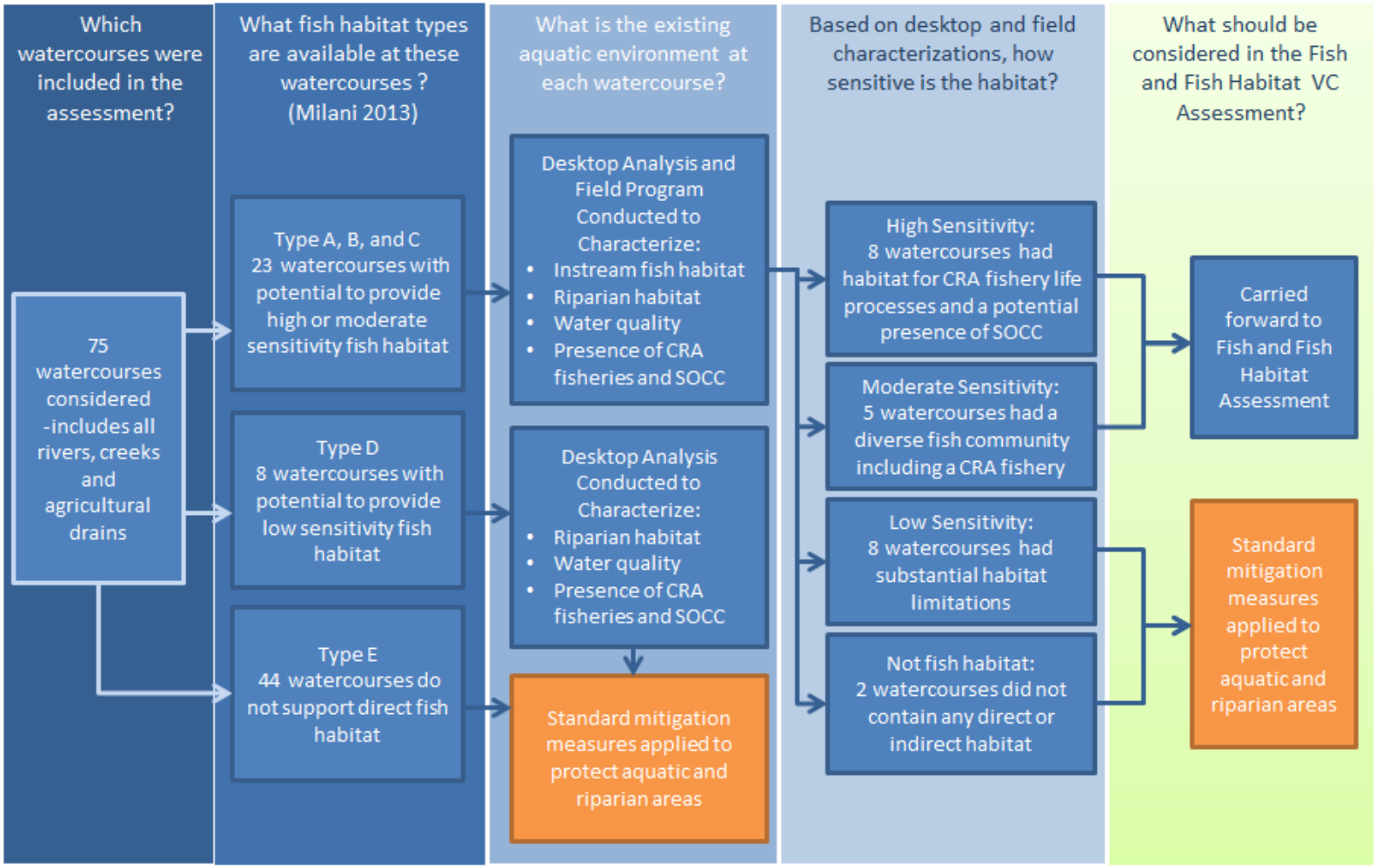


Figure 2-1: Flow Diagram of Data Collected and Decision Framework for the Project Environmental Assessment Process

A list of fish species, including SOCC, which could potentially inhabit watercourses crossed by the Project was compiled through a desktop review of government information sources, primary scientific literature and publications and watershed reports. Life stage information and habitat requirements for all species potentially found in the RAA can be found in Appendix C. If available, information on changes in population status within the RAA for any species was noted, particularly for SOCC.

Baseline ranges for general surface water quality parameters were determined through desktop data collection using:

- Manitoba Conservation and Water Stewardship's Fish Inventory and Habitat Classification System (MCWS 2014),
- City of Winnipeg's Small Stream Water Quality Survey online (City of Winnipeg 2007-2014),
- Manitoba Conservation and Water Stewardship (MCWS 2014) Water Science and Management Branch long-term water quality monitoring data, and
- Environment Canada's Hydrology website (Government of Canada-Wateroffice 2014).

A data review of the most recent watershed management reports available within the RAA was also conducted. Additional surface water quality parameters for each watercourse crossing were measured in the field (see Field Studies section 2.2.2.3), and compiled with data obtained from *in situ* monitoring stations outlined above to provide a representation of variation in surface water quality parameters.

Sources of information used to characterize baseline conditions for fish and fish habitat included the following:

- Government information sources:
  - Manitoba Conservation Database Centre
  - Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2014) (*Canadian Wildlife Species at Risk*)
  - Species at Risk Public Registry (Government of Canada)
  - 2014 Manitoba Anglers' Guide Government of Manitoba
  - The Endangered Species and Ecosystems Act (ESEA) 1990. C.C.S.M. c. E111.
  - Manitoba Water Quality Standards, Objectives and Guidelines(Water Science and Management Branch, Manitoba Water Stewardship, 2011)
  - Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff (DFO 2010)

- Primary scientific literature and publications:
  - Freshwater Fishes of Canada (Scott *et al.* 1998)
  - Fish community and fish habitat inventory of streams and constructed drains throughout agricultural areas of Manitoba (2002–2006) (Milani 2013)
  - The Freshwater Fishes of Manitoba (Stewart *et al.* 2004)
  - A Fish Fauna and Habitat Quality Study of the Seine River, Manitoba (Gaudet 1997)
- Watershed reports and integrated watershed management plans:
  - Seine River Integrated Watershed Management Plan (2009)
  - Seine River Watershed – State of the Watershed Report: Fisheries (2007)
  - Seine River Survey and Restoration Planning Project Final Report (2005)
  - Seine River Watershed Fisheries and Riparian Area Survey (2005)
  - State of the Watershed Report – Seine River Watershed – Fisheries (2012)
  - Seine River Watershed – Fish Species Observed in Smaller Waterways DFO Survey 2003–05
  - Rat-Marsh River Watershed Characterization Report
  - Cooks-Devils Watershed Integrated Watershed Management Plan – Water Quality Report
  - La Salle River Integrated Watershed Management Plan – Fisheries and Aquatic Ecosystems
  - Rat-Marsh River Integrated Watershed Management Plan (2014)
- Project public engagement information:
  - Engagement Round 1 Report
  - Engagement Round 2 Report
  - Engagement Round 3 Report
- Traditional knowledge:
  - 2014 Preliminary Aboriginal Traditional Knowledge Study Community Report (Black River First Nation, Long Plain First Nation and Swan Lake First Nation)
  - Aboriginal Traditional Knowledge Study – Phase 1 (Roseau River Anishinabe Fish Nation 2015)
  - Peguis Traditional Land Use and Occupancy Interview Project

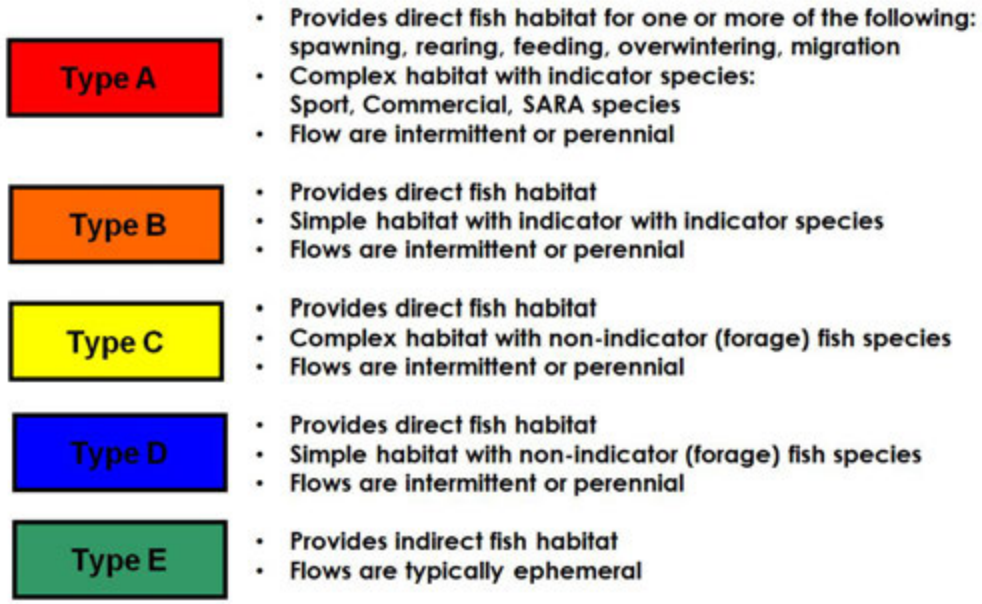
- Manitoba Métis: A review of available information on the use of lands and resources for traditional purposes in the MMTP study area with gap analysis (North/South Consultants Inc. 2014)
- *Lake Winnipeg Fishing: A Brief overview on Aboriginal Fishing on Lake Winnipeg* (Peguis First Nation – Lloyd Stevenson 2015)
- Peguis MMTP survey (Peguis First Nation – Whelan Enns Associates Inc. 2015)

The desktop studies were also used to identify data gaps in the fish habitat information and to guide field studies of waterbodies crossed by the Project.

2.2 FIELD STUDIES

Watercourse crossings were selected for detailed field assessment based on their DFO ranking (Milani 2013). Field assessments were performed at watercourse crossings that crossed the preferred route and were designated to support fish habitat types A, B, and C (Appendix A, Map 1-3 – Stream Crossings). These designations corresponded to areas that provide direct fish habitat.

The five habitat types are outlined below:



(Adapted from Milani 2013)

Field studies were conducted in the fall of 2014 to establish in-water and riparian environment conditions, and to conduct water quality measurements at each of the watercourse crossings. The habitat requirements of species predicted to occur in the LAA, identified during the desktop analysis, were considered when assessing the quality of the habitat available for fish spawning, rearing, overwintering and migration. Sensitivity of these sites to increased sedimentation and turbidity, related to potential project disturbances during construction and operation, was also assessed.

2.2.1 Objectives

The objectives of the field study were as follows:

- Characterize baseline fish habitat conditions (including water quality) within the LAA at proposed watercourse-crossing locations.
- Identify environmentally sensitive sites; those areas requiring special consideration for mitigation, monitoring or management, particularly where SOCC are present.
- Provide current fish habitat data to support the EIS.
- Provide information to enable assessors to analyze interactions with project components.

2.2.2 Methods

2.2.2.1 Fish Habitat Assessments

Field surveys were conducted at the 23 potentially fish-bearing watercourse crossings, between September 15 and October 28, 2014, to characterize fish habitat within the LAA and to conduct water quality measurements. Where a watercourse was present, fish habitat assessments were conducted as outlined by standard operating procedures (SOP) (Stantec 2014). This SOP for aquatic assessment was adapted from Alberta's "Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body" (ESRD 2013), and the associated guide (AENV 2001). The Alberta 'Code of Practice' was adopted here because the Manitoba guidance document has not been updated to reflect changes made to the *Fisheries Act* in 2013. The Code of Practice guidelines establish an expected zone of impact for watercourse crossings and address the information requirements for a full review pursuant to the amended *Fisheries Act*.

At the time of the field assessments, Cooks Creek and Edie Creek were crossed once each by the preferred route; the Final Preferred Route now traverses both of these watercourses twice. Additionally, Fish Creek is now crossed approximately 20 km upstream from the original field assessed location. The assessments of these three crossings were based on aerial imagery, riparian land cover classes (summarized in the Vegetation and Wetlands Technical Data Report) and the previously collected data. The Site 23 crossing was not previously within the ROW of the

Project and was not assessed during the field program. The Final Preferred Route now crosses this area, and the assessment is based on aerial imagery and riparian land cover classes. Where site access and landowner permission allowed, watercourses were categorized, and in-water and riparian vegetation was assessed at three transects; at the centerline of the ROW, 100 m upstream, and 300 m downstream of the centerline. Channel morphology including high water mark width, wetted width, depth and bank height and slope were measured at all crossings. Stream-bank characteristics including bank material, riparian cover and bank stability were recorded. Functional fish cover (in-water and riparian) was estimated as a percentage of the area assessed. Streambed composition was identified and quantified to determine habitat quality and potential spawning habitat. Habitat requirements of fish, including presence of overwintering, rearing, and migration habitat for species identified as potentially present within a site, were also assessed. Photographs and sketches at each crossing were acquired to accompany the data that was collected. Sites defined as No Defined Channel (NDC) were photographed, but limited data were collected at these locations because direct or indirect fish habitat was not present.

Each watercourse was categorized in terms of size and flow regime. This allowed the selection of an appropriate sized LAA for each watercourse.

In the absence of Manitoba guidelines, the Alberta Fish Habitat Manual was used as a guideline (Alberta Transportation 2009) for watercourse categorization.

- **No defined channel (NDC)** – typically a low-lying depression, often cultivated, that does not provide direct or indirect habitat values for fish.
- **Ephemeral** – a seasonally flowing unnamed watercourse with poor to well-defined bed and banks.
- **Intermittent/spring** – an intermittently flowing (*i.e.,* sub-surface and surface flows) unnamed or named watercourse with defined bed and banks, sometimes fed by a groundwater source.
- **Small permanent** – an unnamed or named watercourse that likely flows throughout the year and has a channel width less than 5 m.
- **Large permanent** – an unnamed or named watercourse that likely flows throughout the year and has a channel width greater than 5 m.

2.2.2.2 Habitat Sensitivity Rankings

The *Practitioners Guide to the Risk Management Framework* (DFO 2006) provides guidelines for assessing Project-associated residual effects and characterizing the risk to fish and fish habitat in the context of the *Fisheries Act*, based, in part, on the sensitivity of a watercourse. An updated version of the framework that addresses the changes made to the *Fisheries Act* (2013) has not

been released and, therefore, the basics of the Practitioners Guide still apply. Following review of existing information and field surveys, the sensitivity of fish and fish habitat in each Project watercourse crossing was ranked using criteria adapted from the Guide (DFO 2006).

A watercourse was assigned the highest habitat sensitivity ranking when it was deemed to meet at least one of the following criteria:

High Sensitivity:

- supports habitat for SOCC, including SAR;
- habitat essential to sustaining a CRA fishery;
- presence of spawning or other habitat critical to the survival of a SOCC or a CRA fishery;
- permanent flowing, cool water systems that cannot easily buffer temperature changes or are not resilient to disturbance especially where unique or limited within an ecozone; and
- physical characteristics of the crossing habitat could include undercut banks, bank and watercourse bed materials consisting of cobble, gravel, sand or clays, pool habitat.

Moderate Sensitivity:

- diverse fish community;
- habitat used by one or more species of a CRA fishery for feeding, growth and migration;
- typical of the fish habitat in the region (*i.e.*, large amount of similar habitat readily available); and
- physical characteristics of the crossing habitat could include steep banks, bank and watercourse bed materials consisting of larger rocks and boulders, riffle habitat.

Low Sensitivity:

- poor spawning and rearing habitat for fish;
- habitat has substantial limitations to contribute to a fishery (*e.g.*, sparse in-water and overhead cover, low flows, poor fish passage, no overwintering capacity);
- typically supports only forage fish species which are not limiting to a fishery;
- contributes only indirectly to a CRA fishery;
- physical characteristics of the crossing habitat could include sloping banks, bank and watercourse bed materials consisting of bedrock with smooth, non-turbulent waters; and

- ephemeral watercourses that might not provide habitat for fish to complete one or more of their life processes, but might provide occasional habitat during high flows as well as flow and nutrients to downstream areas.

Not Fish Habitat:

- no direct or indirect contribution to downstream habitat.

2.2.2.3 Surface Water Quality

Water quality parameters comprising dissolved oxygen, pH, turbidity, temperature and conductivity were measured at each of the three transects as described in Section 2.2.2.1. Surface water quality data were compiled from existing sources (*e.g.,* desktop analysis) and field measurements to describe the environment at each watercourse crossing prior to initiation of Project construction. The minimum, maximum and median were calculated and compared to applicable provincial and federal water quality guidelines for the protection of aquatic life (MCWS 2011; CCME 1999). Parameters outside of acceptable guidelines were identified.

2.3 OTHER DATA

Additional information was gathered from other areas of the environmental assessment.

The following Sections describe the data provided.

2.3.1 Traditional Land and Resource Use

The community report from Peguis First Nation (PFN 2015), Roseau River First Nation (RRAFN 2015) and a collaborative community report conducted by Black River, Long Plain and Swan Lake First Nations (2015) provided information on fishing activities within the Project area. Watercourses that are used for fishing and travel were identified. Fishing activities occur throughout the year, with angling and net fishing being the most common methods. Fish species targeted are listed in Table 3-3. Small bodied fish used as bait when fishing were also identified. These included bluntnose minnow, chub, dace, darter, fathead minnow, mud minnow, sculpin, shiner, stickleback, sucker, trout-perch and tullibee. It was also noted that a decrease in fish spawning has been observed over the last decade (RRAFN 2015).

2.3.2 Public Engagement

Data provided during three rounds of public engagement identified minimal public concern for effects of transmission line stream crossings on fish and fish habitat.

2.3.3 Physical Environment

2.3.3.1 Soils

Data provided from the Soil and Terrain Technical Data Report was used to identify soils surrounding riparian areas of watercourses crossed by the Project that could be susceptible to erosion and sedimentation if disturbed. Section 3.2.4 of the Soil and Terrain TDR outlines the methods used to calculate water erosion risk to soils within the LAAs of each watercourse crossing. The Universal Soil Loss Equation (USLE) calculates the potential loss of soils due to water erosion in tonnes/hectare/year (t/ha/y) and assigns a risk classification ranging from very low (<6 t/ha/y) to severe (> 33 t/ha/y). Factors included in the assessment included rainfall, soil and landscape characteristics and crop/vegetation management practices of the area.

2.3.4 Vegetation

Land cover classification data gathered for the Project as part of the Vegetation and Wetland field work and desktop study was used to map land cover within the PDA, LAA and RAA. These land cover types were considered in terms of their contribution to fish and fish habitat, and assigned a value of low, moderate, or high contribution to fish habitat quality. Geographic information system (GIS) measurements were conducted to determine the area (m^2) of types of riparian vegetation cover (see Table 2-1) from 30 m perpendicular to the high water mark within the width of the ROW. Each land cover type present is expressed as a percentage (%) of the area measured. The area covered by different land cover classes within the LAA is expressed in the same manner, with the PDA being included within the LAA measurements. Riparian vegetation change was estimated as the percentage of terrestrial habitat that will permanently be changed (*e.g.*, removal of forested cover) due to Project construction and maintenance activities.

Table 2-1: Land Cover Classes used to Describe Riparian Vegetation

Land Cover Category / Interaction with Fish Habitat	Land Cover Class	Land Cover Definition
Agriculture		
Low contribution to fish habitat quality – Agricultural areas provide little shade and contribute to increased erosion and pesticide run-off into adjacent watercourses.	Cultivated	Land that has been converted to cultivated crops and hayland that is annually tilled, seeded or cut. Includes annual cropland, perennial crops and hayland.
	Pasture	Introduced tame grasses, primarily used for grazing.
Developed		
Low contribution to fish habitat quality – Developed areas provide little shade, contribute	Roads	Man-made routes for vehicles to be driven on, includes surfaced/paved highways and non-surfaced trails.

Table 2-1: Land Cover Classes used to Describe Riparian Vegetation

Land Cover Category / Interaction with Fish Habitat	Land Cover Class	Land Cover Definition
to erosion and can be a source of salt, sand, petroleum products, etc. entering into adjacent watercourses.	Industrial	Land that is predominantly built-up or developed and vegetation is not associated with these land covers. This includes commercial and industry plants and mine structures.
	Railways	Railroad surfaces.
	Buildings	Populated urban areas and farmsteads.
Wetlands		
Moderate contribution to fish habitat quality – Wetland vegetation provides moderate shade and has established root systems which can provide channel stability.	Included dugouts, bogs, fens, marshes, swamps and shallow open water	Can contain a variety of grass-like plants (rushes, sedges, tall rush), shrub species (low, mixed and tall shrubs) and/or trees (coniferous, deciduous and mixed wood).
Native Upland Vegetation		
Moderate to high contribution to fish habitat quality – Native upland vegetation has established root systems which can minimize erosion. Shrubland provides moderate shade, and forested and treed areas provide good shade.	Native Grassland (low)	Land where the sod layer has never been converted to agricultural production, tilled or seeded and dominated by native plant species. Predominately native grass and herbaceous species.
	Shrubland (moderate)	Land dominated by woody, multi-stemmed plants or trees 3 m in height or less dominated by shrub species.
	Hardwood Forest (high)	75–100% of the canopy is broadleaf/deciduous or "hardwood"(*e.g.*, poplar and birch species) forests or treed areas.
	Mixedwood Forest (high)	Forest lands where 26%–74% of the canopy is a mix of coniferous and broadleaf/deciduous forests or treed areas.
	Softwood Forest (high)	Predominately 75–100% of the canopy is coniferous or "softwood" (*e.g.* jack pine and spruce species) forests or treed areas.
	Other Vegetation (N/A)	Riparian vegetation that has not been otherwise classified.

2.3.5 Heritage Resources and the Agricultural Drainage Network

Data provided by the Heritage Resources group included information on land use and drainage practices that have changed fish habitat within the Red River Basin since the late 1800's. To

manage flooding of creeks and rivers in the spring, settlers began constructing drainage canals and ditches in the Red River Valley by the 1880s (Elliott 1978; Ledohowski 2003). Some of the earliest projects were constructed within the Seine River and Roseau River sub-watersheds. As farming expanded, the drainage canals could no longer handle the increased runoff. In the 1950s, the provincial government became involved and larger drainage projects, such as the Seine River diversion, were completed. At this time, there was also a shift to the construction of more shallow, wider drainage channels with gentle slopes to prevent rapid silting. Riparian vegetation was cleared to the watercourse edges that were then subsequently cut for hay (Elliott 1978; Ledohowski 2003). Water quality has also been affected by rural agricultural activities. Surface water is affected by seasonal runoff, local runoff and groundwater discharge. Each of these are directly affected by soil, terrain, vegetation and human activities. Many of the waterways included in this assessment have been affected by agricultural drainage. Typical effects include increased sedimentation, increased nutrient levels and lack of riparian cover.

2.4 RESTRICTED ACTIVITY PERIODS

The criteria for identifying restricted activity periods (RAPs) in Manitoba depends on the location of the in-water work and is based on DFO recommendations (DFO 2013b). RAPs take into consideration the species inhabiting the watercourse, and their spawning periods. Table 2-2 provides an overview of restricted activity periods present within the RAA.

Table 2-2: Restricted Activity Periods for Fish Species in Southern Manitoba

Location	Spring Spawning	Summer Spawning	Fall Spawning
Southern Manitoba	April 1 – June 15	May 1 – June 30	September 15 – April 30
Source: DFO 2013b			

3.0 EXISTING CONDITIONS

3.1 OVERVIEW OF SUB-WATERSHEDS AND WATERCOURSE CROSSINGS

The Project crosses two major watersheds: the Assiniboine River Basin and the Red River Basin. Within the Assiniboine River Basin, the Project extends across one sub-watershed: the Lower Assiniboine River sub-watershed (05MJ). Within the Red River Basin, the Project crosses six sub-watersheds, including: the La Salle River sub-watershed (05OG), the Red River sub-watershed (05OC), the Seine River sub-watershed (05OH), the Cooks Creek/Devils Creek sub-watershed (05OJ), the Rat River sub-watershed (05OE), and the Roseau River sub-watershed (05OD) (Appendix A, Map 1-2 – Sub-Watersheds).

Fish habitat and adjacent land use spatial data were examined for each of the 75 watercourse crossings. Of the 75 watercourse crossings, 23 were identified as potentially supporting high or moderate sensitivity habitat (Milani 2013, *i.e.* DFO Habitat Types A, B, and C) and carried forward to the field program. Of those 23 watercourse crossings, there were 12 watercourse crossings characterized as Type A habitat, six watercourse crossings with Type B habitat, and four watercourse crossings with Type C habitat. Based on Stantec's field investigations, 21 of the 23 watercourse crossings were confirmed to support fish habitat.

3.2 SURFACE WATER QUALITY

In situ surface water quality data were collected at each watercourse where water depth at the time of the habitat assessment was sufficient to submerge the probe of the water quality meter. The objective of the sampling program was to document baseline conditions at the time of the field assessment. Recognizing that one point in time sample will not characterize a watercourse, long-term (2002-2014) ranges for surface water quality parameters were determined through desktop data using sources outlined in Section 2.1 for larger watercourses. Field and desktop data were combined and ranges expressed as minimum, median and maximum values for each water quality parameter (Table 3-1).

Table 3-1: Summary of Range and Median Water Quality Parameters in Potential Fish-Bearing Watercourses Crossed by the Project

Field Site ID	Watercourse Name	Range and Median Values	Water Temperature (°C)	pH (pH units)	Dissolved Oxygen		Conductivity (µS/cm)	Turbidity (NTU)	Flow (m^3/s)	Date Range	References
					(mg/L)	(% SAT)					
1	Sturgeon Creek	Minimum	1.6	6.5	0.8	6.4	425	1.2	0.041	04/2002 – 08/2014	Stantec Fall 2014 Field data, Milani 2013, City of Winnipeg 2007-2014
		Median	16.4	8.0	9.2	86.0	1226	8.0	0.273		
		Maximum	25.9	8.9	15.6	140.4	1692	167.0	21.6		
2	Third Creek	Minimum	3.8	7.7	7.5	56.7	2306	11.5	N/A	10/2014	Stantec Fall 2014 Field data
		Median	-	-	-	-	-	-	N/A		
		Maximum	7.5	7.8	9.5	76.9	2358	17.0	N/A		
3	Unnamed Watercourse	Minimum	7.6	8.0	16.6	138.4	1743	1.7	N/A	10/2014	Stantec Fall 2014 Field data
		Median	-	-	-	-	-	-	N/A		
		Maximum	-	-	-	-	-	-	N/A		
4	Assiniboine River	Minimum	-2.0	7.6	2.6	-	262	7.3	13.9	01/2008 – 09/2014	Stantec Fall 2014 Field data, swq_2008-2013
		Median	13.5	8.3	8.6	-	875	68.8	69.6		
		Maximum	25.3	8.9	13.8	-	1300	461.0	512.0		
5	LaSalle River	Minimum	0.9	7.0	3.9	45.0	265	0.0	0.02	04/2002 – 10/2014	Milani 2013, City of Winnipeg 2007-2013
		Median	18.2	8.1	8.7	91.5	631	27.0	0.47		
		Maximum	27.8	9.4	17.1	165.0	1964	296.0	57.0		
6	Red River	Minimum	-1.4	7.5	2.2	-	274	4.0	18.1	01/2008 – 09/2014	Stantec Fall 2014 Field data, swq_2008-2013
		Median	9.3	8.2	9.3	-	756	27.6	116.0		
		Maximum	28.4	8.7	15.5	-	1780	341	2040.0		
7	Red River Floodway	Minimum	Water quality not assessed at this location (*i.e.*, dry conditions, sampling not possible)								
		Median	-	-	-	-	-	-	0		
		Maximum	-	-	-	-	-	-	809.0		

Table 3-1: Summary of Range and Median Water Quality Parameters in Potential Fish-Bearing Watercourses Crossed by the Project

Field Site ID	Watercourse Name	Range and Median Values	Water Temperature (°C)	pH (pH units)	Dissolved Oxygen		Conductivity (µS/cm)	Turbidity (NTU)	Flow (m^3/s)	Date Range	References
					(mg/L)	(% SAT)					
8	Seine River at Floodway	Minimum	1.3	6.7	5.7	55.0	451	9.5	0.003	08/2004 – 10/2014	Stantec Fall 2014 Field data, Milani 2013, City of Winnipeg 2007-2013
		Median	17.3	8.2	8.35	88.0	509	30.8	1.8		
		Maximum	25.2	8.8	15.3	109.0	616	119	8.6		
9	Cooks Creek	Minimum	7.7	8.0	10.7	89.7	400	16.0	0	06/2003 and 10/2014	Stantec Fall 2014 Field data, Milani 2013
		Median	7.8	8.4	11.0	92.5	630	21.0	0.203		
		Maximum	19.4	8.5	11.1	92.9	632	34.7	7.56		
10	Edie Creek	Minimum	8.5	6.7	9.1	78.2	344	1.1	N/A	07/2003, 05/2005, 10/2014	Stantec Fall 2014 Field data, Milani 2013
		Median	9.7	8.0	10.4	105.0	813	1.8	N/A		
		Maximum	20.9	8.2	13.5	136.7	892	29.7	N/A		
11	Edie Creek South Crossing	Minimum	Water quality not assessed at this location (*i.e.*, this crossing was added post-field season)								
		Median									
		Maximum									
12	Cooks Creek South Crossing	Minimum	Water quality not assessed at this location (*i.e.*, this crossing was added post-field season)								
		Median	-	-	-	-	-	-	N/A	-	-
		Maximum	19.4	8.0	-	-	400	34.7	N/A		
13	Fish Creek	Minimum	Water quality not assessed at this location (*i.e.*, crossing of Fish Creek was in a different location at the time of assessment)								
		Median									
		Maximum									
14	Unnamed Watercourse	Minimum	Water quality not assessed at this location (*i.e.*, dry conditions, sampling not possible)								
		Median	-	-	-	-	-	-	-	-	-
		Maximum	-	-	-	-	-	-	-		

Table 3-1: Summary of Range and Median Water Quality Parameters in Potential Fish-Bearing Watercourses Crossed by the Project

Field Site ID	Watercourse Name	Range and Median Values	Water Temperature (°C)	pH (pH units)	Dissolved Oxygen		Conductivity (µS/cm)	Turbidity (NTU)	Flow (m^3/s)	Date Range	References
					(mg/L)	(% SAT)					
15	Unnamed Watercourse	Minimum	8.8	8.0	9.3	80.1	435	0.2	N/A	10/2014	Stantec Fall 2014 Field data
		Median	9.5	8.2	-	-	435	0.2	N/A		
		Maximum	9.8	8.4	-	-	527	9.3	N/A		
16	Seine River Tributary	Minimum	8.0	8.2	9.3	80.1	310	0.2	N/A	10/2014	Stantec Fall 2014 Field data
		Median	8.3	8.2	11.8	100.5	382	1.6	N/A		
		Maximum	9.5	8.3	11.9	100.7	438	7.6	N/A		
17	Seine River	Minimum	-0.8	7.2	3.5	-	232	2.0	0.003	04/2008 - 10/2014	Stantec Fall 2014 Field data, swq_2008-2013
		Median	7.5	8.3	8.8	-	474	10.4	1.58		
		Maximum	27.3	8.8	13.2	-	592	50.4	19.7		
18	La Broquerie Drain	Minimum	4.4	7.7	9.6	74.0	534	1.7	N/A	05/2004 and 10/2014	Stantec Fall 2014 Field data
		Median	4.9	7.9	10.2	82.8	818	4.4	N/A		
		Maximum	17.0	8.0	11.1	136.8	833	8.3	N/A		
19	Rat River	Minimum	-0.8	7.5	2.5	-	275	2.9	0.011	01/2008 - 10/2014	Stantec Fall 2014 Field data, swq_2008-2013
		Median	10.0	8.2	8.3	-	423	8.8	1.66		
		Maximum	30.0	8.6	11.1	-	774	38.8	11.0		
20	Pine Creek Diversion	Minimum	7.0	8.0	6.7	87.4	309	2.1	0.089	07/2003 and 10/ 2014	Stantec Fall 2014 Field data, Milani 2013
		Median	7.7	8.0	12.0	99.4	680	2.4	0.434		
		Maximum	23.8	8.0	12.3	103.0	687	2.5	3.72		

Table 3-1: Summary of Range and Median Water Quality Parameters in Potential Fish-Bearing Watercourses Crossed by the Project

Field Site ID	Watercourse Name	Range and Median Values	Water Temperature (°C)	pH (pH units)	Dissolved Oxygen		Conductivity (µS/cm)	Turbidity (NTU)	Flow (m^3/s)	Date Range	References
					(mg/L)	(% SAT)					
21	Pine Creek	Minimum	4.6	6.5	5.8	63.7	295	1.7	N/A	07/2003 – 10/2014	Stantec Fall 2014 Field data, Milani 2013
		Median	4.9	7.6	8.3	68.8	358	2.6	N/A		
		Maximum	27.7	7.7	8.8	97.2	370	96.0	N/A		
22	Pine Creek Arm	Minimum	4.2	7.4	5.9	46.7	383	2.6	N/A	10/2014	Stantec Fall 2014 Field data
		Median	4.3	7.4	6.4	49.3	385	2.6	N/A		
		Maximum	4.5	7.5	7.2	56.3	392	3.2	N/A		
23	Unnamed Watercourse	Water quality not assessed at this location (*i.e.,* this crossing was added post field season)									
		Median	-	-	-	-	-	-	N/A	-	-
		Maximum	-	-	-	-	-	-	N/A		

3.3 RIPARIAN VEGETATION

The dominant land use in five of the seven sub-watersheds traversed by the Project is agriculture. Historical and present day land use practices have directly influenced fish and fish habitat, from activities such as cultivation practices, livestock operations (Graveline and Larter 2006), watercourse modifications and channelization, cattle wading into watercourses, use of terrestrial fertilizers that are mobilized into watercourses, and other land use practices that cause erosion (RRIW 2007a). Long-term effects throughout the RAA include changes in riparian vegetation ecosystem structure.

Riparian vegetation was characterized at each potential fish-bearing watercourse crossing, (Types A-D (Milani 2013)). Analysis of the aerial extent of riparian vegetation is focused on land cover types that can have a moderate to high contribution to fish habitat quality; shrubland and forested areas (see Table 2-1 for definitions). Shrubland provides moderate shade, and forested and treed areas provide good shade which moderates water temperature.

Two of the 31 crossings were found to be not fish habitat and were not included in the analysis. Existing landcover within the PDA was categorized (as described in Table 2-1), and the expected change in riparian vegetation associated with Project activities was estimated (Table 3-2). In 15 of 29 watercourses analyzed (*i.e.,* 52% of the watercourses analyzed), riparian vegetation within the PDA was classified predominately agricultural land and developed. Agricultural and developed areas are considered to provide low contributions to fish habitat quality, and nil to minimal changes in riparian vegetation are anticipated at these crossing. Within these 15 crossings, soil erosion risk was negligible to low. Nine of the 15 crossings have a habitat sensitivity ranking of low (Table 3-2) because of low flows, poor spawning and rearing habitat and no overwintering capacity. The other six crossings have habitat that supports CRA and/or SOCC, which increases their sensitivity ranking to moderate or high. The Assiniboine River is one of these crossings, ranked high because it supports a SOCC, and because it is also within an area of the candidate Assiniboine River Clam Ecological Reserve.

At least half of the PDA land cover in the remaining 14 crossings is forested. Their soil erosion risk ranges from low to moderate. Seven of the 14 crossing were ranked as highly sensitive habitat and contain CRA species and/or SOCC. Although these crossings are forested and considered sensitive habitat, the expected change in riparian vegetation resulting from the Project's activities is considered minimal. This is due to the abundance of similar habitat within and outside of the LAA.

Table 3-2: Riparian Vegetation Cover at Potential Fish-bearing Watercourses Crossed by the Project

Site	Watercourse Name	Habitat Sensitivity	Soil Erosion Risk	Existing Land Cover Condition within the Riparian PDA (% of Riparian PDA)					Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
				Agriculture	Developed	Wetland	Native Grassland and Shrubland	Forested	hectares	% of PDA	
1	Sturgeon Creek	Moderate	Negligible to low	41.0	43.7	15.3	0	0	0	0	No expected change in riparian vegetation.
2	Third Creek	Low	Low	82.5	0	3.2	14.3	0	0	0	No expected change in riparian vegetation.
3	Unnamed Watercourse	Low	Low	81.5	0	0	0	18.5	0.64	18.5	No expected change in riparian vegetation.
4	Assiniboine River	High	Low	25.4	0.03	28.3	0	46.2	3.16	46.2	The LAA is crossed by another parallel transmission line. The southern bank of the crossing is predominantly forested. Beaudry Provincial park is located upstream of the LAA and has intact riparian vegetation buffer along both banks. Expected change in riparian vegetation is minimal.
5	La Salle River	High	N/A	0	0	20.9	0	79.1	2.52	79.1	The banks within the LAA have fully intact riparian vegetation buffer. This extends upstream for many km

Table 3-2: Riparian Vegetation Cover at Potential Fish-bearing Watercourses Crossed by the Project

Site	Watercourse Name	Habitat Sensitivity	Soil Erosion Risk	Existing Land Cover Condition within the Riparian PDA (% of Riparian PDA)					Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
				Agriculture	Developed	Wetland	Native Grassland and Shrubland	Forested	hectares	% of PDA	
											and downstream to meet the Red River. Expected change in riparian vegetation is minimal.
6	Red River	High	N/A	34.1	0.70	40.7	0	25.1	1.65	25.1	The LAA is predominately grassland and borders the floodway. The southwest bank has some treed areas. Expected change in riparian vegetation is minimal.
7	Red River Floodway	Moderate	N/A	94.5	5.50	0	0	0	0	0	No expected change in riparian vegetation.
8	Seine River at Floodway	Moderate	Negligible to Moderate	87.8	0	12.2	0	0	0	0	No expected change in riparian vegetation.
9	Cooks Creek	High	Negligible	90.3	0	9.7	0	0	0	0	No expected change in riparian vegetation.
10	Edie Creek	Low	Negligible	40.5	0	6.9	0	52.6	1.51	52.6	No expected change in riparian

Table 3-2: Riparian Vegetation Cover at Potential Fish-bearing Watercourses Crossed by the Project

Site	Watercourse Name	Habitat Sensitivity	Soil Erosion Risk	Existing Land Cover Condition within the Riparian PDA (% of Riparian PDA)					Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
				Agriculture	Developed	Wetland	Native Grassland and Shrubland	Forested	hectares	% of PDA	
			to Low								vegetation. PDA of the project runs parallel with existing transmission corridor.
11	Edie Creek South Crossing	Low	Negligible	0	29.9	0	0	70.1	0	70.1	The LAA is predominately forested except where it crosses a road. Expected change in riparian vegetation is minimal.
12	Cooks Creek South Crossing	High	Negligible	0	0	2.5	0	97.5	1.05	97.5	The banks within the LAA have fully forested riparian vegetation buffer. This extends upstream for many km. Expected change in riparian vegetation is minimal.
13	Fish Creek	Low	Low	0	0	16.6	0	83.4	0.57	83.4	The LAA is predominantly forested. This type of habitat extends upstream and downstream for several km. Expected change in riparian vegetation is minimal.

Table 3-2: Riparian Vegetation Cover at Potential Fish-bearing Watercourses Crossed by the Project

Site	Watercourse Name	Habitat Sensitivity	Soil Erosion Risk	Existing Land Cover Condition within the Riparian PDA (% of Riparian PDA)					Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
				Agriculture	Developed	Wetland	Native Grassland and Shrubland	Forested	hectares	% of PDA	
14	Unnamed Watercourse	Not Fish Habitat	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Channel no longer exists. No expected change in riparian vegetation.
15	Unnamed Watercourse	Not Fish Habitat	Negligible	0	0	100	0	0	0	0	No expected change in riparian vegetation
16	Seine River Tributary	High	Negligible	26.4	0	3.2	0	70.4	0.64	70.4	The LAA has a narrow, thinly treed riparian vegetation buffer between the watercourse and agricultural area. Outside of the LAA the habitat is similar. Expected change in riparian vegetation is minimal.
17	Seine River	High	Negligible	33.2	0	13.3	0	53.2	0.74	53.2	The banks within the LAA have fully intact riparian vegetation buffer. This extends upstream and downstream for many km. Expected change in riparian vegetation is minimal.

Table 3-2: Riparian Vegetation Cover at Potential Fish-bearing Watercourses Crossed by the Project

Site	Watercourse Name	Habitat Sensitivity	Soil Erosion Risk	Existing Land Cover Condition within the Riparian PDA (% of Riparian PDA)					Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
				Agriculture	Developed	Wetland	Native Grassland and Shrubland	Forested	hectares	% of PDA	
18	La Broquerie Drain	Low	Negligible	97.7	2.3	0	0	0	0.00	0	No expected change in riparian vegetation
19	Rat River	High	Moderate	28.8	0	16.4	0	54.8	0.68	54.8	The riparian zone within the LAA contains a mixture of deciduous trees and grasses. This habitat extends upstream and downstream for many km. Expected change in riparian vegetation is minimal.
20	Pine Creek Diversion	Moderate	Negligible	93.9	0	0	6.1	0	0.00	0	Extensive agriculture in riparian area. No expected change in riparian vegetation
21	Pine Creek	Moderate	Negligible	71.7	0	5.7	0	22.6	0.19	22.6	The LAA has a narrow riparian zone of deciduous trees and grasses between the watercourse and agricultural area. Outside of the LAA the habitat is similar for many kilometers upstream.

Table 3-2: Riparian Vegetation Cover at Potential Fish-bearing Watercourses Crossed by the Project

Site	Watercourse Name	Habitat Sensitivity	Soil Erosion Risk	Existing Land Cover Condition within the Riparian PDA (% of Riparian PDA)					Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
				Agriculture	Developed	Wetland	Native Grassland and Shrubland	Forested	hectares	% of PDA	
											Downstream and across the border the land cover consists of more wetlands. Expected change in riparian vegetation is minimal.
22	Pine Creek Arm	Low	Negligible	19.3	0	4.0	62.3	14.4	0.12	14.4	The riparian zone within the LAA contains a mixture of shrubs and grasses. This extends upstream for many km. Expected change in riparian vegetation is minimal.
23	Unnamed Watercourse	Low	Negligible	0	0	0	0	100.0	0.75	100.0	The LAA is predominantly forested. This type of habitat extends upstream and downstream for several km. Expected change in riparian vegetation is minimal.
D1	Unnamed Watercourse	Low	Low	80.4	17.4	2.2	0	0	0	0	No expected change in riparian vegetation.

Table 3-2: Riparian Vegetation Cover at Potential Fish-bearing Watercourses Crossed by the Project

Site	Watercourse Name	Habitat Sensitivity	Soil Erosion Risk	Existing Land Cover Condition within the Riparian PDA (% of Riparian PDA)					Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
				Agriculture	Developed	Wetland	Native Grassland and Shrubland	Forested	hectares	% of PDA	
D2	Unnamed Watercourse	Low	Negligible	96.0	0	4.0	0	0	0	0	No expected change in riparian vegetation.
D3	Unnamed Watercourse	Low	Negligible	100.0	0	0	0	0	0	0	No expected change in riparian vegetation.
D4	Unnamed Watercourse	Low	Negligible	52.7	47.3	0	0	0	0	0	No expected change in riparian vegetation.
D5	Unnamed Watercourse	Low	Negligible	16.8	54.2	29.0	0	0	0	0	No expected change in riparian vegetation.
D6	Unnamed Watercourse	Low	Negligible	31.1	0	0	0	68.9	0.34	68.9	No expected change in riparian vegetation.
D7	Unnamed Watercourse	Low	Negligible	100.0	0	0	0	0	0	0	No expected change in riparian vegetation.
D8	Unnamed Watercourse	Low	N/A	0	0	100.0	0	0	0	0	No expected change in riparian vegetation.

3.4 COMMERCIAL, RECREATIONAL AND ABORIGINAL FISHERIES

Over 75 fish species are known or expected to be in the RAA (See Section 2.1) (Table 3-3).

Table 3-3: Fish Species Known or Expected to Occur within the Seven Sub-watersheds of the RAA

Fish		Lower Assiniboine River	Red River	Seine River	Rat River	La Salle River	Cooks Creek/ Devil's Creek	Roseau River
Common Name	**Species Name**							
banded killifish	*Fundulus diaphanus*		X					
bigmouth buffalo	*Ictiobus cyprinellus*		X			X		
bigmouth shiner	*Notropis dorsalis*	X	X					X
black bullhead	*Ameiurus melas*	X	X	X	X	X		X
black crappie	*Pomoxis nigromaculatus*	X	X	X		X		X
blackchin shiner	*Notropis heterodon*	X	X					
blacknose dace	*Rhinichthys obtusus*	X	X			X		X
blacknose shiner	*Notropis heterolepis*	X						
blackside darter	*Percina maculata*	X	X	X	X		X	X
bluegill	*Lepomis macrochirus*		X		X	X		
bluntnose minnow	*Pimephales notatus*	X	X					
brassy minnow	*Hybognathus hankinsoni*	X	X					
brook stickleback	*Culaea inconstans*	X	X	X	X	X	X	X
brook trout	*Salvelinus fontinalis*		X		X			
brown bullhead	*Ameiurus nebulosus*	X	X	X	X	X		
brown trout	*Salmo trutta*		X		X			X
burbot	*Lota lota*	X	X	X	X	X		X
central mudminnow	*Umbra limi*	X	X	X	X	X	X	X
channel catfish	*Ictalurus punctatus*	X	X		X	X		X
chestnut lamprey	*Ichthyomyzon castaneus*	X	X	X	X			X
cisco	*Coregonus artedi*		X					
common carp	*Cyprinus carpio*	X	X	X	X	X		X
common shiner	*Luxilus comutus*	X	X	X	X	X		X
creek chub	*Semotilus atromaculatus*	X	X			X		X
emerald shiner	*Notropis atherinoides*	X	X	X	X	X		X

Table 3-3: Fish Species Known or Expected to Occur within the Seven Sub-watersheds of the RAA

Fish		Lower Assiniboine River	Red River	Seine River	Rat River	La Salle River	Cooks Creek/ Devil's Creek	Roseau River
Common Name	**Species Name**							
fathead minnow	*Pimephales promelas*	X	X	X	X	X	X	X
finescale dace	*Chrosomus neogaeus*	X	X		X		X	X
flathead chub	*Platygobio gracilis*	X	X					X
freshwater drum	*Aplodinotus grunniens*	X	X	X		X		
golden redhorse	*Moxostoma erythrurum*	X	X		X			
golden shiner	*Notemigonus crysoleucas*	X	X					
goldeye	*Hiodon alosoides*	X	X	X	X	X		X
goldfish	*Carassius auratus*		X	X				
hornyhead chub	*Nocomis biguttatus*	X	X					
Iowa darter	*Etheostoma exile*	X	X				X	X
Johnny darter	*Etheostoma nigrum*	X	X	X	X	X	X	X
lake chub	*Couesius plumbeus*	X	X					
lake sturgeon	*Acipenser fulvescens*	X	X					
lake whitefish	*Coregonus clupeaformis*		X					
largemouth bass	*Micropterus salmoides*		X					
logperch	*Percina caprodes*	X	X					
longnose dace	*Rhinichthys cataractae*	X	X	X	X			X
longnose sucker	*Catostomus catostomus*		X					
mimic shiner	*Notropis volucellus*	X	X					
mooneye	*Hiodon tergisus*	X	X					X
ninespine stickleback	*Pungitius pungitius*	X	X					
northern pike	*Esox lucius*	X	X	X	X	X		X
northern redbelly dace	*Chrosomus eos*	X	X		X			X
pearl dace	*Margariscus margarita*	X	X	X	X			X
pumpkinseed	*Lepomis gibbosus*		X					
quillback	*Carpiodes cyprinus*	X	X		X	X		X
rainbow smelt	*Osmerus mordax*		X					
rainbow trout	*Oncorhynchus mykiss*		X		X			X
river darter	*Percina shumardi*	X	X			X		X

Table 3-3: Fish Species Known or Expected to Occur within the Seven Sub-watersheds of the RAA

Fish		Lower Assiniboine River	Red River	Seine River	Rat River	La Salle River	Cooks Creek/ Devil's Creek	Roseau River
Common Name	**Species Name**							
river shiner	*Notropis blennius*	X	X		X	X		X
rock bass	*Ambloplites rupestris*	X	X	X	X	X		X
rosyface shiner	*Notropis rubellus*	X	X					
sand shiner	*Notropis stramineus*	X	X		X			X
sauger	*Sander canadensis*	X	X		X	X		X
shorthead redhorse	*Moxostoma macrolepidotum*	X	X	X	X	X		X
shortjaw cisco	*Coregonus zenithicus*		X					
silver chub	*Macrhybopsis storeriana*	X	X		X	X		X
silver lamprey	*Ichthyomyzon unicuspis*	X	X		X			X
silver redhorse	*Moxostoma anisurum*	X	X		X	X		
slimy sculpin	*Cottus cognatus*	X						
smallmouth bass	*Micropterus dolomieu*		X					
spotfin shiner	*Cyprinella spiloptera*	X	X		X	X		X
spottail shiner	*Notropis hudsonius*	X	X	X				
stonecat	*Noturus flavus*	X	X		X			X
tadpole madtom	*Noturus gyrinus*	X	X	X	X	X		X
trout-perch	*Percopsis omiscomaycus*	X	X	X				X
walleye	*Sander vitreus*	X	X	X	X	X		X
western blacknose dace	*Rhinichthys obtusus*		X		X			
white bass	*Morone chrysops*		X			X		X
white crappie	*Pomoxis annularis*		X					
white sucker	*Catostomus commersoni*	X	X	X	X	X	X	X
yellow perch	*Perca flavescens*	X	X		X	X		

DFO's Fisheries Protection Policy Statement (2013a) focuses on fish that are part of, or support, CRA fisheries. Manitoba Conservation (2010) has identified 42 sport fish species that are targeted recreationally in Manitoba. Over 30 of these species are part of, or support, a CRA fishery in the RAA, with most found in the Assiniboine, Red, LaSalle, Seine

and Rat Rivers. The sub-watersheds where these species could be present are summarized in Table 3-4.

There are 13 fish species commonly targeted in the Aboriginal Fishery of Lake Winnipeg (Peguis First Nation and Lloyd Stevenson 2015) for both subsistence and commercial use.

Table 3-4: Commercial, Recreational and Aboriginal (CRA) Fishery Species Known of Expected to Occur within the RAA

Common Name	Scientific Name	Contributes to a CRA Fishery	Sub-watershed
black bullhead	*Ameiurus melas*	1, 3	AR, RR, LSR, SR, RTR, ROR
black crappie	*Pomoxis nigromaculatus*	1	AR, RR, LSR, SR
brook trout	*Salvelinus fontinalis*	1	RR, RTR
brown bullhead	*Ameiurus nebulosus*	1, 3	AR, RR, LSR, SR, RTR
brown trout	*Salmo trutta*	1	RR, RTR
burbot/mariah	*Lota lota*	1, 2, 3	AR, RR, LSR, SR, RTR, ROR
carp	*Cyprinus carpo*	2	AR, RR, LSR, SR, RTR
channel catfish	*Ictalurus punctatus*	1, 2, 3	AR, RR, LSR, RTR, ROR
cisco	*Coregonus artedi*	1, 2, 3	RR
freshwater drum	*Aplodinotus grunniens*	1, 2, 3	AR, RR, LSR, SR
golden redhorse	*Moxostoma erythrurum*	1	AR, RR, RTR
goldeye	*Hiodon alosoides*	1, 2, 3	AR, RR, LSR, SR, RTR, ROR
lake sturgeon	*Acipenser fulvescens*	1, 2, 3	AR, RR
lake trout	*Salvelinus namaycush*	3	RR
lake whitefish	*Coregonus clupeaformis*	1, 2, 3	RR
largemouth bass	*Micropterus salmoides*	1	RR
longnose sucker	*Catostomus catostomus*	1	RR
mooneye	*Hiodon tergisus*	1	AR, RR
northern pike	*Esox lucius*	1, 2, 3	AR, RR, LSR, RTR, ROR
quillback	*Carpiodes cyprinus*	1	AR, RR, LSR, RTR, ROR
rainbow trout	*Oncorhynchus mykiss*	1	RR, RTR, ROR
rock bass	*Ambloplites rupestris*	1, 3	AR, RR, LSR, SR, RTR, ROR
sauger	*Sander canadensis*	1, 2, 3	AR, RR, LSR, RTR, ROR
shorthead redhorse	*Moxostoma macrolepidotum*	1	AR, RR, LSR, SR, RTR, ROR
shortjaw cisco	*Coregonus zenithicus*	1	RR
silver redhorse	*Moxostoma anisurum*	1	AR, RR, LSR, RTR
smallmouth bass	*Micropterus dolomieu*	1	RR

Table 3-4: Commercial, Recreational and Aboriginal (CRA) Fishery Species Known of Expected to Occur within the RAA

Common Name	Scientific Name	Contributes to a CRA Fishery	Sub-watershed
stonecat	*Noturus flavus*	1	AR, RR, RTR, ROR
walleye	*Sander vitreus*	1, 2, 3	AR, RR, LSR, SR, RTR, ROR
white bass	*Morone chrysops*	1, 3	RR, LSR, ROR
white crappie	*Pomoxis annnularis*	1	RR
white sucker	*Catostomus commersoni*	1, 2, 3	AR, RR, LSR, SR, RTR, ROR
yellow perch	*Perca flavescens*	1, 2, 3	AR, RR, LSR, RTR
CRA Fishery: 1 Sport Fishery – Manitoba Conservation 2010; 2 Aboriginal/Commercial Fishery – Peguis First Nation – Lloyd Stevenson 2015; 3 Peguis First Nation – Whelan Enns Associates Inc. 2015. Peguis MMTP survey. Sub-watersheds: AR – Assiniboine River; LSR – La Salle River; SR – Seine River; RR – Red River; CDC – Cooks/Devils Creek; RTR – Rat River; ROR – Roseau River			

3.5 AQUATIC SPECIES OF CONSERVATION CONCERN

Nine aquatic SOCC with the potential to occur in the RAA have been identified by the Manitoba Conservation Data Centre (Table 3-5). Habitat requirements for the eight fish and one freshwater mussel are described below.

Banded killifish (*Fundulus diaphanus*) is designated as S1 in Manitoba (*i.e.,* critically imperiled - typically having five or fewer occurrences, or 1,000 or fewer individuals) (MBCDC 2013a, NatureServe 2015a). The species is not regulated under ESEA or SARA. Banded killifish habitat requirements include shallow water, low water velocity, soft substrates, and abundant aquatic vegetation (COSEWIC 2014). In Manitoba, critical habitat regulated under SARA has not been identified for this species. Banded killifish is known to occur in the RAA, in the Red River (MBCDC 2013a). The species' range in Manitoba is likely limited due to the absence of suitable habitat (NatureServe 2015a).

Bigmouth buffalo (*Ictiobus cyprinellus*) is designated as *special concern* by COSEWIC (2009) and under Schedule 1 of SARA. Therefore, the species is not subject to prohibitions under SARA. Bigmouth buffalo is not regulated under ESEA. Bigmouth buffalo is known to occur in the RAA, in the La Salle River and Red River (FIHCS-MCWS 2014). The preferred habitat of bigmouth buffalo consists of oxbows and pools associated with large, slow moving rivers with variable substrates (COSEWIC 2009). The species is tolerant to highly turbid water. In Manitoba, critical habitat regulated under SARA has not been identified for this species. The primary factor limiting the successful recovery of bigmouth buffalo is loss of spawning habitat associated with regulation of water levels (COSEWIC 2009).

Bigmouth shiner (*Notropis dorsalis*) is designated as *not at risk* by COSEWIC (2003a), and is listed as *special concern* under Schedule 3 of SARA. Therefore, bigmouth shiner is not regulated under SARA. Bigmouth shiner is listed as S3 in Manitoba (*i.e.,* vulnerable – rare, typically having 21 to 100 occurrences, or 3,001 to 10,000 individuals) (MBCDC 2013a; NatureServe 2015b). The species is not regulated under ESEA. In Manitoba, bigmouth shiner prefers small streams that are <12 m wide and <1 m in depth, although it has been recorded in larger rivers such as the Assiniboine (COSEWIC 2003a). Typically, bigmouth shiner is found at the upstream limit of riffles and runs, in high velocity areas (COSEWIC 2003a). In Manitoba, critical habitat regulated under SARA has not been identified for this species. Bigmouth shiner is known to occur in the RAA, in the Assiniboine River and Red River (MBCDC 2013a). COSEWIC (2003a) lists several possible threats to the recovery of bigmouth shiner: eutrophication from shoreline development, high spring water levels, bank erosion, and siltation.

Carmine shiner (*Notropis percobromus)* is designated as *threatened* by COSEWIC (2006a) and is protected under Schedule 1 of SARA. It is not regulated under ESEA. A federal recovery strategy for this species has been finalized (DFO 2013c). Habitat requirements of carmine shiner are not well known, although they are typically found in open-water environments, where water clarity and velocity are high, and substrates consist of clean gravel or rubble (DFO 2013c). Critical habitat has only been identified in the Whitemouth and Birch rivers, since little is known about the habitat requirements of carmine shiner (DFO 2013c). Carmine shiner is known to occur in the RAA, in the Seine River, Rat River, and Roseau River (MBCDC 2013b). Key issues affecting this species might include: overexploitation, species introductions, habitat loss/degradation, and pollution. However, the potential magnitude or significance of these threats are poorly understood (DFO 2013c).

Chestnut lamprey (*Ichthyomyzon castaneus*) is designated as *non-active* by COSEWIC (2010) and is designated *special concern* under Schedule 3 of SARA. Therefore, it is not regulated by SARA. Additionally, the species is not regulated under ESEA. The species has been designated S3S4 (*i.e.,* vulnerable or apparently secure – uncertainty exists regarding exact rarity of species) (MBCDC 2013a, b, c). In Canada, chestnut lamprey has been found in small to large lakes, and in creeks to large rivers (COSEWIC 2010). Data collected in the Rat River suggest that chestnut lamprey requires small, shallow, high velocity watercourses with coarse gravel substrate for nest construction and spawning (COSEWIC 2010). In Manitoba, critical habitat regulated under SARA has not been identified for this species. Chestnut lamprey is known to occur in the RAA, in the Assiniboine River, Red River, Seine River and Rat River sub-watersheds (MBCDC 2013a, b, c). No direct factors limiting chestnut lamprey populations have been identified. However, threats that might affect chestnut lamprey include: eutrophication of habitat resulting from run off of fertilizers, as well as pesticide and herbicide pollution (COSEWIC 2010).

Lake sturgeon *(Acipenser fulvescens)* is designated as *endangered* by COSEWIC (2006b) and does not have any status under SARA. Lake sturgeon is not regulated under ESEA. Lake sturgeon require different habitats for spawning, rearing, feeding and overwintering. Large river systems provide diverse habitats to meet these requirements, including deep-water areas for feeding, rearing and overwintering, as well as shallow, fast-flowing, rocky areas for spawning (Wallace 1999; Auer and Baker 2002). Lake sturgeon is known to occur in the RAA, in the Assiniboine River and Red River sub-watersheds (MBCDC 2014). Threats to lake sturgeon include overexploitation (including poaching), dams, contaminants, habitat degradation and introduced species that complete for habitat and resources (COSEWIC 2006b).

Mapleleaf (*Quadrula quadrula)* is designated as *endangered* by COSEWIC (2006c) and ESEA, and is regulated under Schedule 1 of SARA. Mapleleaf mussels are typically found in medium to large rivers with slow to moderately moving waters and sand, gravel, or mud stream beds (COSEWIC 2006c). In Manitoba, critical habitat regulated under SARA has not been identified for this species. Mapleleaf mussels are known to occur within the following sub-watersheds within the RAA (MBCDC 2013a, c): Assiniboine River, Red River, Cook/Devils Creek, Rat River, and Roseau River. COSEWIC (2006c) indicates that the threats facing mapleleaf include habitat degradation and loss, invasive species, as well as industrial and municipal pollution, and agricultural runoff.

Northern brook lamprey (*Ichthyomyzon fossor*) is designated as *non-active* by COSEWIC (2007) and is designated *special concern* under Schedule 3 of SARA. Therefore, it is not regulated by SARA. Additionally, the species is not regulated under ESEA. The species has been designated S2 in Manitoba (*i.e.,* imperiled - very few populations [often 20 or fewer]) (MBCDC 2013b). Northern brook lamprey is typically found in watercourses with clear water. Larval lamprey reside in burrows in silt and sand substrate. Adult northern brook lamprey spawn over substrates comprised of coarse gravel, in fast water (COSEWIC 2007). In Manitoba, critical habitat regulated under SARA has not been identified for this species. Northern brook lamprey is known to occur in the RAA, in the Seine River, Rat River and Roseau River sub-watersheds (MBCDC 2013c). Low water levels and changes to water temperature are considered threats to the success of northern brook lamprey (COSEWIC 2007).

Shortjaw cisco (*Coregonus zenithicus)* is designated as *threatened* by COSEWIC (2003b) and is listed as *threatened* under Schedule 3 of SARA. Therefore, it is not regulated by SARA. Shortjaw cisco is designated S3 in Manitoba (*i.e.,* vulnerable – rare, typically having 21 to 100 occurrences, or 3,001 to 10,000 individuals) (MBCDC 2013b, c; NatureServe 2015c). Shortjaw cisco is found in deep environments in small and large lakes. Spawning takes place in shallower water, over variable substrate (COSEWIC 2003b). In Manitoba, critical habitat regulated under SARA has not been identified for this species. Shortjaw cisco is known to occur in the RAA, in the Red River sub-watershed (MBCDC 2013b, c). There is no single factor that has contributed to the decline of shortjaw cisco in Canada.

However, factors such as over-harvesting, introduced species, and large-scale ecological changes might be contributing to diminished populations of the species (COSEWIC 2003b).

A summary of the SOCC, including conservation status and sub-watersheds where they are potentially located, is found in Table 3-5.

Table 3-5: Aquatic Species of Conservation Concern (SOCC) Known or Expected to Occur within the RAA

Common Name	Scientific Name	Conservation Status		Sub-watershed
		Provincial	Federal	
banded killifish	*Fundulus diaphanus*	MBCDC – S1	None	RR
bigmouth buffalo	*Ictiobus cyprinellus*	None	COSEWIC – *endangered*; SARA – *special concern* (Schedule 1)	LSR, RR
bigmouth shiner	*Notropis dorsalis*	MBCDC – S3	COSEWIC – *not at risk;* SARA – *special concern* (Schedule 3)	AR, RR
carmine shiner	*Notropis percobromus*	None	COSEWIC – *threatened*; SARA – *threatened* (Schedule 1)	SR, RTR, ROR
chestnut lamprey	*Ichthyomyzon castaneus*	MBCDC – S3S4	COSEWIC – *non-active*; SARA – *special concern* (Schedule 3)	AR, SR, RR, RTR
lake sturgeon	*Acipenser fulvescens*	None	COSEWIC – *endangered*, SARA – *no status*	AR, RR
mapleleaf	*Quadrula quadrula*	ESEA - endangered	COSEWIC – endangered; SARA – *endangered* (Schedule 1)	AR, RR, LSR, SR, CDC, RTR, ROR

Common Name	Scientific Name	Conservation Status		Sub-watershed
		Provincial	Federal	
northern brook lamprey	*Ichthyomyzon fossor*	MBCDC – S2	COSEWIC – *non-active*; SARA – *special concern* (Schedule 3)	SR, RTR, ROR
shortjaw cisco	*Coregonus zenithicus*	MBCDC – S3	COSEWIC – *threatened*, SARA – *threatened* (Schedule 3)	RR

3.6 HABITAT SENSITIVITY SUMMARY

The sensitivity of fish and fish habitat in each Project watercourse crossing was ranked using criteria adapted from DFO's *Practitioners Guide to the Risk Management Framework* (DFO 2006) as described in Section 2.2.3.2 as high, moderate and low. The 23 watercourse crossings that were carried forwarded to the field program were characterized as follows (Table 3-6):

- 8 watercourse crossings were ranked as highly sensitive habitat;
- 5 watercourse crossings were ranked as moderately sensitive; and
- 8 watercourse crossings were ranked as low sensitivity habitat.

Additionally, 2 watercourse crossings were deemed not fish habitat and were not carried forward in the Project EIS risk assessment of serious harm to fish and fish habitat. The following is a summary of the criteria found at the watercourses crossed by the Project that contributed to their habitat rankings.

Eight stream crossings were assigned a high habitat sensitivity ranking on the basis of the potential presence of SOCC and CRA fisheries. These watercourses were larger and had overwintering capacity (*i.e.,* the Red and Assiniboine rivers). The riparian vegetation ranged from uniform grasses to more diverse mixed deciduous forest.

Five stream crossing were assigned a moderate habitat sensitivity ranking on the basis of the potential presence of recreational or Aboriginal fisheries. In-water habitat lacked diversity in the LAA due to surrounding agricultural activities at most crossings. Shrubs and trees make up a small proportion of riparian cover along these watercourses.

Eight stream crossings were assigned a Low habitat sensitivity ranking a result of existing watercourse channelization, the presence of forage fish species dominating most watercourses, and low habitat quality. The LAA is heavily disturbed at most crossings because of agricultural land use, which has influenced riparian vegetation because grasses dominate the area. Water flows were low, and there was no overwintering capacity in these watercourses.

3.7 FISH AND FISH HABITAT DESCRIPTION FOR EACH WATERCOURSE CROSSING

Field and desktop data were compiled to characterize fish and fish habitat at each of the 23 watercourse crossings characterized by DFO Habitat Types A, B, and C. Descriptions of each watercourse crossing, including physical characteristics, surface water quality, riparian vegetation cover, fish species known or expected to occur in the watercourse, and fish habitat characteristics present in the LAA, as well as information available regarding the presence of CRA fisheries and aquatic SOCC are provided in the following section.

3.7.1 Site 1 – Sturgeon Creek

The Project crossing location on Sturgeon Creek is approximately 5.6 km north of Headingly, Manitoba (Appendix A, Map 1-100-1), within the Lower Assiniboine River sub-watershed. Sturgeon Creek RAA is predominantly agricultural land and has a total drainage area of approximately 598 km^2 (AECOM 2009). At this watercourse crossing, the Project will parallel an existing transmission line.

Water Quality

Water quality data were collected during field studies and compiled with data from previous studies (Table 3-1). Water temperatures ranged from 1.6 to 25.9°C with a median of 13.3°C. Dissolved oxygen ranged from 0.8 to 15.6 mg/L, with a median of 9.2 mg/L. Conductivity ranged from 425 to 1692 µs/cm with a median of 1,125.5 µs/cm. Turbidity ranged from 1.2 to 167.0 NTU with an average of 8.0 NTU, and pH ranged from 6.5 to 8.9 with a median of 8.0 (Milani 2013; City of Winnipeg 2013, 2014; Stantec 2014). The median values were all within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

Sturgeon Creek is a large permanent watercourse with turbid water and little in-water vegetation. It is Type B habitat at the crossing location (Milani 2013). The watercourse banks are lined with grasses and there is agriculture on both sides. Vegetation appears to create bank stability throughout the assessment area. Substrate was predominantly composed of fines and organics. This crossing location was characterized by low habitat

complexity. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible to low within the LAA.

Historic documentation indicates the potential for 41 fish species to inhabit Sturgeon Creek; common species include white sucker, northern pike, yellow perch, black crappie, brook stickleback, brown bullhead, central mudminnow, channel catfish, creek chub, fathead minnow, freshwater drum, goldeye, Johnny darter, rock bass, sauger, silver lamprey, stonecat, tadpole madtom, and walleye (Manitoba Water Stewardship (MWS) 2004; Milani 2013; City of Winnipeg 2013, 2014) A list of potential species in the RAA, including SOCC, can be found in Tables 3-3 and 3-5, respectively. Based on Stantec's field data, spawning, overwintering, rearing, and migration habitat potential was moderate for forage, coarse and sport fish.

Commercial, Recreational and Aboriginal Fishery

Sturgeon Creek supports fish that are part of a CRA fishery. Previous records of sport fish, including yellow perch, northern pike, white sucker and brown bullhead, contribute to a recreational fishery. Sturgeon Creek is part of the Sturgeon Creek Greenway Trail attraction (Winnipeg Trails Association 2014) adding to the recreational use of this watercourse. Sturgeon Creek is also a well-known urban fishing location, particularly for northern pike (World Fishing Network 2014).

Species of Conservation Concern

Silver chub were previously documented within Sturgeon Creek (MWS 2004). The status of this species is provided in Table 3-5, and habitat requirements are described in Section 3.5. Habitat that the silver chub prefers in found within the LAA, and is common throughout the RAA of this watercourse crossing.

Habitat Sensitivity Ranking

Sturgeon Creek's habitat sensitivity ranking is moderate because of its diverse fish community which supports CRA fisheries. Common species present in this watercourse are moderately resilient to change and the fish habitat available is common throughout the RAA.

3.7.2 Site 2 – Third Creek

The Project crossing location on Third Creek is approximately 1.4 km west of Headingly, Manitoba (Appendix A, Map 1-100-2). Third Creek flows southeast into the Assiniboine River and the crossing location is located approximately 1 km upstream of the confluence. At this watercourse crossing, the Project will parallel an existing transmission line.

Water Quality

Water quality was collected on site by Stantec (2014); historical data for this crossing were not available (Table 3-1). At the time of the field assessment, temperature was 3.8 and 7.5°C at the centerline and downstream locations, respectively. Water depths were too shallow at the upstream location to obtain water quality data. Dissolved oxygen ranged from 7.5 to 9.5 mg/L, conductivity ranged from 2306 to 2358 µs/cm, turbidity ranged from 11.5 to 17 NTU, and pH was between 7.7 and 7.8. All water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

Third Creek was classified as Type A habitat at the crossing location (Milani 2013); however, during the fall field habitat assessment the channel was found to have intermittent flow with dense cattails and very little open water at the crossing location. Land use surrounding this crossing is predominantly agriculture. Riparian vegetation at the crossing consists of grasses, crops and a few scattered trees. Water levels were very shallow (< 0.1m) and connectivity was limited due to intermittent water and dense cattails. Field data from Milani (2013) confirm this assessment; however, their fish habitat characterization of Type A was inconsistent with the data reported. As summarized in the Soil and Terrain TDR, the soil water erosion risk is low within the LAA.

Third Creek is a tributary to the Assiniboine River. It is possible that during spring flood conditions some fish may move into Third Creek from the Assiniboine River; however, there is no historical documentation of this. Based on Stantec's field data, spawning, overwintering, rearing, and migration habitat potential was poor for forage, coarse and sport fish.

Species of Conservation Concern

No SOCC have been documented in Third Creek.

Commercial, Recreational and Aboriginal Fishery

Third Creek has the potential to contribute indirectly to a CRA fishery. Close proximity to the Assiniboine River may allow target fish species to enter during spring flood to use this watercourse for spawning and rearing habitat, but there is no historical record of this.

Habitat Sensitivity Ranking

The habitat sensitivity ranking for Third Creek is low due to poor spawning and rearing habitat for fish, no overwintering capacity due to lack of water and no known contribution to a CRA fishery.

3.7.3 Site 3 – Unnamed Tributary to Assiniboine River

The Project crossing location on the unnamed tributary to the Assiniboine River is approximately 1.6 km southwest of Headingly, Manitoba (Appendix A, Map 1-100-2). Land use in this area is predominantly agriculture. At this watercourse crossing the Project will parallel an existing transmission line.

Water Quality

Water quality was collected on site by Stantec (2014); historical data for this crossing was not available (Table 3-1). The water depths at the centerline and upstream survey locations were too shallow to measure water quality parameters. Data collected at the 300 m downstream from the crossing location was as follows: temperature was 7.6°C, dissolved oxygen was 16.6 mg/L, conductivity was 1743 µs/cm, turbidity was 1.7 NTU, and pH was 8.0. All water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

This intermittent watercourse flows southeast through a marshy, treed area into the Assiniboine River. The unnamed tributary is Type C habitat at the crossing location (Milani 2013). At the time of the fall field assessment, this watercourse was characterized by high in-water algal growth, dense cattails and very shallow water. Sections of this watercourse at centerline, 100 m upstream and below 300 m downstream of centerline were almost dry; water levels were between 0.05 and 0.25 m and stream flow was minimal. Substrate composition was primarily organics with some fines and poor connectivity, limiting habitat potential. As summarized in the Soil and Terrain TDR, the soil water erosion risk is low within the LAA.

No fish have been documented in the unnamed tributary to the Assiniboine River; however, if water levels allow during spring flooding, fish presence is possible due to its close proximity to the Assiniboine River. Based on Stantec's field data, spawning, rearing, and migration habitat potential was poor for forage, coarse and sport fish. Overwintering habitat was nil for forage, coarse, and sport fish.

Species of Conservation Concern

No SOCC have recorded occurrences in this unnamed tributary.

Commercial, Recreational and Aboriginal Fishery

This watercourse has potential to contribute indirectly to a CRA fishery. Close proximity to the Assiniboine River may allow target fish species to enter during spring flood and use it as spawning and rearing habitat, but there is no historical record of this.

Habitat Sensitivity Ranking

The habitat sensitivity ranking of this unnamed tributary to the Assiniboine River is low due to poor spawning and rearing habitat for fish. There is no overwintering capacity due to lack of water, and no known contribution to a CRA fishery.

3.7.4 Site 4 – Assiniboine River

The Project crossing location on the Assiniboine River is approximately 1.8 km southwest of Headingly, Manitoba (Appendix A, Map 1-100-2). The Assiniboine River drainage area is approximately 153,000 km^2 throughout Manitoba, Saskatchewan, and North Dakota (Nelson and Franzin 2000). The land use in the RAA is predominantly agriculture. There are smaller areas used for pasture, woodland for recreation, with some urban development (Manitoba Land Resource Unit 1997). The LAA is crossed by another parallel transmission line.

Water Quality

Water quality data were collected during the 2014 field study, and compiled with historical data from Milani (2013) and Manitoba Water Stewardship long-term monitoring data (2008-2013)(Table 3-1). Temperatures in the last seven years have ranged from -0.2 to 25.3 degrees Celsius with a median of 13.5°C, dissolved oxygen ranged from 2.6 to 13.8 mg/L with a median of 8.6 mg/L, conductivity ranged from 262 to 1300 µs/cm with a median of 875 µs/cm, turbidity ranged from 7.3 to 461.0 NTU with a median of 68.8 NTU, and pH ranged from 7.6 to 8.9with a median of 8.3.

Fish Habitat

The Assiniboine River is a Type A habitat watercourse (Milani 2013). The Assiniboine River is a large, wide, permanently flowing watercourse with very turbid, warm waters (North/South Consulting Inc. 2010). The field-habitat assessment conducted in 2014 confirmed this. Banks consisted predominantly of fines with some small gravel, and higher turbidity and woody debris provided in-water fish cover. The southern bank riparian area is predominantly forested. Beaudry Provincial Park is located upstream of the LAA and has intact riparian vegetation buffer along both banks. As summarized in the Soil and Terrain TDR, the soil water erosion risk is low within the LAA.

Table 3-3 lists the 55 possible species of fish recorded in the Assiniboine River (Manitoba Conservation Fisheries Branch 1998; Stewart and Watkinson 2004; Milani 2013; MCWS 2014). Based on Stantec's field data, the spawning habitat was moderate for forage, sport and coarse fish species as the substrate was predominantly fines, with some gravel present. Rearing habitat was moderate for all species due to aquatic vegetation and riparian cover. The river is deep with good flow (Nelson and Franzin 2000); therefore, the overwintering habitat would be suitable for all species.

Species of Conservation Concern

The Assiniboine River supports six SOCC; bigmouth buffalo, bigmouth shiner, chestnut lamprey, lake sturgeon, mapleleaf and silver chub (COSEWIC 2003a, 2006b, 2006c, 2009, 2010; MBCDC 2014; MCWS 2014a). The status of these species are provided in Table 3-5, and habitat requirements are described in Section 3.5. The Assiniboine River provides suitable habitat for these species extending outside of the LAA. This type of habitat is also common within the RAA of this Project.

Commercial, Recreational and Aboriginal Fishery

The Assiniboine River supports fish that are part of a CRA fishery (Table 3-4). A portion of the Assiniboine River flows through the city of Winnipeg and contributes to urban fishing sites (Manitoba Wildlife Federation (MFW) 2014). The confluence of the Assiniboine River to the Red River also occurs in the city of Winnipeg. Recreational fishing takes place on the Assiniboine River throughout southern Manitoba and Saskatchewan. The Assiniboine River was also identified by Peguis FN as a watercourse used for travel and fishing (Peguis First Nation – Whelan Enns Associates Inc. 2015).

Habitat Sensitivity Ranking

The Assiniboine River's habitat sensitivity ranking is high because of its diverse fish community which supports CRA fisheries. This watercourse contains good migration, overwintering, spawning and rearing habitats and habitats that support SOCC. Fish habitat available in the Assiniboine River is common throughout the RAA.

3.7.5 Site 5 – La Salle River

The Project crossing location on La Salle River is within the southern city limits of Winnipeg, approximately 3.2 km south of the Perimeter Highway (#100) and 600 m west of Pembina Highway (#75).

Water Quality

Water quality data were collected during the 2014 field study and compiled with data from previous studies and regular monitoring of the La Salle River (Milani 2013; MCWS 2008-2013; City of Winnipeg 2007-2014)(Table 3.1). Temperature ranged from 0.9 to 27.8°C with a median of 18.2°C, dissolved oxygen ranged from 3.9 to 17.1 mg/L with a median of 8.7 mg/L, and conductivity ranged from 265 to 1964 µs/cm with a median of 631 µs/cm. Turbidity ranged from 0 to 296 NTUs, with a median of 27 NTU, and pH ranged from 7.00 to 9.24 with a median of 8.1 (Milani 2013; City of Winnipeg 2013, 2014). All median water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

The La Salle River is a tributary of the Red River, flowing into the Red River approximately 4.3 km downstream from the Project crossing. It is considered the main fish-bearing watercourse within the La Salle River Watershed (MWS 2010a). The La Salle River is a Type A watercourse at the crossing location (Milani 2013). This large, permanent watercourse is characterized by deep, turbid water, wide, open channel, and steep banks with grass and deciduous trees throughout the riparian area of the reach at the crossing location (Appendix A, Map 1-100-3). The soil water erosion risk classification was not available for this crossing; however, Baracos and Graham (1981) identified an active slide area along the La Salle River approximately 4 km from its confluence with the Red River (Soil and Terrain TDR). Substrate was predominantly fines with some organic matter. Banks were high (1.0-3.0 m) and stabilized by grasses.

Historic documentation indicated 33 fish species in the La Salle River (Table 3-3) with the majority in the lower reaches of the tributary (MWS 2010a). Thirteen species have been identified as common throughout the watercourse (Graveline and Larter 2006; Milani 2013). Species diversification and habitat quality increases with proximity to the Red River (MWS 2010a). Based on Stantec's field data, spawning habitat was moderate for forage and coarse fish and poor for sport fish. Rearing habitat was moderate to good for forage fish, moderate for coarse fish and poor to moderate for sport fish. Overwintering and migration habitat was good for all fish types. Fish utilization is restricted by water levels in the upper reaches of the tributary as well as multiple dams impeding access from the Red River. The first dam is located approximately 4.5 km upstream from the proposed watercourse crossing (Graveline and Larter 2006).

Species of Conservation Concern

SOCC have been recorded historically in the La Salle River (Graveline and Larter 2006), including bigmouth buffalo, chestnut lamprey, and silver chub. The status of these species is provided in Table 3-5, and habitat requirements are described in Section 3.5.

The La Salle River provides habitat that is suitable for the identified SOCC extending outside of the LAA. Other watercourses within the RAA have habitat suitable for these species. Critical habitat regulated under SARA has not been identified for these species in Manitoba.

Commercial, Recreational and Aboriginal Fishery

The La Salle River supports fish that are part of a CRA fishery. This tributary of the Red River is within the city limits of Winnipeg and could contribute to Winnipeg's recreational fishery. The presence of sport fish, such as northern pike, walleye, and channel catfish, supports this classification (Table 3-4).

Habitat Sensitivity Ranking

The La Salle River's habitat sensitivity ranking is high because of its diverse fish community which supports CRA fisheries. This watercourse contains good migration, overwintering, spawning and rearing habitats and habitats that support SOCC. This crossing has steep banks and treed riparian cover. Fish habitat available in the LAA is common along the La Salle River.

3.7.6 Site 6 – Red River

The Project crossing location on the Red River is at the south end of the City of Winnipeg, between Pembina Highway (Highway 75) and St. Mary's Road (Highway 200), and is approximately 100 m upstream of the Courchaine Road Bridge (Appendix A, Map 1-100-3). This reach of the river receives an upstream point source input from the Winnipeg South End Wastewater Pollution Control Centre.

The Red River received Canadian Heritage River status in 2007 due to its cultural heritage values which include archaeological evidence of over 6,000 years of First Nation river-oriented use and settlement and European exploration in the early 1700s. The Red River was home to many locations of Hudson's Bay Company fur trading forts and posts, including the oldest intact fur trading post in North America, the Lower Fort Gary National Historic Site (Rivers West 2005).

Water Quality

Long-term water quality monitoring data (2008-2013) from Manitoba Water Stewardship was compiled with data from Milani (2013) and field data collected by Stantec (2014)(Table 3-1). Temperature ranged from -1.4 to 28.4 degrees Celsius with a median of 9.3°C, dissolved oxygen ranged from 2.2 to 15.5 mg/L with a median of 9.3 mg/L, and conductivity ranged from 274 to 1780 µs/cm with a median of 756 µs/cm. Turbidity ranged from 4.0 to 341.0 NTUs with a median of 27.6 NTU, and pH ranged from 7.5 to 8.7 with a median of 8.2 (Milani 2013; Stantec 2014; MCWS year). All median water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

The Red River is a large dynamic river that meanders northward to Lake Winnipeg from its headwaters at Breckenridge, Minnesota (Laken 2010). Channel migration and erosion occur naturally, and there are remnants of this with numerous oxbow lakes. Although there are changes in the last century which include bank stabilization and the completion of the Red River Floodway in 1968, periodic severe flooding events still occur. The Red River is a Type A habitat watercourse (Milani 2013). At the crossing location, this watercourse is permanent and characterized by a wide, deep channel with turbid water and very little in-stream vegetation.

The riparian area within the LAA is predominately grassland and borders the floodway. The southwest bank has some treed areas. Banks consisted predominantly of fines and in-water cover consisted of water depth/turbidity. Water was very turbid and depths were deep, so substrate type was not identified. Due to the number of dams created on the upper reaches of the river, flow rates and substrate have become more homogeneous along the Red River (KGS Group 2008). The soil water erosion risk classification was not available for this crossing; however, Baracos and Graham (1981) identified active slide areas along the Red River approximately 2.5 km upstream and downstream from the PDA (Soil and Terrain TDR).

Sixty two fish species have been previously documented in the Red River within Manitoba by Stewart and Watkinson (2004) and another source indicates 31 species identified within the city limits of Winnipeg (KGS Group 2008). The most abundant species occurring in the Red River include channel catfish, sauger, goldeye, white sucker, freshwater drum, emerald shiner, and river shiner (KGS Group, 2008). A list of fish species thought to inhabit the Red River is provided in Table 3-3. Based on Stantec's field data, spawning and rearing habitat potential was assessed as moderate for forage and coarse fish and poor for sport fish. Overwintering and migration-habitat potential was good for all fish types.

Species of Conservation Concern

SOCC have been recorded historically in the Red River. The mapleleaf mussel, chestnut lamprey, silver chub, bigmouth buffalo, bigmouth shiner, cisco, and lake sturgeon have been identified as being present within the Red River (KGS Group, 2008; MCDC 2014). Lake sturgeon were identified as extirpated in the early 1990s but have been stocked annually since 1997 (KGS Group 2008). The status of these species is provided in Table 3-5, and habitat requirements are described in Section 3.5. The Red River provides habitat that is suitable for the identified SOCC extending outside of the LAA. Other watercourses within the RAA also have habitat suitable for these species. Critical habitat regulated under SARA has not been identified for these species in Manitoba.

Commercial, Recreational and Aboriginal Fishery

The Red River supports fish that are part of a CRA fishery (Table 3-4). Peguis FN, Black River FN, Long Plain FN and Swan Lake FN have identified sites along the Red River where they fish. The Red River flows through the city of Winnipeg and contributes to the urban fishing sites indicated by the Manitoba Wildlife Federation (MFW 2014). Recreational fishing takes place on the Red River throughout Manitoba as many sport fish are present including channel catfish, northern pike, sauger and walleye (MWS 2014).

Habitat Sensitivity Ranking

The Red River's habitat sensitivity ranking is high because of its diverse fish community which supports CRA fisheries. This watercourse contains good migration, overwintering,

spawning and rearing habitats and habitats that support SOCC. Fish habitat available in the Red River is common throughout the RAA.

3.7.7 Site 7 – Red River Floodway

The Project crossing location on the Red River Floodway is in the south end of Winnipeg, between Pembina Highway (Highway 75) and St. Mary's Road (Highway 200), and is approximately 1 km downstream from the Red River Floodway Inlet Control Structure (Appendix A, Map 1-100-3). The Red River Floodway was completed in 1968 to protect the City of Winnipeg against spring flooding. The average operation duration each spring is 22 days between mid-April to mid-May. In recent years, the Floodway has also been operated in the summer (KGS Group 2008).

Water Quality

Water quality measurements were not conducted at this location due to dry conditions at the time of field sampling. During spring runoff, water passing through the Control Structure will be similar as that in the Red River (Table 3-1).

Fish Habitat

The Red River Floodway is a Type B habitat watercourse (Milani 2013). At the time of the assessment (October 8, 2014), the crossing location was dry. Both terrestrial and emergent aquatic species were present. The soil water erosion risk classification was not available for this crossing. Because the Red River Floodway becomes part of the Red River when the Inlet Control Structure is active, species present in the Red River have the potential to inhabit the floodway (Table 3-3). However, the Inlet Control Structure acts as a barrier to fish passage, restricting movement in the range of 10-62% of the time, depending on the fish species and their timing of migration.

Sixty-two fish species have been previously documented in the Red River within Manitoba by Stewart and Watkinson (2004) and another source indicates 31 species identified within the city limits of Winnipeg (KGS Group 2008). The most abundant species occurring in the Red River incudes channel catfish, sauger, goldeye, white sucker, freshwater drum, emerald shiner, and river shiner (KGS Group 2008).

Species of Conservation Concern

SOCC have been recorded historically in the Red River and, therefore, have the potential to inhabit the Red River Floodway (Table 3-5). Chestnut lamprey, silver chub, bigmouth buffalo, bigmouth shiner, cisco, and lake sturgeon have been identified as being present within the Red River (KGS Group 2008). Lake sturgeon were identified as extirpated in the early 1990s but have been stocked annually since 1997 (KGS Group 2008). The status of these species is provided in Table 3-5, and habitat requirements are described in Section 3.5.

Because of the sedentary nature of the mapleleaf mussel, it is unlikely that it would occur within the floodway. Even if individuals were transported into the floodway, they would not survive through the summer when the floodway dries up.

The Red River Floodway provides only marginal fish habitat suited for the identified SOCC. Other watercourses within the RAA have more suitable for these species. Critical habitat regulated under SARA has not been identified for these species in Manitoba.

Commercial, Recreational and Aboriginal Fishery

The Red River Floodway supports fish that are part of a CRA fishery as it is part of the Red River during high water conditions. The Red River flows through the city of Winnipeg and contributes to the urban fishing sites (MFW 2014). Recreational fishing takes place on the Red River throughout Manitoba as many sport fish are present, including channel catfish, northern pike, sauger and walleye (Table 3-4).

Habitat Sensitivity Ranking

The habitat sensitivity ranking for the Red River Floodway is moderate due to the potential for supporting CRA for part of the year.

3.7.8 Site 8 – Seine River at Floodway

The Project crossing location on the Seine River is approximately 500 m west of Lagimodiere Boulevard (Highway #59), and is 70 m upstream of the Red River Floodway (Appendix A, Map 1-100-4). The Seine River Watershed is approximately 2,509 km^2 with agriculture predominating throughout the RAA (MWS 2009). About 30 m downstream of the crossing location, before the Seine River reaches the Floodway, is the Seine River Inverted Syphon and overflow structure. The syphon carries Seine River water under the floodway, where it continues to meet the Red River. Under flood conditions, excess Seine River water can be diverted into the Floodway (Manitoba CEC 2005).

Water Quality

Data were collected during the field studies and compiled with previous studies in the area (Milani 2013) and monitoring programs (City of Winnipeg 2013-2014)(Table 3-1). Temperature ranged from 1.3 to 25.2°C with a median of 17.3°C, dissolved oxygen ranged from 5.7 to 15.3 mg/L with a median of 8.4 mg/L, and conductivity ranged from 451 to 616 µs/cm with a median of 509 µs/cm. Turbidity ranged from 9.5 to 119.0 NTUs with a median of 30.8 NTU, and pH ranged from 6.7 to 8.8 with a median of 8.2 (Milani 2013; City of Winnipeg 2007-2014; Stantec 2014). All median water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

The Seine River, which is a tributary of the Red River, is a Type A habitat watercourse (Milani 2013). At the crossing location, this large, permanent watercourse has moderate in-water vegetation and turbid water. Flow was low at the time of assessment and substrate was predominantly fines with some organics. Vegetation was limited to cattails and other emergent species. The riparian area was grassed and the LAA extends downstream past the syphon and into the Red River Floodway area. As summarized in the Soil and Terrain TDR, the soil water erosion risk is low to moderate within the LAA.

Historic documentation indicated 32 fish species in the Seine River with the majority in the lower reaches of the tributary and during high flow years (MWS 2010b)(Table 3-3). Other records identify 24-25 fish species previously recorded in the Seine River (MCWS 2014; Gaudet 1997). It is likely that most fish species return to the Red River before water levels decrease. Access to the Seine River above the syphon from the Red River is possible via the Seine River Diversion (MWS 2010b). Based on Stantec's field data, spawning and rearing habitat potential was moderate for forage fish and poor for coarse and sport fish. Overwintering habitat potential was poor at this crossing for all fish types due to water depth. Upstream migration from below the centerline is unlikely due to the 1.5 m vertical drop and water velocity of the Seine River Syphon (Manitoba CEC 2005).

Species of Conservation Concern

SOCC have been recorded in the Seine River. Bigmouth buffalo is listed as potentially inhabiting the river (MWS 2010b). The status of this species is provided in Table 3-5, and habitat requirements are described in Section 3.5. The habitat of the Seine River could be suitable for the bigmouth buffalo within the LAA, below the syphon.

Commercial, Recreational and Aboriginal Fishery

The Seine River supports fish that are part of a CRA fishery (Table 3-4). This tributary of the Red River contributes to a recreational fishery in Winnipeg's rural area. The presence of sport fish such as northern pike, walleye, and channel catfish support this classification. The Seine River was also identified by Peguis FN as a watercourse used for travel and fishing (Peguis First Nation – Whelan Enns Associates Inc. 2015)

Habitat Sensitivity Ranking

The habitat sensitivity ranking for this Seine River crossing near the floodway is moderate, due to the moderate spawning, rearing and overwintering habitat for forage fish. Although bigmouth buffalo could be present in the LAA, the physical barrier posed from the syphon make it very difficult for these fish to enter the PDA. Fish habitat available in the LAA is common along this reach of the Seine River.

3.7.9 Site 9 – Cooks Creek

The Project crossing location on Cooks Creek is approximately 7.78 km southwest of the community of Anola, Manitoba (Appendix A, Map 1-100-5). Cooks Creek is a tributary of the Red River, with a drainage area of approximately 730 km^2 (North/South Consultants 2004). Agricultural as well as urban and rural development predominates within the RAA (MWS 2013).

Water Quality

Water quality data were collected during the field study was compiled with results from Milani 2013 (Table 3-1). Temperatures ranged from 7.7 to 19.4°C with a median of 7.8°C, dissolved oxygen ranged from 10.7 to 11.1 mg/L with a median of 11.0 mg/L, and conductivity ranged from 400 to 632 µs/cm with a median of 630.5 µs/cm. Turbidity ranged from 16.0 to 34.7 NTUs with an average of 23.2 NTU, and pH ranged from 8.0 to 8.5 with a median of 8.3 (Milani 2013; Stantec 2014). All median water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

Cooks Creek is a Type A habitat watercourse (Milani 2013). At the crossing location, this large permanent watercourse is characterized by moderately deep, turbid water and heavily grassed banks and riparian area. Substrate was predominantly fines with some organics. This watercourse is highly channelized with banks and riparian areas covered in thick grasses. At the 300 m downstream location, a ford was identified during the field assessment and substrate was coarse in this area. There was limited in-water vegetation and no observed barriers to fish movement, with exception of the ford if water levels decreased. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible within the LAA.

Previous studies indicated 33 fish species (Table 3-3) inhabit Cooks Creek near the confluence with the Red River (North/South Consultants 2004). This number is likely less towards the headwaters area, where the Project crosses this watercourse. Surveys reported in Milani (2013) identified six species in this area; blacksided darter, brook stickleback, central mudminnow, fathead minnow, Iowa darter and white sucker. Based on Stantec's field data, spawning and rearing habitat potential was poor to moderate for forage, coarse, and sport fish. Water depths and flow appeared sufficient to provide overwintering habitat.

Species of Conservation Concern

SOCC have been identified in Cooks Creek. Bigmouth buffalo, chestnut lamprey, and silver chub are listed as potentially inhabiting the river (North/South Consultants 2004;

MBCDC 2014). The status of these species is provided in Table 3-5, and habitat requirements are described in Section 3.5. Within the LAA, the habitat does not appear to be suitable for the chestnut lamprey, but may be acceptable for the other two species that prefer silty rivers with pools and backwaters. There is no limiting habitat present in the LAA.

Commercial, Recreational and Aboriginal Fishery

Cooks Creek supports fish that are part of a CRA fishery (Table 3-4). This watercourse contributes to Winnipeg's surrounding area recreational fishery with red horse, northern pike, walleye, and yellow perch commonly targeted species (MWF 2014).

Habitat Sensitivity Ranking

The habitat sensitivity ranking for this Cooks Creek crossing is high due to the potential presence of SOCC, including suitable habitat within the LAA. As well the habitat is used by one or more CRA fish species for spawning, rearing and growth, and overwintering is possible for small-bodied fish. Fish habitat available in the LAA is typical along this reach of Cooks Creek for many kilometers.

3.7.10 Site 10 – Edie Creek

The Project crossing location on Edie Creek is approximately 3.6 km southwest of the community of Anola, Manitoba (Appendix A, Map 1-100-5). The confluence of Cooks Creek and Edie Creek occurs approximately at the intersection of Cooks Creek Road and Corbett Road. The Project will parallel an existing transmission line at the crossing of Edie Creek.

Water Quality

Water quality data were collected in the field and through desktop searches (Table 3-1). Temperature ranged from 8.54 to 20.9°C with a median of 9.7°C, dissolved oxygen ranged from 9.1 to 13.5 mg/L with median of 10.4 mg/L, and conductivity ranged from 344 to 892 µs/cm with a median of 813 µs/cm. Turbidity ranged from 1.1 to 29.7 NTUs with a median of 1.8 NTU, and pH ranged from 6.7 to 8.2 with a median of 8.0 (Milani 2013; Stantec 2014). All median water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

Edie Creek is a tributary of Cooks Creek. Portions of Edie Creek are classified as either Type A or B fish habitat (Milani 2013). At the crossing location, this small permanent watercourse is characterized by shallow water and tall, abundant in-stream vegetation, which likely limited fish movement in some reaches within the LAA. There was no flow, and the water was very shallow at the time of assessment. The substrate was

predominantly organics with some fines. Riparian vegetation in the LAA was predominantly agriculture with some forested areas. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible to low within the LAA.

Six species have been documented in Edie Creek (Milani 2013). During spring high water conditions, fish present in Cooks Creek have the potential to access Edie Creek. Based on Stantec's field data, spawning, rearing and migration habitat potential was poor for all fish species. Overwintering habitat was nil. Downstream, towards the Cooks Creek confluence, the potential for fish habitat increases as water depth and flow increases.

Species of Conservation Concern

SOCC have not been recorded in Edie Creek; however, in Cooks Creek, bigmouth buffalo, chestnut lamprey, and silver chub are listed as species of concern potentially inhabiting the river (North/South Consultants 2004). The status of these species is provided in Table 3-5, and habitat requirements are described in Section 3.5. The density of instream vegetation at this Edie Creek crossing makes it unsuitable habitat for the SOCC listed above.

Commercial, Recreational and Aboriginal Fishery

There is no known CRA fishery in Edie Creek. This watercourse potentially supports forage fish species. Small-bodied fish in Edie Creek may support CRA species in Cooks Creek.

Habitat Sensitivity Ranking

The habitat sensitivity ranking for this crossing of Edie Creek is low due to poor spawning and rearing habitat, likely limited to forage fish only, and no overwintering capacity due shallow water and no flow.

3.7.11 Site 11 – Edie Creek South Crossing

The Project's second crossing location on Edie Creek is approximately 6.5 km upstream of the first crossing.

Water Quality

Water quality was not measured at this location during the field habitat assessment. Historical water quality data reported water temperature was 12.9°C, conductivity was 344 µs/cm, turbidity 29.7 NTUs, and pH was 6.7 (Milani 2013)(Table 3-1). Dissolved oxygen was not determined. All water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

Edie Creek is a tributary of Cooks Creek. This portion of Edie Creek is classified as Type B fish habitat (Milani 2013). Aerial photos suggest that the fish habitat is different at Site 11 than at Site 10 because the watercourse is channelized at this Project crossing, whereas upstream it is not. Additionally, the riparian vegetation is forested. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible within the LAA.

Six species have been documented in Edie Creek (Milani 2013). During spring high water conditions, fish present in Cooks Creek have the potential to access Edie Creek.

Species of Conservation Concern

SOCC have not been recorded in Edie Creek; however, in Cooks Creek, bigmouth buffalo, chestnut lamprey, and silver chub are listed as species of concern potentially inhabiting the river (North/South Consultants 2004). The status of these species is provided in Table 3-3, and habitat requirements are described in Section 3.5.

Commercial, Recreational and Aboriginal Fishery

There is no known CRA fishery in Edie Creek. This watercourse potentially supports forage fish species. Small-bodied fish in Edie Creek may support CRA species in Cooks Creek.

Habitat Sensitivity Ranking

The habitat sensitivity ranking for this crossing of Edie Creek is low due to the poor habitat downstream including shallow water and dense instream vegetation that would limit migration from Cooks Creek.

3.7.12 Site 12 – Cooks Creek South Crossing

The Project's second crossing location on Cooks Creek is approximately 19 km upstream from the first crossing. Cooks Creek is a tributary of the Red River, with a drainage area of approximately 730 km^2 (North/South Consultants 2004). Agricultural as well as urban and rural development predominates within the RAA (MWS 2013).

Water Quality

Water quality was not measured at this location during the field habitat assessment. Historical water quality data reported water temperature was 19.4°C, conductivity was 400 µs/cm, turbidity 34.7 NTUs, and pH was 8.0 (Milani 2013)(Table 3-1). Dissolved oxygen was not determined. All water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

Cooks Creek is a Type A habitat watercourse (Milani 2013). Aerial photos suggest that the fish habitat is different at Site 12 than at Site 9 because the watercourse is not channelized at this Project crossing, as it is downstream. Additionally, the riparian vegetation is forested. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible to low within the LAA.

Previous studies indicated 33 fish species (Table 3-3) inhabit Cooks Creek near the confluence with the Red River (North/South Consultants 2004). This number is likely less towards the headwaters area, where the Project crosses this watercourse. Surveys reported in Milani (2013) identified six species in this area; blacksided darter, brook stickleback, central mudminnow, fathead minnow, Iowa darter and white sucker.

Species of Conservation Concern

SOCC have been identified in Cooks Creek. Bigmouth buffalo, chestnut lamprey, and silver chub are listed as potentially inhabiting the river (North/South Consultants 2004; MBCDC 2014). The status of these species is provided in Table 3-5, and habitat requirements are described in Section 3.5.

Commercial, Recreational and Aboriginal Fishery

Cooks Creek supports fish that are part of a CRA fishery (Table 3-4). This watercourse contributes to Winnipeg's surrounding area recreational fishery with red horse, northern pike, walleye, and yellow perch commonly targeted species (MWF 2014).

Habitat Sensitivity Ranking

The habitat sensitivity ranking for this Cooks Creek crossing is high due to the potential presence of SOCC. As well, the habitat may be used by one or more species of a fishery for spawning, rearing and growth.

3.7.13 Site 13 – Fish Creek

The Project crossing on Fish Creek is located approximately 14 km northeast of Ste. Anne. Fish Creek is a tributary of the Seine River. Agricultural, as well as urban and rural development, predominate within the RAA.

Water Quality

Water quality was not measured at this location during the field habitat assessment.

Fish Habitat

This portion of Fish Creek is classified as Type C fish habitat (Milani 2013). Aerial photos show that this watercourse crossing is surrounded by predominantly forest with some agricultural land use. This section of Fish Creek is also less channelized than farther

downstream. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible within the LAA.

Species of Conservation Concern

No SOCC have been documented in this watercourse.

Commercial, Recreational and Aboriginal Fishery

There is no known CRA fishery in Fish Creek. This watercourse potentially supports forage fish species. Small-bodied fish in Fish Creek may support CRA species in the Seine River.

Habitat Sensitivity Ranking

Based on land cover data, the crossing location is forested with wetland areas. The habitat sensitivity ranking for this crossing of Fish Creek is low due to the poor habitat downstream including shallow water and dense instream vegetation. Spawning and rearing habitat is expected to be poor, likely limited to forage fish only, and no overwintering capacity due shallow water.

3.7.14 Site 14 – Unnamed Watercourse

The Project crossing location on the unnamed watercourse is approximately 2.9 km southwest of Richer, Manitoba, and 1.6 km west of Highway 302 (Appendix A, Map 1-100-6).

Water Quality

Water quality data were not collected at this crossing location because the watercourse was dry.

Fish Habitat

This watercourse was rated Type C habitat (Milani 2013). GIS information suggested that this watercourse had no defined drainage or confluence with a major watercourse. Field habitat assessment confirmed this crossing location was dry with no defined channel. There is also no historic documentation of this unnamed watercourse containing fish or fish habitat.

Species of Conservation Concern

No SOCC have been documented in this unnamed watercourse.

Commercial, Recreational and Aboriginal Fishery

The unnamed watercourse has no potential to contribute to a CRA fishery.

Habitat Sensitivity Ranking

This crossing was ranked as not fish habitat.

3.7.15 Site 15 – Unnamed Watercourse

The Project crossing location on the unnamed watercourse is approximately 5.5 km southwest of Richer, Manitoba and 800 m west of Highway 302 (Appendix A, Map 1-100-6).

Water Quality

Water quality measurements were obtained during the field studies at two locations within the LAA because water was deep enough to submerge the probe. Historical data were not available for this site. Temperature ranged from 8.8 to 9.8°C, dissolved oxygen was 9.3 mg/L, and conductivity ranged from 435 to 527 µs/cm (Table 3-1). Turbidity ranged from 0.2 to 9.3 NTUs and pH ranged from 8.0 to 8.4. Water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

This watercourse was classified as Type C habitat (Milani 2013). GIS information suggested that this creek had no defined drainage or confluence with a major watercourse in the area. The field assessment at this crossing location determined this watercourse is characterized by dense cattail growth, undefined bed and banks and marsh-like features. There is no apparent connectivity to another watercourse and limited potential for fish habitat. No historic documentation is present for this unnamed watercourse.

Species of Conservation Concern

No SOCC have been documented in this unnamed watercourse.

Commercial, Recreational and Aboriginal Fishery

The unnamed watercourse has no potential to contribute to a CRA fishery.

Habitat Sensitivity Ranking

This crossing was ranked as not fish habitat.

3.7.16 Site 16 – Seine River Tributary

The Project crossing location on the tributary to the Seine River is approximately 3.4 km northeast of La Broquerie, Manitoba, and approximately 4 km from the confluence of the Seine River (Appendix A, Map 1-100-7). Land use in RAA is predominantly agriculture.

Water Quality

Historical water quality data were not available; therefore, only field data are reported. Water quality values were measured at three locations within the LAA (Table 3-1). Temperature ranged from 8.0 to 9.5°C, dissolved oxygen ranged from 11.8 to 11.9 mg/L, and conductivity ranged from 310 to 438 µs/cm. Turbidity ranged from 0.2 to 7.6 NTUs, and pH ranged from 8.2 to 8.3. Water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

This tributary to the Seine River is a Type A habitat watercourse (Milani 2013). At the crossing location, the tributary is characterized by clear, shallow water with abundant in-water and overhead cover. Grasses and deciduous trees dominate the riparian areas. The LAA has a narrow, thinly treed riparian vegetation buffer between the watercourse and agricultural area. Outside of the LAA, the riparian vegetation is similar along this large, permanent watercourse. Watercourse substrate was mixed with the majority being small and large gravel. Substrate mixture, undercut banks, and abundant woody debris create ideal rearing habitat and no barriers to movement were observed with in the LAA. As summarized in the Soil and Terrain TDR, the soil water erosion risk classification is negligible within the LAA.

Fish data are limited for this Seine River tributary; however, the crossing location is only 4 km from the confluence to the Seine River indicating that Seine River species have the potential to reach the LAA. Historic documentation indicated 32 fish species in the Seine River with the majority in the lower reaches of the tributary (Table 3-3) and during high flow years (MWS 2010b). Other historical records identify 24 fish previously recorded in the Seine River (MCWS 2014, Garnet 1997). Fish were observed in this watercourse during field assessments. Based on Stantec field data, spawning and migration habitat potential was moderate to good for forage, coarse, and sport fish. Rearing habitat potential was good for all fish types. Overwintering habitat was moderate; depth may limit this potential, although some deeper pools (> 0.5 m) were observed.

Species of Conservation Concern

SOCC have been recorded historically in the Seine River and, therefore, have the potential to enter the tributary crossed by the Project. The SOCC possibly in the area is bigmouth buffalo (MWS 2010b). The status of this species is provided in Table 3-5, and habitat requirements are described in Section 3.5. Habitat preferences of the bigmouth buffalo suggest that this Seine River tributary is unsuitable.

Commercial, Recreational and Aboriginal Fishery

The tributary to the Seine River has the potential to support fish that are part of a CRA fishery (Table 3-4). Sport fish from the Seine River could enter this tributary and support

recreational fishing by rural communities. The Seine River was identified by Peguis FN as a watercourse used for travel and fishing (Peguis First Nation – Whelan Enns Associates Inc. 2015). Close proximity of this tributary to the confluence of the Seine River lends the potential for Aboriginal fisheries.

Habitat Sensitivity Ranking

The habitat sensitivity ranking of this Seine River Tributary is high because of the good spawning, rearing and migration habitat that it provides, and its potential for overwintering habitat. It may also support a CRA fishery. This crossing has undercut banks, mixed gravel substrate, pool habitat, wood debris and treed riparian cover; making it sensitive to perturbations.

3.7.17 Site 17 – Seine River

The Project crossing location on the Seine River is approximately 1.66 km northeast of La Broquerie, Manitoba (Appendix A, Map 1-100-7). The Seine River Watershed is approximately 2,509 km^2 (MWS 2009). Land use in RAA is predominantly agriculture.

Water Quality

Water quality data were collected during the field studies, and compiled with historical data (Milani 2013; City of Winnipeg 2007-2014; MCWS 2008-2013)(Table 3-1). Temperature ranged from -0.8 to 27.3°C with a median of 7.5°C, dissolved oxygen ranged from 3.5 to 13.2 mg/L with a median of 8.8 mg/L, and conductivity ranged from 232 to 592 µs/cm with a median of 474 µs/cm. Turbidity ranged from 2.0 to 50.4 NTUs with a median of 10.4 NTU, and pH ranged from 7.2 to 8.8 with a median of 8.3. All average water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

The Seine River is a tributary of the Red River. It is a large, permanent watercourse, characterized as Type A habitat (Milani 2013). At the crossing location, the Seine River is moderately wide and deep with slumped banks. Grasses and deciduous trees dominate the riparian areas and overhead cover is abundant. This extends upstream and downstream for many kilometers. Substrate was a mixture of all sizes with the majority being fines. In-water and over hanging cover were abundant in the forms of woody debris, under cut banks, and vegetation. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible within the LAA.

Historic documentation indicated 32 fish species in the Seine River (Table 3-3) with the majority in the lower reaches of the tributary and during high flow years (MWS 2010b). Other studies identified 24 fish species in the Seine River (Garnet 1997; MCWS 2014). Based on Stantec's field data, spawning, rearing, migration and overwintering habitat

potential was moderate to good for all potential species. No barriers to movement were observed within the LAA.

Species of Conservation Concern

SOCC have been recorded in the Seine River. Bigmouth buffalo is listed as potentially inhabiting the river (MWS 2010b). The status of this species is provided in Table 3-5, and habitat requirements are described in Section 3.5. Habitat preferences of the bigmouth buffalo which included large silty rivers with backwater habitat suggest that the Seine River is suitable for it. This habitat is not limiting as it extends for kilometers upstream and downstream of the LAA.

Commercial, Recreational and Aboriginal Fishery

The Seine River supports fish that are part of a CRA fishery (Table 3-4). The Seine River was identified by Peguis FN as a watercourse used for travel and fishing (Peguis First Nation – Whelan Enns Associates Inc. 2015). This watercourse also contributes to a recreational fishery in Winnipeg's rural area. The presence of sport fish, such as northern pike, walleye, and channel catfish, supports this classification.

Habitat Sensitivity Ranking

The Seine River's habitat sensitivity ranking is high because of its diverse fish community that supports a CRA fishery. This watercourse contains good migration, overwintering, spawning and rearing habitats, and habitats that could support SOCC. This crossing has physical characteristics, such as in-water and overhanging cover, woody debris, under cut banks and treed riparian cover that are sensitive to perturbation. Fish habitat available in the LAA is common along the Seine River.

3.7.18 Site 18 – La Broquerie Drain

The Project crossing location on La Broquerie Drain is approximately 1.6 km east of the town of La Broquerie, Manitoba (Appendix A, Map 1-100-7). The land use in the RAA is predominantly agriculture.

Water Quality

Water quality data were collected during field studies and analyzed with data from Milani (2013)(Table 3-1). Temperature ranged from 4.4 to 17.0°C with a median of 4.9°C, dissolved oxygen ranged from 9.6 to 11.1mg/L with a median of 10.2 mg/L, and conductivity ranged from 534 to 833 µs/cm with a median of 818 µs/cm. Turbidity ranged from 1.7 to 8.3 NTUs with a median of 4.4 NTU, and pH ranged from 7.7 to 8.0 with a median of 7.9. All median water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

The La Broquerie Drain is a small tributary of the Seine River. The confluence of the Seine River is approximately 240 m downstream of the crossing location. The La Broquerie Drain is a Type B habitat watercourse (Milani 2013). At the crossing location, this intermittent watercourse is narrow and entrenched with shallow, slow flowing water and dense overhanging vegetation. Land use within the LAA is predominantly agriculture.

The streambed substrate was predominantly fines with some organic material and small gravel. Overhanging vegetation provided adequate cover, and in high-water years or spring runoff, this tributary likely provides moderate habitat for small-bodied fish. As summarized in the Soil and Terrain TDR, the soil-water erosion risk is negligible within the LAA.

There is no historic documentation of fish presence for the La Broquerie Drain, however due to the close proximity of the Seine River, there is potential for any fish species occupying the Seine River to be utilizing this tributary in the spring. Records indicate that 32 fish species in the Seine River however the majority are in the lower reaches of the tributary and during high flow years (MWS 2010b). The confluence of the Seine River is in the upper reaches of the watercourse and likely do not provide habitat for all 32 species identified in the lower reaches. Based on Stantec's field data, spawning and migration habitat potential was poor while rearing habitat potential was moderate for all potential fish species if the water levels were high in the spring. Overwintering habitat potential was nil due to very shallow water (0.1 m).

Species of Conservation Concern

SOCC have not been recorded historically in the La Broquerie Drain; however, bigmouth buffalo is listed as potentially inhabiting the Seine River (MWS 2010b). The status of this species is provided in Table 3-5, and habitat requirements are described in Section 3.5. Habitat preferences of the bigmouth buffalo suggest that habitat within the LAA is unsuitable.

Commercial, Recreational and Aboriginal Fishery

The La Broquerie Drain has potential to contribute indirectly to a CRA fishery. Close proximity to the Seine River may allow target fish species to enter during spring flood and use it as spawning and rearing habitat, but there is no historical record of this.

Habitat Sensitivity Ranking

The habitat sensitivity ranking of La Broquerie Drain is low due to poor spawning and rearing habitat for fish, no overwintering capacity due to lack of water, and no known contribution to a CRA fishery.

3.7.19 Site 19 – Rat River

The Project crossing location on the Rat River is approximately 15 km southwest of Woodridge, Manitoba and 2.6 km southwest of Highway #12 (Appendix A, Map 1-100-8). The Rat River has a drainage area of 817.5 km^2, and eventually drains into the Red River. The land cover in the RAA is a combination of mixed forest and grasslands.

Water Quality

Water quality data were collected during field studies, and analyzed data from other monitoring programs (MCWS 2008-2013)(Table 3-1). Temperature ranged from -0.8 to 30.0°C with a median of 10.0°C, dissolved oxygen ranged from 2.5 to 11.1 mg/L with a median of 8.3 mg/L, and conductivity ranged from 275 to 774 µs/cm with a median of 423 µs/cm. Turbidity ranged from 2.9 to 38.8 NTUs with a median of 8.8 NTU, and pH ranged from 7.5 to 8.6 with an average of 8.2. All average water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

This large permanent river is a Type A habitat watercourse (Milani 2013). At the Project crossing location, the Rat River is wide and deep with slumped banks that are stabilized with grasses. The substrate is mixed, coarse gravel with fines, and there is good in-water cover with in-water vegetation, woody debris and undercut banks. The riparian area of the Rat River contains a mixture of deciduous trees and grasses which extends upstream and downstream for many kilometers. As summarized in the Soil and Terrain TDR, the soil-water erosion risk is moderate within the LAA.

Data available for the Rat River indicate that up to 40 species inhabit the river (City of Winnipeg 2014; MCWS 2014). Red River fish species are dominant in the lower reaches of the river (Graveline, Western, and MacDonell 2005). Studies compiled by Dr. Ken Stewart (Professor Emeritus, University of Manitoba) indicate that 13 species were identified near the proposed crossing location, close to Highway 12. Milani (2013) indicated 10 species were common throughout the Rat River (Graveline, Western, and MacDonell 2005). Based on Stantec's field data, spawning, rearing, overwintering and migration habitats were moderate to good for all fish types.

Species of Conservation Concern

SOCC have been recorded historically in the Rat River, including chestnut lamprey and silver chub (Graveline, Western, and MacDonell 2005; MWS 2014). The status of these species is provided in Table 3-5, and habitat requirements are described in Section 3.5. Habitat preferences of the chestnut lamprey and silver chub suggest that the Rat River contains suitable habitat for them within the LAA. However, this is not limiting because it extends upstream and downstream outside of the LAA.

Commercial, Recreational and Aboriginal Fishery

The Rat River supports fish that are part of a CRA fishery (Table 3-4). Notable recreational and sport fishing species include perch, rock bass, northern pike and walleye (MWS 2014). The Rat River was also identified by Peguis FN as a watercourse used for travel and fishing (Peguis First Nation – Whelan Enns Associates Inc. 2015).

Habitat Sensitivity Ranking

The Rat River's habitat sensitivity ranking is high because of its diverse fish community which supports CRA fisheries. This watercourse contains moderate to good migration, overwintering, spawning and rearing habitats, and habitats that support SOCC. Fish habitat available in the LAA is common along the Rat River.

3.7.20 Site 20 – Pine Creek Diversion

The Project crossing location on the Pine Creek Diversion is approximately 5.6 km north of Pine Creek, Manitoba and 1.8 km downstream of the confluence to Pine Creek (Appendix A, Map 1-100-9). The Pine Creek Diversion was created for flood control within the Roseau River Watershed (Red River Basin Commission 2007). The land use in the RAA consists of extensive agriculture.

Water Quality

Water quality was collected on site and compiled from Milani (2013)(Table 3-1). Temperature ranged from 7.0 to 23.8°C with a median of 7.7°C, dissolved oxygen ranged from 6.7 to 12.3 mg/L with a median of 12.0 mg/L, and conductivity ranged from 309 to 687 µs/cm with an average of 680 µs/cm. Turbidity ranged from 2.1 to 245 NTUs with a median of 2.4 NTU, and the pH ranged from 8.0 to 8.0 with a median of 8.0. All average water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

The Pine Creek Diversion is a small, permanent, Type B habitat watercourse (Milani 2013). At the Project crossing location of the Pine Creek Diversion, the watercourse is characterized by deep, clear water with a uniform, entrenched channel. The substrate was predominantly fines and organics. In-water vegetation consisted of abundant submergent species, and minimal overhead cover was provided from overhanging grasses. Crops come to within meters of the watercourse along the LAA.

Historic documentation indicates four minnow species and one young-of-the-year walleye were collected in the Pine Creek Diversion (Milani 2013). MCWS records also show that, until 2003, brook trout were stocked in East Pine Creek which flows into the Diversion (MWS 2003). Please see Table 3-3 for the list of species present. Spawning,

rearing, and migration habitat potential was good for forage and coarse fish, and moderate for sport fish. Overwintering habitat potential was moderate for forage fish and poor for larger-bodied fish. As summarized in the Soil and Terrain TDR, The soil water erosion risk is negligible within the LAA.

Species of Conservation Concern

No SOCC have been recorded in the Pine Creek Diversion or Pine Creek where the diversion channel originates (Milani 2013).

Commercial, Recreational and Aboriginal Fishery

The Pine Creek Diversion has the potential to support fish that are part of a CRA fishery. Fish species in the Pine Creek Diversion, such as walleye and brook trout, indicate this area contributes to a recreational I fishery (Table 3-4).

Habitat Sensitivity Ranking

The habitat sensitivity ranking of the Pine Creek Diversion is moderate due to no recorded SOCC present, but there is the potential for a CRA fishery. At this crossing there is also the potential presence of spawning, rearing, migration and overwintering habitat.

3.7.21 Site 21 – Pine Creek

The Project crossing location on Pine Creek is approximately 10 km southeast of Piney, Manitoba, and is 300 m north of the Minnesota, US border (Appendix A, Map 1-100-9). Located within the Roseau River Watershed (Red River Basin Commission 2007), land cover in the RAA is predominantly agriculture.

Water Quality

Data from previous studies (Milani 2013) was analyzed with water quality data collected during the field studies (Table 3-1). Temperature ranged from 4.6 to 27.7°C with a median of 4.9°C, dissolved oxygen ranged from 5.8 to 8.8 mg/L with a median of 8.3 mg/L, and conductivity ranged from 295 to 379 µs/cm with a median of 358 µs/cm. Turbidity ranged from 1.7 to 96.0 NTUs with a median of 2.6 NTU, and pH ranged from 6.5 to 7.7 with a median of 7.6. All median water quality parameters were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

Pine Creek is a small, permanent watercourse with Type A habitat (Milani 2013). The riparian vegetation along Pine Creek consists of a narrow strip of deciduous trees and grasses along the watercourse edge. Outside of this buffer is extensive agriculture. In-water vegetation was abundant, with cover also from woody debris and undercut

banks. The substrate was predominantly fines with some organics. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible within the LAA.

Milani (2013) reported ten species inhabiting the upper reaches of Pine Creek (Table 3-2). Based on Stantec's field data, spawning habitat was moderate and rearing habitat was moderate to good for all fish types. Overwintering habitat potential was poor due to shallow waters present during the fall field assessment. No obvious barriers to migration were observed although a partial beaver dam was noted downstream of the crossing location. MCWS records show that, until 2003, brook trout were stocked in East Pine Creek (MWS 2003). Please see Table 3-3 for the list of species present. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible within the LAA.

Species of Conservation Concern

No SOCC have been recorded in Pine Creek (Milani 2013).

Commercial, Recreational and Aboriginal Fishery

Pine Creek has the potential to support fish that are part of a CRA fishery. Fish species in the Pine Creek Diversion, such as walleye and brook trout, indicate this area contributes to a recreational fishery.

Habitat Sensitivity Ranking

The habitat sensitivity ranking for this crossing on Pine Creek is moderate because of the moderate to good spawning and rearing habitat and lack of overwintering habitat. The habitat supports predominantly forage fish, with the potential for a CRA fishery. There are no known SOCC in this watercourse. This habitat within the LAA is typical along the upstream of Pine Creek.

3.7.22 Site 22 – Pine Creek Arm

The Project crossing location on the Pine Creek Arm is approximately 3.0 km southwest of Pine Creek, Manitoba, and is 395 m north of the United States border (Appendix A, Map 1-100-9). The Pine Creek Arm is a tributary of Pine Creek. The confluence to Pine Creek occurs approximately 1 km downstream of the crossing location (Red River Basin Commission 2007).

Water Quality

Water quality was collected during field studies; historical data for this location was not available (Table 3-1). Temperature ranged from 4.2 to 4.5°C, dissolved oxygen ranged from 5.9 to 7.2 mg/L, and conductivity ranged from 383 to 392 µs/cm. Turbidity ranged from 2.6 to 3.2 NTUs, and pH ranged from 7.4 to 7.5. All average water quality parameters

were within the guidelines for the protection of aquatic life (CCME 2007; Hasnain *et al.* 2010).

Fish Habitat

Pine Creek Arm is a Type B habitat watercourse (Milani 2013). At the crossing location, this watercourse is marsh-like with dense in-water vegetation and low water levels. Substrate was predominantly fines and organics. In-water vegetation was dense with cattails and other emergent species. Water levels were very low (maximum 0.5 m) and downstream of the crossing location was dry. Riparian habitat consisted of mostly grass and shrubs with some trees. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible within the LAA.

Fish assemblage data were not available for the Pine Creek arm; however, because it runs parallel to Pine Creek and there is connectivity between sites, it is likely the fish species present in Pine Creek are representative of those in Pine Creek Arm (Table 3-2). Based on Stantec's field data, spawning and migration habitat potential was poor for all fish types. Rearing habitat potential was low for all fish types and overwintering habitat potential was nil for all fish types. This tributary is likely only fish-bearing in the spring and during high water years.

Species of Conservation Concern

No SOCC have been recorded in the Pine Creek Arm or Pine Creek (Milani 2013).

Commercial, Recreational and Aboriginal Fishery

The Pine Creek Arm has the potential to indirectly support fish that are part of a CRA fishery.

Habitat Sensitivity Ranking

The habitat sensitivity ranking of Pine Creek Arm is low due to poor spawning and rearing habitat for fish, no overwintering capacity due to lack of water, and only indirect contribution to a CRA fishery.

3.7.23 Site 23 – Unnamed Watercourse

This unnamed crossing in the Roseau River sub-watershed, southeast of Menisino, was not assessed during field studies because, at the time of the fall 2014 field investigations, it was not part of the preferred route.

Water Quality

Water quality was not measured at this location during the field habitat assessment and historical data were not available for this site.

Fish Habitat

Field observations northeast of the preferred crossing location suggest that it is within a bog and is likely only accessible under frozen conditions. Aerial imagery shows this area to be densely forested. GIS information suggests that this watercourse has no defined drainage or confluence with a major watercourse in the area. There is no apparent connectivity to another watercourse and, therefore, there is limited potential for fish habitat. This watercourse was classified as Type C habitat (Milani 2013), however, no other historic documentation is available for this unnamed watercourse. As summarized in the Soil and Terrain TDR, the soil water erosion risk is negligible within the LAA.

Species of Conservation Concern

No SOCC have been documented in this unnamed watercourse.

Commercial, Recreational and Aboriginal Fishery

There is no known CRA fishery in this unnamed watercourse. Because there is no confluence with a major watercourse, this unnamed watercourse does not directly or indirectly support fish that are part of a CRA fishery.

Habitat Sensitivity Ranking

The habitat sensitivity ranking for this unnamed crossing is low due to the lack of connectivity to another watercourse, no defined drainage data indicated by GIS, and the apparent bog habitat of the area. Spawning and rearing habitat is expected to be poor to nil, and there is likely no overwintering capacity due to shallow water that would freeze to the bottom in winter.

3.8 SUMMARY OF EXISTING CONDITIONS FOR FISH AND FISH HABITAT

Based on information available from existing data sources and data collected during field habitat assessments, fish and fish habitat at the 23 watercourse crossings were classified as shown in Table 3-6.

Table 3-6: Summary of Field-Assessed Watercourses Crossed by the Project

Field Site ID	Watercourse Name	Sub-watershed	DFO Habitat Classification (Milani 2013)	Habitat Sensitivity Ranking	Watercourse Classification	Location (Zone 14)		Common Fish Species Present in the LAA (Milani 2013; MCWS-FIHCS 2014)	SOCC Present in the LAA (MBCDC 2014)	Restricted Activity Period
						Easting	Northing			
1	Sturgeon Creek	Lower Assiniboine River	B	Moderate	Large Permanent	612910	5531454	carp, channel catfish, northern pike, rock bass, stonecat, white sucker	none	April 1 – June 30
2	Third Creek	Lower Assiniboine River	A	Low	Intermittent	612927	5525935	unknown	NA	unknown
3	Unnamed Watercourse	Lower Assiniboine River	C	Low	Intermittent	612902	5525292	unknown	NA	unknown
4	Assiniboine River	Lower Assiniboine River	A	High	Large Permanent	612879	5524896	bullhead, carp, channel catfish, drum, sauger, shorthead redhorse	lake sturgeon, mapleleaf, black sandshell, chestnut lamprey, silver chub	April 1 – June 30
5	La Salle River	La Salle River	A	High	Large Permanent	633227	5512065	brook stickleback, bullhead, carp, central mudminnow, fathead minnow, Johnny darter, northern pike	none	April 1 – June 30
6	Red River	Red River	A	High	Large Permanent	634584	5512564	bullhead, burbot, channel catfish, goldeye, quillback, sauger, walleye, white sucker	mapleleaf, chestnut lamprey, silver chub, lake sturgeon	April 1 – June 30
7	Red River Floodway	Red River	B	Moderate	Intermittent	635188	5512794	fathead minnow, Johnny darter, northern pike, troutperch,	none	April 1 – June 30
8	Seine River at Floodway	Seine River	A	Moderate	Large Permanent	640874	5516975	carp, spottail shiner, tadpole madtom, troutperch, white sucker, walleye	none	April 1 – June 30
9	Cooks Creek	Cooks/Devils Creek	A	High	Large Permanent	662612	5525300	blackside darter, brook stickleback, central mudminnow, fathead minnow, lowa darter	none	April 1 – June 30
10	Edie Creek	Cooks/Devils Creek	A	Low	Small Permanent	667719	5525480	brook stickleback, central mudminnow	none	May 1 – June 30
11	Edie Creek South Crossing	Cooks/Devils Creek	B	Low	Small Permanent	671723	5523621	unknown	none	unknown
12	Cooks Creek South Crossing	Cooks/Devils Creek	A	High	Large Permanent	672786	5518328	unknown	none	unknown
13	Fish Creek	Seine River	C	Low	Small Permanent	676923	5511779	brook stickleback, blacksided darter, central mudminnow, fathead minnow	none	May 1 – June 30
14	Unnamed Watercourse	Seine River	C	Not Fish Habitat	No Defined Channel	682218	5501010	NA	NA	NA

Table 3-6: Summary of Field-Assessed Watercourses Crossed by the Project

Field Site ID	Watercourse Name	Sub-watershed	DFO Habitat Classification (Milani 2013)	Habitat Sensitivity Ranking	Watercourse Classification	Location (Zone 14)		Common Fish Species Present in the LAA (Milani 2013; MCWS-FIHCS 2014)	SOCC Present in the LAA (MBCDC 2014)	Restricted Activity Period
						Easting	Northing			
15	Unnamed Watercourse	Seine River	C	Not Fish Habitat	Small Permanent	682915	5498178	NA	NA	NA
16	Seine River Tributary	Seine River	A	High	Large Permanent	681914	5491363	brook stickleback, carp, central mudminnow, northern pike, white sucker	none	April 1 – June 30
17	Seine River	Seine River	A	High	Large Permanent	681836	5488643	bullhead, brook stickleback, carp, central mudminnow, northern pike, white sucker	none	April 1 – June 30
18	La Broquerie Drain	Seine River	B	Low	Intermittent	681859	5488119	unknown	NA	unknown
19	Rat River	Rat River	A	High	Large Permanent	696166	5452120	bullhead, burbot, carp, goldern redhorse, northern pike, white sucker, yellow perch	none	April 1 – June 30
20	Pine Creek Diversion	Roseau River	B	Moderate	Small Permanent	722395	5435232	brook stickleback, central mudminnow, Iowa darter, Johnny darter	none	May 1 – June 30
21	Pine Creek	Roseau River	A	Moderate	Small Permanent	724281	5432250	blackside darter, brook stickleback, central mudminnow, finescale dace, Iowa darter, Johnny darter, white sucker	none	April 1 – June 30
22	Pine Creek Arm	Roseau River	C	Low	Small Permanent	724870	5432386	unknown	none	unknown
23	Unnamed Watercourse	Roseau River	C	Low	N/A	714475	5438668	unknown	none	unknown

4.0 DATA GAPS

Some uncertainties remain in this assessment as a result of:

- There are different methods of data collection or data management that exist between provincial government, watershed conservation districts and community conservation groups, which has led to incomplete or dated information in the databases;
- Fish sampling was not conducted as part of the field assessment, so fish presence data was sourced from desktop historical data;

- A one-time field survey was conducted rather than a multi-season survey;
- Type D habitat watercourse crossings were assessed only by aerial imagery review and land cover classifications (see the Vegetation and Wetlands TDR);
- Type E habitat watercourse crossings were not considered to provide fish habitat;
- The final preferred route crossing on Fish Creek is more than 20 km away from the field-assessed Project crossing location;
- The southern crossings on Cooks and Edie creeks were not assessed during field studies because, at the time of the fall 2014 field investigations, they were not part of the route options; and
- A Type C habitat crossing in the Roseau River sub-watershed, southeast of Menisino, was not assessed during field studies because, at the time of the fall 2014 field investigations, it was not part of the preferred route.

5.0 KEY CONSIDERATIONS

Preliminary desktop and field assessment revealed the following:

- Two watersheds and seven sub-watersheds are crossed by the Project.
- Seventy-five watercourses, including 29 potentially fish-bearing watercourses, are crossed by the Project.
- Nine watercourses crossings traversed by the Project were assessed to be high sensitivity watercourses; the Assiniboine River, La Salle River, Red River, Cooks Creek (both crossings), Seine River, Seine River tributary (Site 16), Rat River and Pine Creek.
- Over 75 fish species, including over 30 species that are part of, or contribute to, CRA fisheries, are known or expected to occur within the RAA.
- Nine aquatic SOCC are known or expected to occur within the RAA, including three SOCC recorded by the MBCDC within the LAA, *i.e.,*
  - Chestnut lamprey is designated *special concern* under Schedule 3 of SARA. The species is not regulated under SARA or ESEA. Within the RAA, chestnut lamprey is known to occur in the Assiniboine River, Red River, and Rat River sub-watersheds. Within the LAA, it has been recorded in the Assiniboine River and Red River. Habitat in these rivers is suitable for the adult life stage of the chestnut lamprey (Appendix C).
  - Lake sturgeon is designated *endangered* by COSEWIC. The species is not regulated under SARA or ESEA. Within the RAA, lake sturgeon is known to occur in the Assiniboine River and Red River sub-watersheds. Within the LAA, it has been recorded in the Assiniboine River and Red River. Habitat in these rivers is suitable for the adult life stage of the Lake Sturgeon (Appendix C).
  - Mapleleaf is designated *endangered* by COSEWIC and ESEA, and is regulated under Schedule 1 of SARA. Within the RAA, mapleleaf is known to occur in the Assiniboine River, Red River, Cook/Devils Creek, Rat River, and Roseau River sub-watersheds. Within the LAA, it has been recorded in the Assiniboine River and the Red River. Habitat in these rivers is suitable for all life stages of the mapleleaf mussel (Appendix C).

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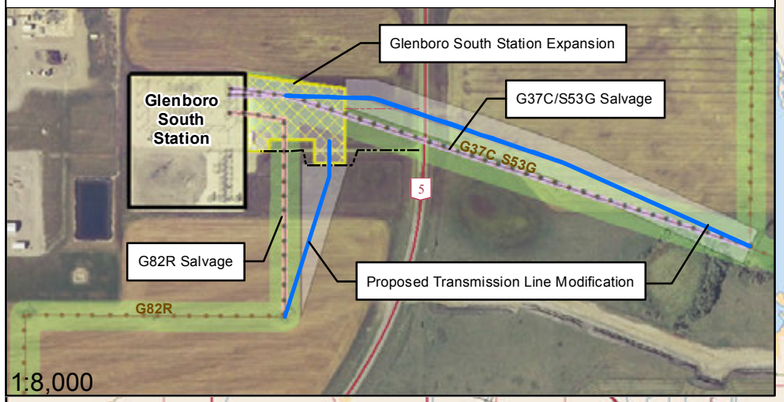
Appendix A MAPS

Inset 1: Glenboro South Station Expansion



Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (Existing Corridor)
- Final Preferred Route (New Right-of-way)
- Transmission Line (Salvage)
- M602F Modification (New)
- Existing/New Glenboro South Station Access
- New Glenboro South Station Access
- G37C Salvage
- G82R Salvage
- Station Expansion
- Existing ROW

Infrastructure

- Existing 500kV Transmission Line
- Existing 230kV Transmission Line

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- City
- First Nation Lands
- Ecological Reserve
- Wildlife Management Area
- Provincial Park
- Provincial Boundary

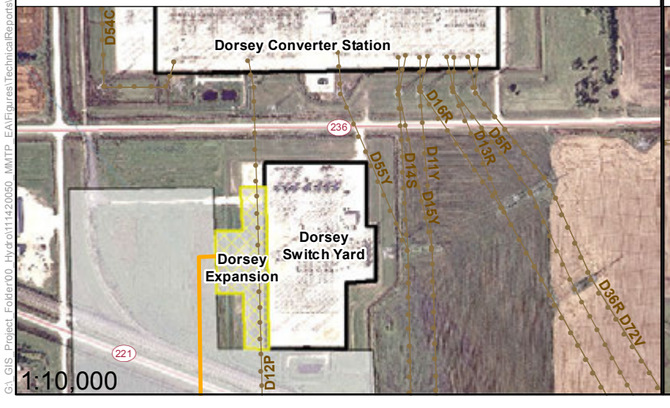
Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: August 05, 2015

N

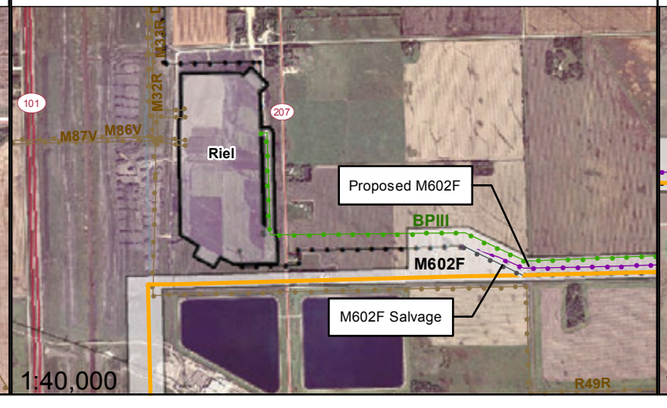
0 10 20 Kilometres
0 5 10 20 Miles

1:1,000,000

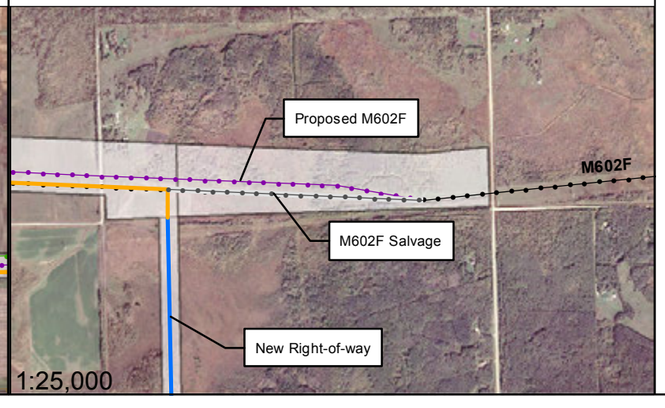
Inset 2: Dorsey Expansion



Inset 3: Riel and M602F Modifications

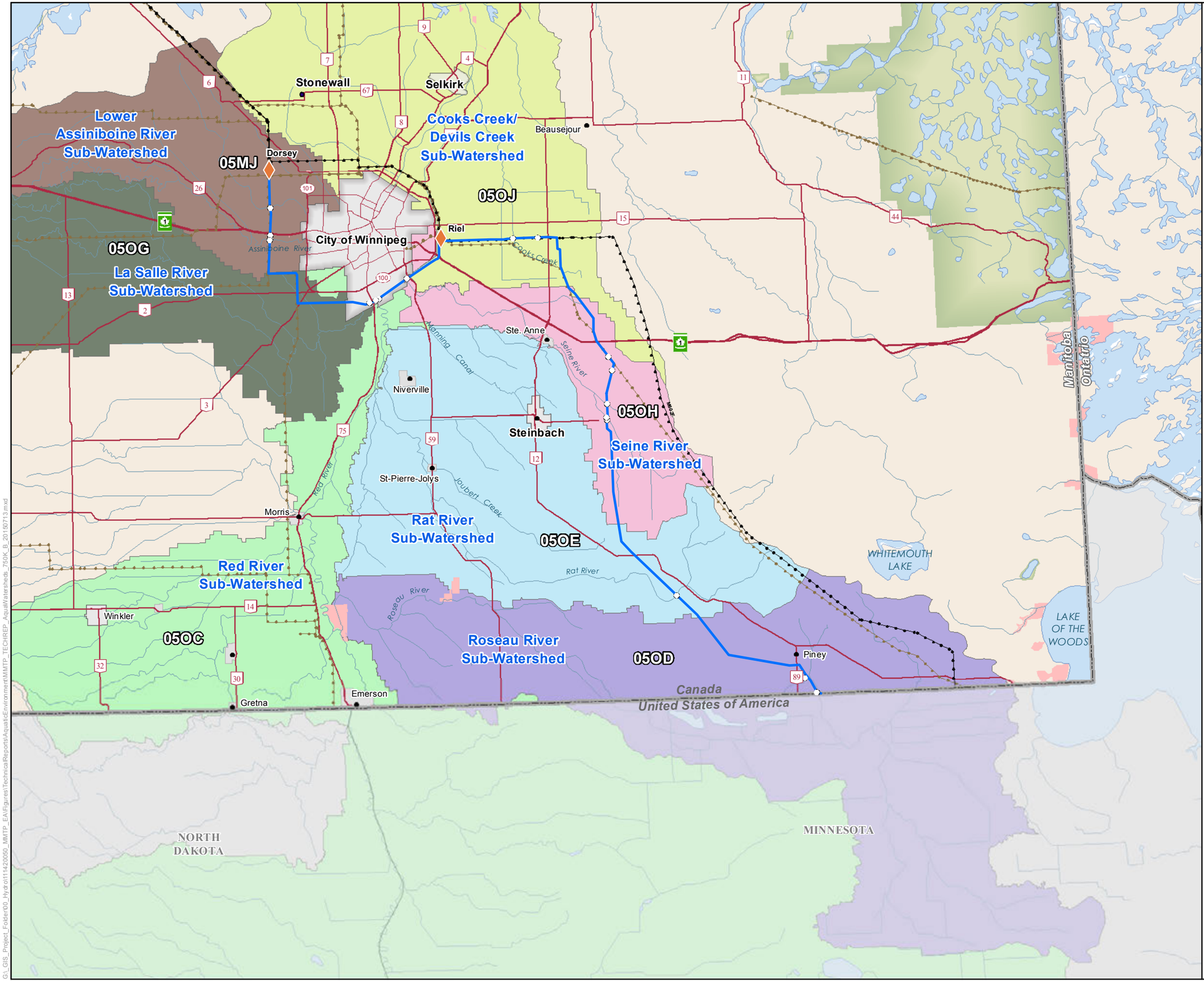


Inset 4: M602F Extension and Salvage



Project Infrastructure

Map 1-1



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Converter Station (Existing)
- Final Preferred Route (FPR)

Infrastructure

- Existing 500kV Transmission Line
- Existing 230kV Transmission Line

Aquatics Survey Sites

- Survey Site

Sub-Watersheds[1]

- Cooks Creek/Devils Creek Sub-Watershed
- La Salle River Sub-Watershed
- Lower Assiniboine River Sub-Watershed
- Rat River Sub-Watershed
- Red River Sub-Watershed
- Roseau River Sub-Watershed
- Seine River Sub-Watershed

Landbase

- Community
- Trans Canada Highway
- Provincial Highway
- City / Town
- First Nation Lands
- Provincial Park

Source:
1. Sub-Basins, 2013, Agriculture and Agri-Food Canada.

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 22, 2015

N

0 10 Kilometres
0 5 10 Miles

1:750,000

Sub-Watersheds

Map 1-2

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Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Converter Station (Existing)
- Final Preferred Route (FPR)

Infrastructure

- Existing 500kV Transmission Line
- Existing 230kV Transmission Line

Assessment Area

- Fish and Fish Habitat Regional Assessment Area

DFO Fish Habitat Classification [1]

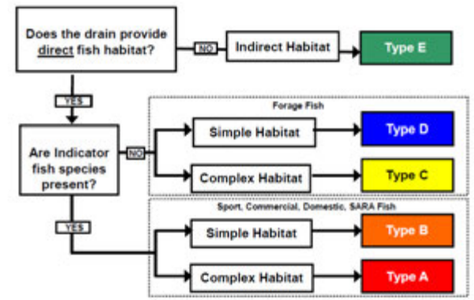
* Refer to chart below for more detail

- Type A
- Type B
- Type C
- Type D
- Type E

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- City
- First Nation Lands
- Ecological Reserve
- Wildlife Management Area
- Provincial Park

Habitat Type Decision Flowchart [1]



Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 22, 2015

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0 5 10 Miles

1:500,000

Stream Crossings

Map 1-3

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Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Converter Station (Existing)
- Final Preferred Route (FPR)

Infrastructure

- Existing 500kV Transmission Line
- Existing 230kV Transmission Line

DFO Fish Habitat Classification[1]

- Type A
- Type B
- Type C

Map Tile Index - 1:30,000

- Map Series Tile

Assessment Area

- Fish and Fish Habitat Regional Assessment Area

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- First Nation Lands
- Ecological Reserve
- Wildlife Management Area
- Provincial Park
- City

Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 17, 2015

N

0 5 10 Kilometres
0 5 10 Miles

1:500,000

Index of Map Series
Stream Crossings

Map Series 1-100

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Site 1 – Sturgeon Creek: Looking west, upstream from RoW centerline of the Sturgeon Creek crossing. Habitat is uniform with silt substrate and grassy riparian cover. Surrounding area is predominantly agriculture.

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure
- Final Preferred Route (FPR)

DFO Fish Habitat Classification[1]
- Type A
- Type B
- Type C

Infrastructure
- Existing 230kV Transmission Line

Soil Water Erosion Risk Class[2]
tons/hectare/year
- Not available in dataset
- N - Negligible (<6 t/h/y)
- L - Low (6-11 t/h/y)
- M - Moderate (11-22 t/h/y)
- H - High (22-33 t/h/y)
- S - Severe (>33 t/h/y)

Assessment Area
- Project Development Area (PDA)
- Fish and Fish Habitat Local Assessment Area

Landbase
- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- Rural Municipality

Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.
2. Soil Resource Inventory, 2015. Stantec

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 17, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Stream Crossings

Map 1-100-01

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Site 2 – Third Creek: At RoW centerline facing the left downstream bank of Third Creek. There is very little open water with dense cattails at this crossing.

Site 3 – Unnamed Tributary of the Assiniboine: Looking upstream at RoW centerline of crossing. This intermittent watercourse is characterized by high instream algal growth, dense cattails and very shallow water.

Site 4 – Assiniboine River: RoW Centerline crossing of the Assiniboine River. Riparian area is wooded with some agriculture and urban development. Turbid waters with woody debris provide instream cover.

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)

DFO Fish Habitat Classification[1]

- Type A
- Type B
- Type C

Infrastructure

- Existing 230kV Transmission Line

Soil Water Erosion Risk Class[2]

tons/hectare/year

- Not available in dataset
- N - Negligible (<6 t/h/y)
- L - Low (6-11 t/h/y)
- M - Moderate (11-22 t/h/y)
- H - High (22-33 t/h/y)
- S - Severe (>33 t/h/y)

Assessment Area

- Project Development Area (PDA)
- Fish and Fish Habitat Local Assessment Area

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- First Nation Lands
- National/Provincial Park
- Rural Municipality

Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.
2. Soil Resource Inventory, 2015. Stantec

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 17, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Stream Crossings

Map 1-100-02

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Site 5 – La Salle River: Looking south-west upstream from RoW centerline. Substrate consists of fines and organic matter. Banks and riparian areas are stabilized with deciduous trees and grasses.

Site 6 – Red River: At RoW centerline, looking south-east upstream. Water is turbid water with fine substrate and little instream vegetation. Riparian area is covered in grasses with some trees.

Site 7 – Red River Floodway: Facing north-east from RoW centerline. Conditions dry at the time of the survey.

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)

DFO Fish Habitat Classification[1]

- Type A
- Type B
- Type C

Infrastructure

- St. Vital Transmission Complex (Proposed)

Soil Water Erosion Risk Class[2]

tons/hectare/year

- Not available in dataset
- N - Negligible (<6 t/h/y)
- L - Low (6-11 t/h/y)
- M - Moderate (11-22 t/h/y)
- H - High (22-33 t/h/y)
- S - Severe (>33 t/h/y)

Assessment Area

- Project Development Area (PDA)
- Fish and Fish Habitat Local Assessment Area

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- City / Town
- National/Provincial Park
- Rural Municipality

Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.
2. Soil Resource Inventory, 2015. Stantec

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 17, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Stream Crossings

Map 1-100-03

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Site 8 – Seine River at Floodway: At RoW centerline looking downstream at the Seine River Siphon. The substrate is predominantly fines and vegetation is limited to cattails and other emergent species.

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure
- Final Preferred Route (FPR)

DFO Fish Habitat Classification[1]
- Type A
- Type B
- Type C

Infrastructure
- St. Vital Transmission Complex (Proposed)
- Existing 115-230kV Transmission Line

Soil Water Erosion Risk Class[2]
tons/hectare/year
- Not available in dataset
- N - Negligible (<6 t/h/y)
- L - Low (6-11 t/h/y)
- M - Moderate (11-22 t/h/y)
- H - High (22-33 t/h/y)
- S - Severe (>33 t/h/y)

Assessment Area
- Project Development Area (PDA)
- Fish and Fish Habitat Local Assessment Area

Landbase
- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- City / Town
- Rural Municipality

Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.
2. Soil Resource Inventory, 2015. Stantec

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 17, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Stream Crossings

Map 1-100-04

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Site 9 – Cooks Creek: At RoW centerline, looking north downstream. Highly channelized with banks and riparian areas covered in thick grasses.

Site 10 – Edie Creek: Looking upstream, facing east at RoW centerline. Water is shallow with high instream vegetation.

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Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)
- M602F Modification (New)

DFO Fish Habitat Classification[1]

- Type A
- Type B
- Type C

Infrastructure

- Existing 500 kV Transmission Line
- Existing 230kV Transmission Line
- Bipole III Transmission Line (Approved)
- Existing 115-230kV Transmission Line

Soil Water Erosion Risk Class[2]

tons/hectare/year

- Not available in dataset
- N - Negligible (<6 t/h/y)
- L - Low (6-11 t/h/y)
- M - Moderate (11-22 t/h/y)
- H - High (22-33 t/h/y)
- S - Severe (>33 t/h/y)

Assessment Area

- Project Development Area (PDA)
- Fish and Fish Habitat Local Assessment Area

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- Rural Municipality

Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.
2. Soil Resource Inventory, 2015. Stantec

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 17, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Stream Crossings

Map 1-100-05

Site 15 – Unnamed: Looking north from RoW centerline. Undefined bed and banks with dense cattail growth and marsh-like features. No known confluence with a major watercourse.

Site 14 – Unnamed: RoW was under dry conditions; poorly drained area and no confluence with a major watercourse.

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure
- Final Preferred Route (FPR)

DFO Fish Habitat Classification[1]
- Type A
- Type B
- Type C

Infrastructure
- Electrical Station
- Existing 230kV Transmission Line

Soil Water Erosion Risk Class[2]
tons/hectare/year
- Not available in dataset
- N - Negligible (<6 t/h/y)
- L - Low (6-11 t/h/y)
- M - Moderate (11-22 t/h/y)
- H - High (22-33 t/h/y)
- S - Severe (>33 t/h/y)

Assessment Area
- Project Development Area (PDA)
- Fish and Fish Habitat Local Assessment Area

Landbase
- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- Rural Municipality

Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.
2. Soil Resource Inventory, 2015. Stantec

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 17, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles
1:30,000

Stream Crossings

Map 1-100-06

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Site 16 – Seine River Tributary: Facing east, upstream at RoW centerline. Water is clear and shallow with abundant instream and overhead cover. Grasses and deciduous trees dominate the riparian areas.

Site 17 – Seine River: Looking west, downstream from RoW centerline. Instream and over hanging cover are abundant in the forms of woody debris, under cut banks, and vegetation. Grasses and deciduous trees stabilize riparian areas.

Site 18 – La Broquerie Drain: Facing north-east looking downstream. Drain is narrow and entrenched with shallow, slow flowing water and dense overhanging vegetation.

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)

DFO Fish Habitat Classification[1]

- Type A
- Type B
- Type C

Soil Water Erosion Risk Class[2]

tons/hectare/year

- Not available in dataset
- N - Negligible (<6 t/h/y)
- L - Low (6-11 t/h/y)
- M - Moderate (11-22 t/h/y)
- H - High (22-33 t/h/y)
- S - Severe (>33 t/h/y)

Assessment Area

- Project Development Area (PDA)
- Fish and Fish Habitat Local Assessment Area

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- Rural Municipality

Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.
2. Soil Resource Inventory, 2015. Stantec

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 17, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Stream Crossings

Map 1-100-07

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Site 19 – Rat River: Looking west, downstream from RoW centerline. Slumped banks are stabilized with grasses. Mixed course substrate with fines, good instream cover with vegetation, woody debris and undercut banks.

Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)

DFO Fish Habitat Classification[1]

- Type A
- Type B
- Type C

Soil Water Erosion Risk Class[2]

tons/hectare/year

- Not available in dataset
- N - Negligible (<6 t/h/y)
- L - Low (6-11 t/h/y)
- M - Moderate (11-22 t/h/y)
- H - High (22-33 t/h/y)
- S - Severe (>33 t/h/y)

Assessment Area

- Project Development Area (PDA)
- Fish and Fish Habitat Local Assessment Area

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- Rural Municipality

Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.
2. Soil Resource Inventory, 2015. Stantec

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 17, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Stream Crossings

Map 1-100-08

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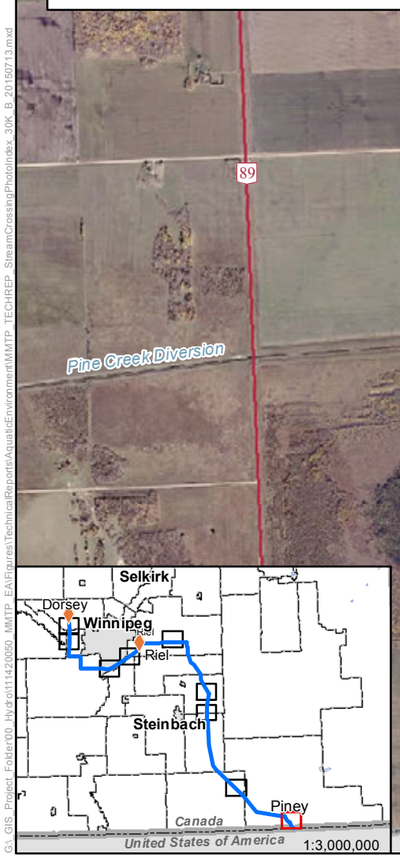
Site 20 – Pine Creek Diversion: Facing north-east, looking upstream from RoW centerline. Channel is uniform with extensive agriculture on both sides. Streambed substrate is predominantly fines and organics. Instream submergent plant species and grasses on the bank provide the only cover.

Site 21 – Pine Creek: Facing north, looking upstream from RoW centerline. Instream cover is good with dense vegetation, woody debris and undercut banks. Good grass and tree riparian vegetation.

Site 22 – Pine Creek Arm: Looking south, downstream from RoW centerline. At the crossing location this watercourse is marsh-like with dense instream vegetation and low water levels.



Manitoba Hydro

Manitoba-Minnesota Transmission Project

Project Infrastructure

- Final Preferred Route (FPR)

DFO Fish Habitat Classification[1]

- Type A
- Type B
- Type C

Soil Water Erosion Risk Class[2]

tons/hectare/year

- Not available in dataset
- N - Negligible (<6 t/h/y)
- L - Low (6-11 t/h/y)
- M - Moderate (11-22 t/h/y)
- H - High (22-33 t/h/y)
- S - Severe (>33 t/h/y)

Assessment Area

- Project Development Area (PDA)
- Fish and Fish Habitat Local Assessment Area

Landbase

- Community
- Railway
- Trans Canada
- Provincial Highway
- Provincial Road
- Ecological Reserve
- Rural Municipality

Source:
1. Designation of Drains, 2013. Department of Fisheries and Oceans Canada.
2. Soil Resource Inventory, 2015. Stantec

Coordinate System: UTM Zone 14N NAD83
Data Source: MBHydro, ProvMB, NRCAN
Date Created: July 17, 2015

N

0 0.5 1 Kilometres
0 0.25 0.5 Miles

1:30,000

Stream Crossings

Map 1-100-09

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Appendix B LIFE STAGE INFORMATION FOR FISH SPECIES POTENTIALLY FOUND IN THE RAA

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
Banded killifish	*Fundulus diaphanous*	Egg	Hatch in 11-12 days at temps of 22.2-26.7°C		Eggs stick to the vegetation by means of adhesive threads	1,5
		Larvae/Fry				1,5
		Juvenile				1
		Adult	Spawn spring - summer	-Shallow, clear, quiet water, over sand or gravel bottom with patches of vegetation during growth stage. This can range from marginal waters of streams, rivers, or lakes, to small ponds. Surface to midwater dwellers -Quiet, heavily vegetated water for spawning	-Feed from surface to bottom on aquatic insect larvae and planktonic crustaceans -Suitable spawning temperature is 23°C	5
Bigmouth buffalo	*Ictiobus cyprinellus*	Egg	hatch in ~2 weeks	-Shallow water, in marshes, or flooded riverbanks, or lakeshores		1
		Juvenile				1
		Adult	spawn mid-May to early June	-Still or slow-moving waters of large rivers or lakes during growth -Spawn in shallow water, in marshes, or flooded riverbanks, or lakeshores during spawning	-Feed in midwater on plankton, on bottom on minute organisms -No nest built. Eggs scattered over vegetation. -Move into small tributary streams and into marshes or flooded lake margins. -High water events required for spawning. -Tolerant of turbid water -Suitable temperature for spawning are 15.5-18.3°C	1, 5
Bigmouth shiner	*Notropis dorsalis*	Adult	spawn late May to early August	-Benthopelagic. Commonly found in riffles and runs, moderately turbid to turbid water, gravel substrates	-Feed mostly on aquatic insect larvae, but filamentous algae also found in stomach contents Max age 2 yrs.	5
Black bullhead	*Ameiurus melas*	Egg	In high temps, eggs			1

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			hatch in as little as 5 days			
		Larvae/Fry		Schools of larvae can be seen in quiet, protected backwaters	Found in tributaries along the Red and Assiniboine rivers and shoreline marshes of lakes Winnipeg and Manitoba	5
		Juvenile				5
		Adult	Spawn mid- to late June	-Benthic, over fine substrates such as mud and silt. -Lower sections of small-to medium-sized streams of low gradient, ponds, and backwaters of larger rivers, lakes and impoundments -Found in most of the same places as the brown bullhead, but is more common in tributaries and peripheral waters, and less common in current and in deep water in river main stems -Spawn in tributaries and marginal waters, soft substrate, moderate to heavy submerged vegetation	-Opportunistic predators and scavengers feeding mostly on the bottom, taking snails, leeches, crayfish, tadpoles, minnows, and pieces of larger fish (likely taken as carrion) - - Can withstand high temperatures during growth (>35°C) - Suitable spawning temperature is >21°C	1, 5
Black crappie	*Pomoxis nigromaculatus*	Egg	Hatch in 3-5 days		-	1
		Larvae/Fry	Guarded by male for a few days and then desert nest		-Hatchlings begin feeding on plankton	1, 5
		Juvenile				5
		Adult	Spawn June - July	-Clear, quiet waters of lakes and rivers. Usually associated with cover such as weed beds or submerged wood during growth periods -Spawn in clay to fine gravel substrate with some vegetation. At times nests are made in the protection of an undercut	-Feed on fish and aquatic insects, but also continue to feed on planktonic crustacea -Schooling, midwater fish -Active, feed all winter. -Male excavates or cleans a nest on substrate ranging from clay to fine gravel	1, 2, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
				bank.	- - Suitable temperature for spawning is 18-20°C	
Blackchin shiner	*Notropis heterodon*	Juvenile				1
		Adult	Spawn June-August	-Cool, clear, weedy, protected waters in lakes and marginal waters of rivers in the Canadian Shield in SE MB. May be tolerant of hypoxic conditions	-Feed on crustaceans, oligochaetes, and larval and adult insects that are associated with aquatic vegetation	5
Blacknose dace	*Rhinichthys obtusus*	Egg				1
		Larvae/Fry				1
		Adult	Spawn in spring – usually May or June	-Associated with moderately fast channel velocities and can commonly be found at the tail of a rapid in a pool -found in tributaries of L Winnipeg and the Red and Assiniboine River watersheds - Prefer small, clear, swiftly flowing streams with gravely substrates -Spawn on gravel bottoms in fast flowing water of shallow riffles	-Benthic feeder, primarily prey on aquatic insect larvae and plant may compromise 25% of their diet -Suitable spawning temperature is 9-21.1°C	1,5
Blacknose shiner	*Notropis heterodon*	Adult	Spawn June – mid-August	-Cool, clear, weedy, protected waters in lakes, marginal waters of rivers, and smaller streams in Canadian Shield for growth -Sandy substrate for spawning	-Feed on planktonic crustaceans, larval and adult insects, small mollusks, and other benthic invertebrates. Some algae also identified in stomach contents -Tolerant of hypoxia – can survive typical winterkill conditions -Intolerant of turbidity	1, 5
Blackside darter	*Percina maculata*	Egg	minimum incubation of ~6 days			1
		Larvae/Fry			-Feed near surface on planktonic crustaceans, but become benthic feeders as they grow	1, 5
		Adult	Spawn May	-Flowing water ranging from small streams to large rivers, and, less	-Feed on aquatic insects and some fish	1, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			- June	commonly, in the littoral zone of lakes during growth. Common in tributaries of Red and Assiniboine Rivers -Rocky substrate, often around vegetation. -Move upstream for spawning. Slow-moving water of pools and runs and riffles in streams. Gravel or coarse sand substrate	eggs -Eggs extruded into interstitial spaces in substrate or are covered with sand stirred up by the spawning act. -Suitable spawning temperature 16.5°C	
Bluegill	*Lepomis macrochirus*	Egg	Hatching ~3-5 days			1
		Larvae/Fry				1
		Juvenile			-Mature at 2-3yrs	5
		Adult	Spawn early- to mid-summer, with peak spawning in early July	-Lakes, streams, and rivers, usually in areas of slow or no current during growth. This species also does well in small human-made impoundments -Prefers cover such as weed beds, submerged wood, or boulders. -Gravel to mud substrates for spawning	-Feed on aquatic insects, small crayfish and other crustaceans, other aquatic invertebrates, and small fish. Plant material can also make up a significant proportion of stomach contents -Groups of fish retreat to deeper water in winter where they congregate in colonies but continue feeding -Winter aggregations break up when water temps reach 10°C, and males appear first in shallow water of spawning areas -Suitable spawning temperature 16-21°C	1, 5
Bluntnose minnow	*Pimephales notatus*	Egg	Hatch in 7-14 days, depending upon temp.			1, 5
		Larvae/Fry				1
		Juvenile				1
		Adult	Spawn May - August	-Protected, marginal waters and tributary mouths during growth.	-Feed on bottom and in midwater on algae, larval and adult insects, and	5, 1

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
				-Spawning occurs over mud substrates with submerged wood as cover, and on cobble to boulder substrates.	planktonic crustacea -Male excavates nest in sand or gravel substrate, under logs, bark, or other covering objects. Eggs are laid on the underside of these objects. - Suitable spawning temperature is >20°C	
Brassy minnow	*Hybognathus hankinsoni*	Adult	Spawn May-June	-Small- to medium-sized streams, usually in pools or slower runs. Live over substrates of gravel, sand, or mud, and the water may vary from turbid to clear. -Spawning occurs over vegetation along stream margins or flooded marshes (Becker, 1983)	-Opportunistic feeder, feeding mainly on algae and organic detritus. -Eggs broadcast over vegetation -Suitable spawning temperature is 10-12.8°C	1, 5
Brook stickleback	*Culaea inconstans*	Egg	8-9 days at 18.3°C			1, 3
		Juvenile				1
		Adult	Spawn in April to July depending on water temp.	-Quiet, weedy water in stream headwaters, ponds, prairie pothole lakes, and human-made impoundments during growth. Variable substrate -Shallow water with dense vegetation during spawning	-Feed on or near the bottom on aquatic insects, crustaceans, filamentous algae, and the eggs and hatchlings of fish - -Suitable spawning temperature is 8-19°C	1, 5
Brook trout	*Salvelinus fontinalis*	Egg	Incubate over winter. Hatch in: 28 days @14 45 days @10 165 days @ 2	-Small-large gravel substrate with less than 15-20% sand -Groundwater upwellings are essential for most spawning sites	-Eggs are buried in a redd -Redd must stay free of silt -Suitable spawning habitat is essential for spawning success -Suitable temperature for eggs is 3-14°C with 4.5-11.5°C being optimal	2
		Larvae/Fry	Remain in redd until yolk is absorbed Begin to feed 23-35 days after	-Slow water areas near banks, close to cover, may feed in areas with higher current or off the bottom -Instream cover is essential	-Groundwater levels have a direct effect on fry abundance -Suitable temperature is 2-19°C with 8-15°C being optimal	2

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			hatching			
		Juvenile		-Leave rapids in mid-summer in favor of cooler water in channels and pools with a gravel substrate, move into smaller streams in fall	-Feed primarily on bottom, occasionally off water surface, mainly on invertebrates -Larger fish become more closely associated with overhead cover -Suitable temperature is 8-19°C with 11-16°C being optimal	2,5
		Adult	Spawn August to December	-Clear, cold spring fed streams with silt free, rocky bottoms, 1:1 riffle to pool ratio with some deep areas, vegetated banks, stable water flows and temperatures -Also found in cold, clear lakes Spawn in rubble cover substrates of lakes and deep stream pools -Spawn in shallow gravel shoals in lakes or streams that surround spring upwellings	-Known to use groundwater seepage areas or deep pools when stream temperatures exceed 20°C, -Stay in vicinity of cover and groundwater upwellings -. Females excavates a redd where eggs are deposited and covered -Suitable temperature for spawning is 2-13°C with <9°C being optimal. -Suitable growth temperature is 4-19°C with 11-16°C being optimal	1, 2, 5
Brown bullhead	*Ameiurus nebulosus*	Egg	-eggs take 6-9 days to hatch at 20.6-23.3C		-Suitable temperature is 20.02-27°C	1, 2
		Larvae/Fry		- Schools of larvae live in quiet, protected backwaters and tributaries along the Red and Assiniboine rivers and shoreline marshes of lakes Winnipeg and Manitoba		1,5
		Juvenile			-Suitable temperature is 27.32°C	1, 2
		Adult	Spawn May-June during the day	-Benthopelagic, over fine substrates such as mud and silt. -Lower sections of small-to medium-sized streams of low gradient, ponds, and backwaters of larger rivers, lakes and impoundments -Tributaries and marginal waters, soft	-Omnivorous, feeding mostly on the bottom, taking snails, leeches, crayfish, tadpoles, minnows, and pieces of larger fish (likely taken as carrion). - Nocturnal, resistant to pollution and burrow into bottom mud to avoid adverse conditions	1, 2, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
				substrate, moderate to heavy submerged vegetation -Usually found around shores of lakes, or in coves, bays, or creek mouths -Nests more commonly on sand or gravel substrates than black bullhead	-Parents excavate a nest in soft substrate undercut banks, in woody debris or other cover. -Suitable growth temperature is 20.0-36.0 °C -Suitable spawning temperature is >21.1 °C	
Brown trout	*Salmo trutta*	Egg				1
		Juvenile				1
		Adult	Fall spawners	-Lakes and streams. Larger individuals are almost always in lakes or deep pools and runs in streams. In lakes, they tend to stay close to the shore in water <15m deep -Do not spawn in the wild in MB. Ascend into headwaters and spawn on riffles, as well as rocky reefs along lakeshores. Shallow water, gravel substrate	-Juveniles and smaller fish feed mainly on invertebrates, larger fish tend to be more piscivorous. -Female creates shallow depression (redd) in gravel, in which eggs and sperm are deposited. Process repeated many times, after which female covers redd with gravel -Suitable temperature for growth is 18-24°C -Suitable temperature for spawning is 6.7-8.9°C	1, 5
Burbot	*Lota lota*	Egg			-Suitable temperature is 4-6°C	1, 2
		Larvae/Fry		-Rocky shores and weedy areas of tributary streams, shallow sandy bottoms of lakes		2
		Juvenile		-Stony bottomed riffles, the tails of rapids, or lakeshores		1, 2, 5
		Adult	Spawns in midwinter (January to March), under ice	-Deep waters in lakes, large cool rivers. Main channels or rivers and offshore in lakes -Spawn over sand and gravels shoals and lake bottoms in shallow water	-Feed mainly on benthic and planktonic crustaceans, adults also feeding on fish -Individuals have a home range of about 4 km in diameter -Post spawning run into tributary rivers in late winter and early spring -Suitable temperature for growth is 15.6-18.3 °C -Suitable temperature for spawning is 0.6-1.7 °C	1, 2, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
Central mudminnow	*Umbra limi*	Egg	Eggs hatch in ~6 days			1, 5
		Larvae/Fry				1, 5
		Juvenile			-Move back to the main stream when they are 30mm in length	1, 5
		Adult	Spawn May - June	-Prefer beds of aquatic vegetation in streams and ponds in bogs. Often found in waters that are O_2 deficient by mid-summer -Move upstream or laterally to shorelines or into ponds or marshes to spawn	-Carnivorous, feed on a wide variety of aquatic invertebrates, fish becoming the most important item during winter -Eggs deposited on submerged plants. -Suitable spawning temperature is 13°C	1, 5
Channel catfish	*Ictalurus punctatus*	Egg	Hatch in 5-10 days at temps 15.6-27.8C	-dark and secluded areas		1, 2
		Larvae/Fry	remain in nest for 7-8 days	-Shallow water areas for cover. Slow flowing areas of rocky riffles, debris-covered gravel or sand bars	-Feed mainly on benthic invertebrates	1, 2
		Juvenile		-Similar to that of fry. Feed alone in quiet, shallow water over sand bars, drift piles, and rocks	-Variability in growth depending on habitat.	2, 5
		Adult	-Spawn Late June - early July -Likely do not spawn every yr.	-Mainly benthopelagic, prefers large rivers and lakes. Found in main stem of the larger rivers, offshore in L Winnipeg, and eastern trib. of L Winnipeg. Seldom seen in smaller streams. -Prefers strong current and shear areas between strong current and eddies. Can be found near surface or in shallow water, likely on feeding excursions -Spawn on gravel - rubble substrates, higher water velocities -Known spawning areas include Netley Creek, Cook's Creek, and Red R. south of St. Agathe and at Aubigny	-Feed on benthic invertebrates, crayfish, aquatic insects, and small freshwater mussels. Become increasingly piscivorous as they grow -Complex life history making use of all accessible reaches of Red River-Assiniboine River- Lake Winnipeg system -May move either upstream or downstream to spawning areas -Nest excavated under cover, or a cavity, and is cleaned by the male. - -Suitable temperature for spawning is >21°C	2, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
Chestnut lamprey	***Ichthyomyzon castaneus***	Larvae/Fry	Ammocoetes larva lives for 5-7 yrs., probably 7yrs in MB.	-Burrow in firm sand-mud substrates in fast-flowing water, presumably near hatching site.	-Larvae filter-feed on organic detritus, microscopic algae, and protozoa.	1, 5
		Adult	-Trans-formation to adult likely completed in fall. -Adults ascend streams in mid-late June.	-Move downstream into larger rivers -Migrate upstream into tributaries to spawn.	-Construct a communal nest by moving gravel with their oral discs.	5
Cisco	*Coregonus artedi*	Egg	Hatch in 155-175 days in wild		-Suitable temperature is 2-8° C	1, 2
		Larvae/Fry	Appear 3-5 days after ice breakup	-Shallow inshore areas and offshore spawning shoals	-Suitable temperature is 6.5-12°C	1, 2
		Juvenile			-Upper lethal temperature is 26° C	2
		Adult	Fall spawners, often under ice cover	-Shallow in spring, below thermocline in summer, shallow again as water cools in fall -Generally in deep water areas of lakes -Spawn in lake shoals and river shallows over gravel or rocky substrates, but can spawn over others	-Feed on plankton mainly, although adults will often feed on benthic fauna, including insect larvae and small mollusks -Suitable temperature for growth is <17°C -Spawning time is temperature dependent -Suitable temperatures for spawning <5°C with 3-4°C being optimal -Spawning known to occur pelagically at depths of 9-12 m in 64 m of water	1, 2, 5
Common carp	*Cyprinus carpio*	Egg	hatch in 3-6 days			1

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
		Larvae/Fry				1
		Juvenile				5
		Adult	Spawn May – early June	-Slow-moving or still waters ranging from streams and ponds to large rivers and lakes. All substrates – but prefer shallow water with soft substrates for feeding -Spawn in weedy or grassy shallows. Move upstream to spawn	-Usually benthic-feeding omnivores, consuming detritus, vegetation, a wide variety of invertebrates, and even small fish and some carrion. Also observed surface-feeding on floating seeds - Suitable spawning temperature is 17-28°C.	1, 5
Common shiner	*Luxilus comutus*	Egg			-Eggs lodge among gravel	1
		Larvae/Fry				1
		Adult	Spawn May-late July	-Pools and slower stretches of medium- and small-sized streams. Occurs over a variety of substrates, from silt and sand to gravel. Appears to prefer open water with beds of aquatic vegetation -Apparently spawn in streams exclusively. Flowing or still water, gravel substrate. Often spawn at head of gravelly riffle	-Opportunistic, omnivorous feeder, consuming filamentous algae, a variety of aquatic invertebrates, and adult insects from the water surface -Often uses nests excavated by other species in gravel in a commensal relationship. Alternatively, the male excavates a nest in gravel in running water -Suitable temperature for spawning 15.6-18.3° C	1,5
Creek chub	*Semotilus atromaculatus*).	Egg		-Clear streams		1
		Juvenile		-Shallow riffles or quiet, shallow water		1, 5
		Adult	Spawn in spring (last 2 weeks of May)	-Prefer small clear streams and brooks, but is also found in near-shore waters of lakes. Pools and slick runs, or undercut banks. -Substrates from silt in pools to coarse gravel in the runs Shallow channels in small streams over gravel substrate. In smooth water just above or below riffles	-Feed on aquatic invertebrates mostly, although crayfish and fish become important in age 1 fish and older -Male builds long trench in gravel about 250mm wide, 500-1000mm long, 50mm high, with a pit 200-250mm in diameter and 80-200mm deep, parallel to current. Male spawns with several females, eggs in the trench are buried with gravel -Suitable spawning temperature >14	1, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
Emerald shiner	*Notropis atherinoides*).	Egg	Hatch in 24 - 32 hrs.			1
		Larvae/Fry				1
		Juvenile			-Pelagic, feeding on rotifers, ciliated protozoa, and algae	1
		Adult	last week in June to early August	-Open waters in lakes and large rivers, usually offshore and near the surface in summer, inshore areas in the fall -Move back into deeper waters of lakes and large rivers for over winter -Thought to be midwater spawners	. Feed on larval and adult insects and planktonic crustaceans -Do not usually live longer than 3 years -Populations tend to fluctuate greatly in abundance - Suitable temperature for spawning is 21-24°C	1, 5
Fathead minnow	*Pimephales promelas*	Egg	Hatch in 4.5 – 6 days			1, 5
		Larvae				1
		Juvenile			-In warm waters rapidly growing fish can reach adult size and spawn by late summer of their first year	1
		Adult	Spawn in spring (mid-May – late June)	-Broad range of habitats and water turbidities, from bog ponds and headwater streams to lakes and large, turbid rivers. -Prefers aquatic vegetation as cover. Fine substrates, including sapropel -Spawn on underside of rocks, branches and plants in shallow water. Nests built on soft substrates such as sand or mud	-Benthic feeders on detritus, as well as microscopic plants and animals -Can withstand winterkill conditions. -Suitable temperatures for spawning >15.6°C	1, 3, 5
Finescale dace	*Phoxinus neogaeus*	Adult	Spawn spring (late April)	-Bog habitats in small lakes, ponds, and streams. They live in quiet, clear, cool, often brown-stained water. More common over firmer substrates of gravel or sand	-Feeds mainly on aquatic invertebrates, including small mollusks and a variety of larval insects, also some filamentous algae -Have been observed spawning in depressions covered by submerged logs. Eggs are deposited on the substrate	5
Flathead chub	*Platygobio*	Juvenile				1

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
	gracilis					
		Adult	Spawn spring - summer	-Mid-channel, in fast-flowing sections of larger rivers. Found on gravel, sand, or, less commonly, rubble. Small schools will gather in scour holes on d/s side of obstructions -Sometimes moves into smaller streams in spawning season	-Predatory, consuming a variety of aquatic invertebrates at all life-history stages, as well as small fish (by adults). Feeding is mostly benthic, but they do occasionally surface-feed.	1, 5
Freshwater drum	*Aplodinotus grunniens*	Egg	Hatch in 25-30hrs at temps of ~22°C	-Float on water surface	-Suitable temperature is 22°C	1, 2, 5
		Larvae/Fry	Attached to surface film for approx. 24-48hrs	-Float on water surface, or attached to surface film		2
		Juvenile		->25mm found on or near bottom, where they remain for most of their lives		2, 5
		Adult	Spawn in June	-Large, shallow bodies of water. Prefers clear water but can adapt to relatively high turbidity levels. Lives mostly in shallows -Mainstems of large rivers and in the MB Great Lakes -Spawn in open water, far from shore, with current. Bays and lower portions of rivers, over substrates ranging from silt and clay to rubble	-Feed mostly on benthic invertebrates, especially crayfish, snails, and mussels. Adapted to bottom feeding -Suitable temperature for growth is <25.6°C -Move into shallower waters in the spring then back to deeper water of the main channel in late fall. Suitable temperature for spawning is 20-23°C	1, 2, 5
Golden redhorse	*Moxostoma erythrurum*	Egg				1
		Juvenile				1
		Adult	Spawn May - June	-Shallow, clear waters of lakes occupying nearshore areas at shallow depths, or clear rivers over sand or gravel bottoms	-Feed on aquatic insect larvae and bivalve mollusks -Migrate upstream up to 32km. Migration	1, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
				without heavy silt, occupying shallow riffles and runs -Smaller rivers and streams in riffles over substrate ranging from fine sand to cobble with scattered boulders	movements positively correlated with stream discharge -Suitable temperature for spawning is >8-10°C	
Golden shiner	*Notemigonus crysoleucas*	Egg				1
		Juvenile				1
		Adult	Begins mid- to late June, and continues for entire summer	-Quiet, usually clear, water with aquatic vegetation cover, in ponds, oxbow lakes, or streams with extensive shallow areas. Usually found over soft substrates	-Midwater to surface feeders. Consume a wide variety of planktonic invertebrates, with cladocerans, entomostracans, and insect larvae being most common. May also consume significant amount of plant material. -Tolerant of low O_2 – can survive in waters subject to winterkill -Eggs broadcast over submerged aquatic vegetation. Have been observed laying eggs in nests of largemouth bass - Suitable temperature for spawning is >20°C	1, 5
Goldeye	*Hiodon alosoides*	Egg	Incubate for 1-2 weeks	-Lake shallows, pools and back water areas in turbid water over firm substrate		1, 2, 3
		Larvae/Fry		-Float at water's surface, drifting with wind and currents	-Remain in same area as spawning grounds until migrating to overwintering areas in deeper lakes and rivers	1, 2
		Adult	-Highest growth rate is between June and September -Spawn late May and early July following	-Open water of large turbid rivers and lakes, preferring quiet pools and backwater areas, but also found in faster waters -Overwinter in deeper areas of lakes and rivers -Spawn in midwater in larger turbid rivers. Gravel shoals over firm substrates	-Midwater- to surface-feeding fish, which feed mainly on aquatic insect larvae, and emerging and flying insects in low light conditions -Suitable temperature for growth is 22-28.5°C with 27-29°C being optimal -Probably dormant during period of ice cover	1, 2, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			ice breakup		-Spawning migrations from winter habitats up rivers and tributary streams when water temperatures reach 10-12°C	
Goldfish	Carassius auratus	Egg	Hatch in ~3 days or more, depending on temp.			1
		Adult	Spawn May-June	-Prefer quiet, weedy water and are less tolerant of turbidity than carp. -Warm, weedy shallows for spawning	-Omnivorous feeders, taking mostly larval and adult aquatic insects -Move offshore into deeper water beginning in late August. -Tolerant of hypoxic conditions – can survive winterkill conditions that eliminate most native species of minnow. -Eggs deposited on aquatic vegetation -Suitable temperature for spawning is >15.6°C	1, 5
Hornyhead chub	*Nocomis biguttatus*	Egg				5
		Juvenile		-Along shorelines, most commonly in beds of aquatic vegetation, over silty sand or gravel substrates	-Feed on benthic aquatic invertebrates	5
		Adult	Spawn May – July	-Benthic, over gravel to boulder substrates, low to moderate water velocities in runs or pools. Clear water -More often in tributaries of large rivers -Spawn in flowing water on gravel substrate	-Feed on filamentous algae, along with aquatic invertebrates -Males clean a nest area in gravel. Cleaned pebbles are carried onto the nest area by the male. Males spawn with a succession of females, expanding the nest as required -Suitable temperature for spawning is >23.9°C	1, 5
Iowa darter	*Etheostoma exile*	Egg	Hatch in 9-10 days at 13-16°C			1

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
		Adult	Spawn April to June	-Clear, standing or slowly moving water in lakes or rivers in areas containing rooted aquatic vegetation and a substrate consisting of organic debris, sand or peat. -In MB, in weed beds along shores of lakes and rivers, in oxbow lakes, and in headwater streams and ponds including bog habitats. -Spawning occurs in shallow waters near shore, fibrous roots of plants under undercut banks, or on bottom organic debris	-Feed on a variety of aquatic insect larvae and crustaceans -Suitable temperature for spawning is 13°C	1, 5
Johnny Darter	*Etheostoma nigrum*	Egg	Hatch in 5-8 days at 22-24°C			1
		Adult	Spawn May to June	-Most commonly found in waters with moderate or no current with a sand, sand and gravel or sand and silt substrate -Do not inhabit weedy areas or gravel riffles of streams -Spawn in quiet water, in pools in streams and along lakeshores. Nest on undersides of rocks	-Feeds on aquatic insects and crustaceans -Males arrive at spawning areas before females, establish territories and prepare the underside of a rock for a nesting site -Males guard eggs and keep them free of silt	1, 5
Lake chub	Couesius plumbeus	Egg		-Tributary streams and shallow water	-Yellowish eggs, about 500 per female	5
		Adult	Spawn early spring, but known to extend into the summer	-Cool water in both streams and lakes. Wide range of depths, from shoals 15cm deep in streams, to rocky habitats along lakeshores, to depths of 178m in Lake Superior -Spawn in tributary streams and shallow water, over rocky bottoms	-Younger fish are planktivores and larger fish feed on benthic aquatic insects -Found in deeper waters of lakes during the summer -Suitable temperature for spawning is ~14-19°C	1, 3, 5
Lake sturgeon	*Acipenser fulvescens*	Egg	Hatch in 16-18 days @ 10°C, 4-5	-Incubate in interstices among rocks and gravel	-Suitable temperature range of 10 to 18°C, with 14 to 16°C being optimal -Adhesive eggs) are randomly scattered	1, 2

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			days @ 20°C		over the substrate, no nest is constructed	
		Larvae/Fry	Larvae remain dormant in substrate until yolk is absorbed (about 10 days)	-Stay in dark crevices and other cover until yolk is absorbed before moving into backwaters	-A combination of low oxygen levels and temperatures in excess of 20°C has been known to cause high mortalities in the young of other sturgeon species	1, 2
		Juvenile		-Fish are found over sand and gravel bars in fast water in summer and fall.	-Males mature at 12-20 years, females mature at 14-33 years	1, 2
		Adult	-Long-lived, ages of 50 yrs. for males and 80 yrs. for females are known. -Spawn May to mid-June	-Bottom feeders, are found most often over fine to medium sand in larger lakes and rivers. Most densely distributed in current -Deep pools in main river channels over sand-silt bottoms Spawn in rapids or the base of impassable falls, as well as off wind-swept shores over hard substrate such as boulders or bedrock.	-Backwaters and river banks in May and June, move into water deeper than 2 m in July for fall and winter, movements may in part be based on temperature and oxygen requirements -Adult fish often move over long distances (>100 km) -Suitable temperature for growth is less than 24°C -Upstream spawning migrations usually <100 km and rarely >400 km -Spawning success can be affected by low or fluctuating water levels -Suitable temperature for spawning >11°C	1, 2, 5
Lake whitefish	Coregonus clupeaformis	Egg	Hatch in 130-175 days at 1°C		-egg mortality can be high especially at temperatures above 10°C	1, 2
		Larvae/Fry	Appear 3-23 days after ice breakup	-Found in shallow waters in protected areas -Leave shallows by early summer	-Larvae spend 2.5-3 months under ice -Suitable temperature is 0-17°C	2
		Juvenile		-Shallow waters in spring, deeper, cooler waters in the fall	-Suitable temperature is 1-12°C	1, 2

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
		Adult	Fall spawners, September - October	-Shallow waters in spring, deeper, cooler waters in the fall. -Over winter in rivers and lakes -Spawning is primarily in lakes, but also occurs in rivers on gravel, mud, sand substrates	-Feed mainly on benthic and planktonic invertebrates and small fish -Relatively rapid growth -Max age 17yrs. Males mature at a younger age and die earlier -Suitable temperature for growth is 1-12°C -Suitable temperature for overwintering is 0–0.3 °C - -Suitable temperature for spawning is 5.5-9.4°C with 5° being optimal but it can vary	1, 2, 5
Largemouth bass	*Micropterus salmoides*	Egg	Hatching takes 3-5 days	-Protected gravel beds. Will use exposed roots and emergent vegetation in nests	-Changes in temp., wind, waves, nest desertion, turbidity and predation by fish limit success of the hatch -Suitable temperature is 13-26°C	1, 2
		Larvae/Fry		-Flooded terrestrial vegetation or emergents used for cover	-Suitable temperature is 21-34°C with 27-30°C being optimal	1, 2, 5
		Juvenile		-Similar to adult	-Suitable temperature is 21-32°C	1, 2
		Adult	-Max length increase in 1st 2 years -Spawn June - August	-Lakes and large rivers, usually in quiet marginal waters. Prefers submerged wood or weedbeds. -Move to the bottom over winter. -Spawn on gravelly sand to marl and soft mud substrate. Will spawn on finer substrates if there are hard surfaces available for the eggs to adhere to	-Feed on fish , as well as frogs, snakes, small rodents, and ducklings -Suitable temperature for growth is 26.6-27.7°C -Suitable temperature for nest building at 15.6°C and spawning is 16-18°C	1, 2, 5
Logperch	*Percina caprodes*	Egg			-Suitable temperature about 22-26°C	1
		Adult	Spawn May - late June	-Usually in deeper waters offshore and in large rivers, sometimes in areas with swift current. Tolerant of turbid water -Found over sand, gravel, or rocky substrates -Spawn on sandy shoals in shallow water	-Use snout to roll over stones, leaves, or other objects on the bottom to feed on organisms underneath them -Suitable temperature for spawning is 16-23° C	1, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
Longnose dace	*Rhinichthys cataractae*	Egg	Hatch in 7-10 days at 15.6oC			1, 3
		Larvae/Fry	Yolk sac absorbed at 7 days	-At the surface of quiet waters near the shore		1
		Juvenile	Move to bottom at ~ 4 months	-Bottom dwelling		1
		Adult	Spawn late spring and into summer	-Clean, swift flowing streams with a gravel or boulder substrate, often in areas of high turbulence. Also in inshore waters of lakes over gravel or boulder substrate -Benthic, in crevices between boulders -Some fish move into deeper waters in summer -Spawn in riffles over a gravel to rubble substrate (particle size 5-20cm)	-Feed on aquatic insects (mainly caddis fly and black fly larvae) -Larger, older fish have a proportionately smaller gas bladder and are less buoyant. These fish are found in areas with high velocities -Tolerant of a wide range of temperatures -Suitable temperature for spawning is 4-16°C	1, 3, 5
Longnose sucker	*Catostomus catostomus*	Egg	-Exper-imentally hatch in 8 days at 15°C and 11 days at 10°C, probably longer in most streams	-Gravel substrates in cool, flowing streams -Often at the tails of riffles	-Suitable temperature is 7-15.5°C	1, 2
		Larvae/Fry	-Remain in gravel for 1-2 weeks after hatching, move into lakes 1-2	-Spend first summer in stream	-Drifting fry are found close to surface	1, 2

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			months later			
		Juvenile				2
		Adult	-Spawn early spring (mid-April to mid-May) -Move into spawning areas primarily at night, but spawn in the day	-Clear cold lakes and in swift rivers with hard substrates. Tend not to be found in smaller streams except when spawning. -Primarily nocturnal -Areas with adequate O_2 levels, often in streams or offshore areas -Spawn in flowing waters in streams with a gravel substrate in riffles and in shallow areas of lakes over gravel substrates	-Feed on bottom-dwelling invertebrates and some plant material. -Migrate upstream following ice breakup -Movements affected by fluctuations in discharge. Spawn earlier than white suckers -Suitable temperature for growth is <27°C and for spawning is >5° C	1, 2, 5
Mimic shiner	*Notropis volucellus*	Egg				1
		Adult	-Spawn in the last 3 weeks of July but varies geographically	-Found in lakes and rivers, living in open water often adjacent to rapids in streams -Often found in water <1m deep in substrates ranging from sand to bedrock. -Prefers quiet to still water -Found in streams and lakes in eastern Manitoba at least to the Belanger River and its westernmost occurrence is in the Icelandic River. -No reports on spawning habitat	-Feed primarily of entomostracans, green, and blue-green algae -Spawning probably takes place at night and likely eggs are broadcasted over aquatic vegetation at depths of 15-20 feet. -Suitable spawning temperature is 15-20°C	1,5
Mooneye	*Hiodon tergisus*	Egg				1
		Larvae/Fry		-Large, clear streams		1
		Juvenile		-Large, clear streams		1
		Adult	Spawn April-June	-Feeds mostly in large, clear, swiftly flowing waters, lives in shallow waters. More common in less turbid and slower moving water than goldeye. -Spawn in large, clear streams	-Midwater to surface water feeder, feeding on same food items as goldeye -Large upstream spawning migrations in the spring. Spawns in midwater -Probably spawn somewhat later than goldeye.	1, 5
Ninespine	*Pungitius*	Egg				1

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Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
stickleback	*pungitius*					
		Larvae/Fry	Leave nest when ~15 mm long			1
		Juvenile				1
		Adult	Spawn in summer (~June - July)	-Lakes, creeks and streams, also in brackish water in coastal areas. Prefers open water in the main stems of rivers and in lakes -Spawn in shallow weedy areas, fresh water	-Feed mainly on benthic crustaceans and aquatic insects -Males build a hollow, tube-like nest in weeds out of aquatic vegetation -Males may spawn with several females in the same nest and may build a second nest while caring for the young in the first one	1, 5
Northern pike	*Esox lucius*	Egg	Hatch in 5-26 days at 20 to 6°C respectively	-Shallow sheltered areas, over dense vegetation or flooded areas with adequate circulation and rising or stable water levels	-Sensitive to high rates of siltation -Suitable temperature is 6.4-19°C, with 9-15°C being optimal and >16°C results in high mortality	1, 2
		Larvae/Fry	-Leave spawning site after reaching 15-20 mm in length (about 6 weeks) -Absorb yolk sac in 9-10 days	-Dense vegetation in shallow sheltered area of rivers and lakes	-Attach to vegetation to stay above low oxygen levels found on bottom -Suitable temperature is 7.5-26°C with 21-26°C being optimal	2
		Juvenile		-Shallow areas with flooded vegetation or weed beds, usually stay close to shore	-Feed mainly on zooplankton and aquatic insects for the first few weeks of life Can tolerate lower O2 conc. than adults -Suitable temperature is 3-28°C with 19-21°C being optimal	2, 5
		Adult	Spawning occurs	-Prefer extensive weed beds of submerged and emergent macrophytes,	-Visual predators, feeding mainly on fish. -Suitable temperature for growth is 4-	1, 2, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			shortly after ice out (early April)	clear, cool water and low current areas, but can also be found in wide variety of environments -Move higher in the water column over winter as O_2 conc. becomes depleted -Over flooded vegetation in calm shallow bays, rivers and backwaters	24°C with 20-21°C being optimal -More tolerant of low O_2 conc. than many species -Move upstream soon after ice out, into shallow waters with vegetation, to spawn. -Suitable temperature for spawning is 4-18 °C	
Northern redbelly dace	*Phoxinus eos*	Egg			-Eggs hatch in 8-10 days at water temps of 21.1-26.7C	1
		Juvenile				1
		Adult	Spawn spring – early summer	-Bog habitats in headwater streams and ponds. Quiet, clear, cool, often brown-stained waters -Spawn over fine substrates including silts and peaty debris	-Feed mainly on filamentous algae, diatoms, unidentified organic detritus, and occasionally insects -Spawn in masses of filamentous algae, with a female and one to eight males forming a spawning group. Eggs are deposited in the algal masses, and are non-adhesive	1, 5
Pearl dace	*Margariscus margarita*	Egg		-Clear water on sand or gravel		1
		Juvenile		-Shallower water than adults		1
		Adult	Spawn late April - early May	-Cool bog ponds, creeks, headwater streams and lakes. Cool, clear, slow-flowing water. Often in stained, tea-colored water. -Spawning substrates ranging from gravel to silt, in quiet or flowing water. Clear water	-Aquatic insect larvae are the most common food, but terrestrial insects are also taken. -Intraspecific resource partitioning has been observed, with different age classes occupying different depths and consuming different foods. -Suitable temperature for spawning is >16°C	1, 4, 5
Pumpkinseed	Lepomis gibbosus	Egg	Hatch in as few as 3 days at 28C			1
		Larvae/Fry				1
		Juvenile				1

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
		Adult	Spawn in June	-Quiet, clear to slightly turbid water. Usually found in weed beds or submerged wood cover. Found in lakes, ponds, and slow-moving areas of rivers. Usually seen in large numbers near the surface of the water -Spawn in swamps - gravel shoals. Aquatic vegetation	-Feed on aquatic insects, as well as a variety of other invertebrates. Small fish may be a significant diet item seasonally -Upper lethal temps of 24°C for fish acclimated at 18°C, and 30.2°C for fish acclimated at 28°C -Suitable temperature for spawning is 16-21°C	1, 5
Quillback	*Carpiodes cyprinus*	Adult	Spawn mid to late April	-Lakes and larger streams, sand to silt substrates -Spawn on coarse to fine gravel in riffles during high discharge periods and move to deeper water with sand substrate as water levels decline	-Benthic, small-particle feeders, feeding mainly on chrionomid larvae, ostracods, cladocerans, and copepods -Move as far as 32km upstream during years with high discharge and only 2-3km during years in lower discharge. Spent fish migrate downstream between mid-May - early June -Suitable temperature for spawning is >5-6°C	1, 5
Rainbow smelt	*Osmerus mordax*).	Egg	-hatch in 2-3 weeks depending on temp, 20-30 days at 4.0-10°C, 10 days at 15.5°C			1, 2, 5
		Larvae/Fry		-drift downstream to lake or estuary	-Prefer warm water	1, 2
		Juvenile		-Close inshore along sand and gravel beaches	-Prefer cool water	1, 2
		Adult	Spawn shortly after ice-out (March - May)	-Midwater fish, preferring cool lakes, reservoirs, or lake-like expansions of large river. -Natively anadromous, however non-anadromous populations have been widely introduced -Following breakup of thermal stratification, distribution throughout the	-Suitable temperature for growth is 15°C and overwintering is 4°C -Suitable spawning temperature is 4.5-15°C	1, 2, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
				lake becomes more random -Usually ascends streams to spawn, but also spawns on reefs and along shorelines of lakes		
Rainbow trout	*Oncorhynchus mykiss*	Egg	Hatch in 28-60 days	-Gravel substrate	-Suitable temperature is 7-12°C	1, 2
		Larvae/Fry	Emerge late June, early July	-Require cover in the form of vegetation, debris or coarse gravel substrate	-Remain in gravel for 1-2 weeks after hatching -Suitable temperature is 10-21°C	2
		Juvenile		-Over gravel and rubble substrates, in and under cover in the form of overhanging banks, riffles, logs and debris	-Suitable temperature is 5-20°C	2
		Adult	Some spawn downstream in spring (May-June) and others upstream in fall	-Rock and boulder substrate, utilize pools, runs, chutes and riffles of streams and rivers. Most commonly lake dwellers -Adequate cover required -Hide in substrate at very low temperatures. Some fish migrate into lakes, other remain is streams over winter -Spawn in streams with cobble substrate, at head of riffles or downstream edges of pools	-Feed mostly on invertebrates, larger individuals may feed on fish -Some fish migrate from lakes into streams to spawn, other remain in streams year round -Suitable temperature for growth is <21°C -Prefer to overwinter in deep areas containing abundant cover -Suitable temperature overwinter is 4-8°C -Suitable temperature is 2-16 °C	1, 2, 5
River darter	*Percina shumardi*	Juvenile			-Feed on aquatic insects mainly, as well as zooplankton and fish eggs	5
		Adult	Spawn May - July in MB	-Large rivers with rubble or boulder-strewn gravel substrate, in fair to moderate current, little to no vegetation -May also be found in silted, turbid tributaries and lakes -In MB, found in the littoral areas of the MB Great Lakes and our larger rivers		1, 5
River shiner	*Notropis blennis*	Juvenile				5
		Adult		-Large, turbid rivers and the lowermost reaches of their tributaries. -Lives in non-turbulent water at low to	-Feeds on aquatic larval and adult terrestrial and aquatic insects, but also takes planktonic crustacea and some	5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
				moderate water velocities, over substrates ranging from silt to gravel -Spawn on sand – gravel substrate	algae -Early YOY found by early July into early September	
Rock bass	*Ambloplites rupestris*	Egg	Hatch in 3-4 days at 20.5-21.0°C		-Eggs adhesive	1
		Larvae/Fry				1
		Juvenile		-Littoral to limnetic in various lakes		1
		Adult	Spawn June	-Rocky habitats in the littoral zone of lakes, and pools and runs in streams and in rivers. Prefers cover such as submerged wood or aquatic plants -Spawn in swamps - gravel shoals	-Predatory, feeding on crayfish, other aquatic crustacea, aquatic insects, and small fishes -Males excavate shallow nest depression, which he defends against other males. -Suitable temperature for spawning is 16-21°C	1, 5
Roysface shiner	*Notropis rubellus*	Egg				1
		Larvae/Fry		-Hatching occurs 8 days after spawning	-Work their way into gravel substrates after hatching	1
		Adult	-Spawn May-June	-prefer flowing water most often in lower portions of the stream -Prefer fine gravel and sand substrates -intolerant of turbidity - Spawn on depression in gravel	-Aquatic insects dominate their diet with algae and terrestrial vegetation secondary -Suitable spawning temperature is 20-28.9°C (Average 21°C)	1
Sand shiner	*Notropis stramineus*	Egg				1
		Adult	Spawn mid-June to mid-July	-Tails of riffles, moderate velocity runs, and similar habitats along the margins of rivers. Most common over gravel or sand substrates.	-Feed on organic detritus, diatoms and other algae, and larval and adult insects -Eggs scattered over clean gravel or sand	1,5
Sauger	*Sander canadensis*	Egg	Hatch in 25-29 days at 4.5 to 12.8°C	-In crevices in rocks or among gravel on the bottom, out of current	-Suitable temperature is 9-18°C, with 12-15°C being optimal	1, 2

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			8-13 days at 15°C			
		Larvae/Fry	Remain on bottom for 7-9 days after hatching	-May be found on shallow mud flats	-Suitable temperature is >6°C	1, 2
		Juvenile		-Large shallow lakes and large slow rivers that have high turbidity	-Feed on zooplankton and aquatic insects -Suitable temperature is 16-28°C	1, 2, 5
		Adult	Spawn May to June, usually no longer than 2 weeks in duration	-Prefer shallower, more turbid water than the walleye, and is more common in turbid rivers than walleye. Substrates ranging from clay or silt to rubble and boulders -Found in Red River, Assiniboine River, and MB Great Lakes -Prefer to spawn in flowing water in shallows over sand or gravel shoals in large turbid lakes and rivers	-Feed on fish, crayfish, leeches, and aquatic insects -Better adapted to turbid water than walleye -Suitable temperature for growth is 18.6-19.2° and winter is <12°C -Spawn at night and may make extensive spawning migrations -Suitable temperature for spawning is 3.9-15°C with 9-15 being optimal	2, 5
Shorthead redhorse	*Moxostoma macrolepidotum*	Egg				1
		Juvenile			northern populations can be slower. Mature at about 4 or 5 years of age	1
		Adult	Spawn May - June	-Shallow, clear waters of lakes occupying nearshore areas at shallow depths, or clear rivers over sand or gravel bottoms without heavy silt, occupying shallow riffles and runs -Spawn in smaller rivers and streams in riffles over substrate ranging from fine sand to cobble with scattered boulders	-Feed on aquatic insect larvae and bivalve mollusks -Migrate upstream up to 32km. Migration movements positively correlated with stream discharge -Suitable temperature for spawning is >8-10°C	1, 5
Shortjaw Cisco	*Coregonus zenithicus*	Adult	Fall spawners	-Benthopelagic in deeper water than the cisco -Spawn on clay bottom	-Feed on *Mysis* and *Pontiporeia* mainly -<100m in length. Females heavier and live longer than males. Max age 9yrs	5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
Silver chub	Macrhybopsis storeriana	Larvae/Fry		-Main stems of large rivers and lowermost reaches of their tributaries. Slower-moving water, over soft substrates		1
		Adult	Spawn June-July	-Thought to occur in open water	-Benthic feeder, taking aquatic insect larvae, mainly caddis flies, mayflies, and amphipods -Suitable temperature for spawning is >21°C	1, 5
Silver lamprey	*Ichthyomyzon unicuspus*	Egg	Hatch in several weeks	-Gravel riffles		1
		Larvae/Fry	Ammocoetes leave nest after hatching	-Burrow into mud and silt at river margins	-Remain in river bottom for their ammocoete life (4-7 years)	1
		Juvenile				1
		Adult	-Adults by 8th year of life -Spawn May and June	-Migrate downstream to lakes following transformation -Spawn in gravelly riffles in larger rivers	-Adults are parasitic on other fishes, -May feed over the winter, length and weight decrease and intestine becomes less functional as eggs develop during winter prior to spawning -Build shallow nest by moving stones with mouth and sweeping away sand and silt with the tail	1
Silver redhorse	*Moxostoma anisurum*	Egg				1
		Juvenile		-Slow-moving waters over variable substrate where overhanging banks provide protection from predators		1
		Adult	Spawn late May - early June	-Primarily river fish, although also found in lakes. -Typically found in deeper, lower velocity water, over finer grained substrates than shorthead redhorse -Spawn in gravel to rubble substrates in main channel of streams. Do not ascend	-Feed on aquatic insect larvae and small crustaceans -Small changes in temp affect spawning activity -Suitable temperature for spawning is >13.3°C	1,5

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Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
				tributaries		
Slimy sculpin	*Cottus cognatus*	Egg	Hatch in about 4 weeks at 8°C			1
		Juvenile				1,5
		Adult	Spawn early May or June	-Deeper waters of lakes and cooler streams with a rock or gravel substrate, bottom dwelling. Quiet water - Spawn in shallow waters with a rock or gravel substrate, under stones, also under submerged tree roots	-Feed on aquatic insects, as well as some crustaceans, fish eggs, and small fish long. -Suitable temperature for spawning is >5°C	1,5
Smallmouth bass	*Micropterus dolomieu*	Egg	Hatching usually takes place in 4-10 days	-Out of current or near cover which provides current breaks	-Sudden temps shifts (>8) may kill eggs, as well as flooding -Suitable temperature is 11.7-25°C	1, 2
		Larvae/Fry	Remain in nest for 6-15 days	-Calm, shallow areas near rocky shelters or fallen logs over sandy substrate	- Suitable temperature is 18-32°C with 25-29°C being optimal	1, 2
		Juvenile		-Avoid thick, shallow weed beds. Seek the quiet dark water in the lee of boulders and logs	-Feed on small crustaceans and insects -Strong homing to spawning grounds - Suitable temperature is 16-30°C with 25-29°C being optimal	1, 2, 5
		Adult	-Max growth in May-October. -Gradual dispersal after brood protection -Begin overwinterin g habits in early September -Spawn in	-Found mostly in lakes and lake-like, usually impounded, reaches of rivers. Rocky substrates, using boulders and bedrock ledges for cover, as well as submerged wood or aquatic vegetation. Moderately shallow water -Overwinter in deep pools near cover. Prefer boulders for cover -Spawn in lakes and rivers, usually near the protection of rocks, logs, or more rarely, dense vegetation. Sandy, gravel, or rocky bottom	-Predacious, feeding on insects, fish and crayfish - Suitable temperature for growth is 20.3-21.3°C, upper lethal temp as high as 35°C -Aggregate near the bottom over winter, are very inactive and eat little. Begin feeding in the spring when water temps reach 8.5°C - Suitable temperature for overwintering is <6.7°C , with 12-13°C being optimal -Male excavates nest in gravel or rubble substrate, and cleans substrate of nest. Nest is circular and has a diameter ~	1, 2, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			late spring - early summer, over 6-10 days		twice the body length of the male. -Eggs attached to clean stones near center of nest - Suitable temperature for nest building begins at >12°C, spawning at 16-18°C	
Spotfin shiner	*Cyprinella spiloptera*	Egg				5
		Juvenile				3
		Adult	-Live to 3 yrs. old -Spawn late May – early September	-Low-velocity, turbid water in large rivers and the lower reaches of tributaries. Substrates from sand to mud and silt -Spawning observed over sandy lake shoals or creek mouths. Place of spawning apparently depends on current strength, depth, and availability of underwater objects to lay eggs on	-Feeds at or near surface, on insects and emerging insect larvae, plankton, and even small fish and drifting fish eggs. -Males select crevices among boulders, the bark of fallen trees, etc., as spawning territories	1, 3, 5
Spottail shiner	*Notropis hudsonius*	Egg				1
		Juvenile			-Feed on planktonic crustaceans and some algae	5
		Adult	Spawn spring and early summer	-Lakes, larger streams, and rivers. In streams and rivers, prefers marginal water with little or no current. Most often associated with weed beds -Variety of substrates, but most common over gravel, sand, or sandy silt in weed beds. -Spawns over sandy shoals – gravel substrate. Both lakes and streams, sometimes in mouths and lower reaches of tributary streams		1, 5
Stonecat	*Noturus flavus*	Egg				1
		Juvenile				1
		Adult		-Can be abundant both in main stems of large rivers and in their tributaries. Also	-Mainly a benthic, nocturnal feeder, feeding on aquatic insects, with caddis	1,5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
				present in lakes near sand and gravel bars where there is wave action -Usually substrate of coarse gravel to boulders -Interstitial spaces among stones in runs and riffles -Spawn in streams or shallow, rocky areas of lakes	fly larvae being the most frequent food item -Males excavate or clean a nest and tend it after spawning. Nest under cover such as stones -Suitable temperature for spawning is >23°C	
Tadpole madtom	*Noturus gyrinus*	Egg				1
		Juvenile				5
		Adult	Spawn in July	-Quiet, clear, protected water, in dense stands of aquatic vegetation. -Substrates of mud or silt -Most common in tributaries to the larger rivers. -Usually spawn in rivers but to a lesser extent in lakes in shallow water	-Benthic, feeding on amphipods and crustaceans -Nests under cover, male guards nest. No post-hatching parental care. -Females may spawn several times, likely with different males	1, 5
Trout-perch	*Percopsis omiscomaycus*	Egg				1
		Juvenile				1
		Adult	Prolonged spawning period, from early spring into summer (up to 4 months). Observed in May in MB	-Lives primarily in lakes, in deeper water during the day, only moving into shallow waters at night. -Found in shallow, sometimes turbid streams in Manitoba, Saskatchewan, and possibly in Alberta and the Northwest and Yukon territories. Associated with rocky substrates. Abundant in the south basin of L Winnipeg in the nearshore benthic habitat -Shallow, rocky streams, shallow water of lakes over sand, gravel, or bedrock substrate	-Feed on or near the bottom, mostly on aquatic invertebrates, but very large individual may take the fry and eggs of other fish -Broadcast spawners, depositing non-adhesive eggs over substrate. Eggs fall into crevices among the rocks	1,5
Walleye	*Sander vitreum*	Egg	Hatch in 26 days at 4.4°C, 14-21	-Clean gravel or cobble substrates, or mats of vegetation -Require rising or stable water depths	-High mortality can be caused by siltation, fluctuations in water temperature or heavy wave action	1,2

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			days at 8-15°C	and areas with current	- Suitable temperature 2-18°C, with 9-15°C being optimal	
		Larvae	-Absorb yolk sac in 3-5 days -Disperse with current 10-15 days after hatching	-In shallow shoreline areas before dispersing	- Suitable temperature17-24°C with 22°C being optimal and will not feed if under 15°C	2
		Juvenile		-Deep or turbid water near bottom or under overhead cover to avoid light	-Start feeding on plankton, shifting to larger invertebrates -Need <10°C chill period for gonad maturation, males mature in 2-4 years, females in 3-8 years - Suitable temperature 16-28°C with 20-25°C being optimal	2, 5
		Adult	Spring spawner, shortly after ice breakup - April-late May	-Large shallow mesotrophic, turbid lakes and rivers are most suitable habitat -Primarily in deeper water in the day, moving inshore to feed at night -Overwinter in deeper waters with little or no current over a gravel-cobble substrate -Spawn in lakes or streams. Shallow waters along shorelines, shoals, riffles, and dam faces, over areas with clean gravel-cobble substrate with good water circulation. Also known to use flooded vegetation in some areas (Red River main stem and trib. (Cook's Creek, Rat and Roseau Rivers)).	-High levels of activity during times of ice breakup and freeze-over - Suitable temperature for growth is 13-25°C with 20-25°C being optimal -Spawn annually, spawning stream homing behavior has been observed - Suitable temperature for spawning is >4°C	1, 2, 5
Western blacknose dace	*Rhinichthys obtusus*	Egg		-Shallow water with a gravel substrate	- Suitable temperature is ~21°C	1
		Larvae	About 5 mm at hatching		-Benthic feeders, on aquatic insect larvae and some plant material	1,5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
		Adult	Spawn late spring and into summer	-Clean, swift flowing streams with a gravel substrate Also in inshore waters of lakes over gravel or boulder substrate -Spawn in shallow riffles over a coarse sand – gravel substrate (particle sizes <5cm)	-Suitable temperature for spawning is 9-18°C	1,5
White bass	*Morone chrysops*	Egg	Hatch in 46hrs at 15.6C	-Firm, sand substrate or vegetation. Become attached to gravel, boulders, or vegetation on the bottom	-Suitable temperature is 15.6-21.6°C	1, 2
		Larvae	Yolk-sac absorbed in 8 days	-Drift downstream to a reservoir, lake, or a riverine backwater	-Suitable temperature is 10-32°C	1, 2
		Juvenile		-Move into sandy shoals or littoral areas at night to feed	-Growth strongly correlated with temp, and insect and forage fish availability -Suitable temperature 12-30°C	1, 2, 5
		Adult	Spawn in early - mid-July	-Shallow, highly productive lakes and larger, slow-flowing rivers -Spawn in rivers and lakes (L Winnipeg, lower Red and Winnipeg rivers, Icelandic River, Manigotagan River). Hard bottoms ranging from sand to boulders and bedrock outcrops	-Feed mainly on emerald shiners in MB. Various fish such as yellow perch, bluegills, carp, black crappies in other areas -Suitable temperature for growth is 12-30°C and 30-34°C in summer -Prefer deep water as this reduces turbidity problems and provides a heat storage reservoir during the winter -. Attach to bottom -Suitable temperature for spawning 14.4-21.1°C	1, 2, 5
White crappie	*Pomoxis annularis*	Egg	Hatch in ~4 days, with a range of 2-4.5 days depending on temp		Adhere to substrate and to one another	1
		Larvae	Remain on nest for short time period, in some cases			1

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			only 4 days elapse from start of hatching to departure of young			
		Juvenile			-Feed on plankton	1, 5
		Adult	Spawn May - June, for approximately a 29-day period	-Lakes and rivers. Found over a variety of substrates from mud or silt to gravel. Most often, found in or near cover such as submerged wood -Spawn in areas with rooted plants or algae usually beside or in the nest. At times, nests are established in the protection of undercut banks	- Are a schooling fish and feed on aquatic insects and fish -Nests cleaned or excavated in finer grained substrates than most centrarchids use. Males guard nest and fan eggs - Suitable temperature for spawning is 16-20°C	1, 5
White sucker	*Catostomus commersoni*	Egg	Experimentally hatch in 8-11 days at 10 to 15°C	-Shallow water with a gravel substrate	-Suitable temperature is 7-15.5°C	1, 2
		Larvae	Remain in gravel for 1-2 weeks, then migrate downstream about a month after spawning began	-Gravel substrate for first two weeks	-Migrate downstream at night	1, 2
		Juvenile	May remain in spawning stream for 5 months or more			1, 2
		Adult	Early spring (mid- to late April). May	-Warm shallow lakes and bays, ponds, bogs, streams, and large rivers. Pools below riffles	-Feed on benthic invertebrates, with most feeding at dawn and dusk -Lake fish grow larger than river fish. In	1, 2

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
			be protracted until June	-Benthic over a variety of substrates, but mostly over sand, silt and mud substrates -Often overwinter in streams and move upstream after ice breakup -Spawn in shallow water with a gravel bottom, although can vary from sand to boulders. Usually in streams but occasionally on lake margins or stream mouths	MB, appears to be slow-growing resident headwater populations in some streams (Brokenhead R., Cypress R., Roseisle Cr.) associated with bogs -Suitable temperature for growth is 11.8-20.6°C -Group spawners, 1 female with 2-4 males, eggs are scattered, no nest is built -Individuals spawn in same stream every year. Most spawning occurs at dawn and dusk -Suitable temperature for spawning is >10°C	
Yellow perch	*Perca flavescens*	Egg	Hatch in 6 days at 20°C and 50 days at 5-6°C	-Aquatic rooted vegetation or flooded terrestrial vegetation, also rocks, sand or gravel substrate	- Suitable temperature is 7-20°C	1, 2
		Larvae	Move into open water in 2 months	-Littoral zone, over sand, silt, rock or gravel substrates	-Pelagic larvae - Suitable temperature is 3-28°C, with 10-20°C being optimal	2
		Juvenile		-Shoreline areas in lakes and rivers with moderate vegetation over a mud, sand, or gravel substrate	-Often found in mixed schools with other species, such as cyprinids -Rapid growth in young fish, females grow faster and larger than males -Suitable temperature is 17-26°C with 20-23°C being optimal	1, 2
		Adult	Spring spawners - May - June	-Shoreline areas of clear lakes, also in large slow moving rivers with moderate amounts of vegetation -Deeper waters in lakes -Spawn in aquatic vegetation or flooded terrestrial vegetation in sheltered areas with little current	-Opportunistic feeder, taking a wide variety of invertebrates and fish -Primarily active during the day, move up or down in water column depending on light levels - -Suitable temperature for growth is 11-25°C -Active during the winter -Migrate into tributaries and shallow areas of lakes to spawn -Suitable temperature for spawning is	1, 2, 5

Appendix B-1: Life Stage Information for Fish Species Potentially Found in the RAA

Common Name	Scientific Name	Life Stage	Timing	Suitable habitat	Comments	Ref.
					>6°C	

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