MANITOBA – MINNESOTA TRANSMISSION PROJECT
Environmental Impact Statement

ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS ON FISH AND FISH HABITAT

CHAPTER 8
SEPTEMBER 2015

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ABBREVIATIONS AND ACRONYMS

AHCD	Assiniboine Hills Conservation District
AMP	Access Management Plan
ATK	Aboriginal traditional knowledge
CCME	Canadian Council of Ministers of the Environment
CD	Conservation District
CEAA 2012	*Canadian Environmental Assessment Act, 2012* (S.C. 2012, c. 19, s. 52)
CEC	Clean Environment Commission
CEnvPP	Construction Environmental Protection Plan
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
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
ESS	environmentally sensitive site
FIHCS	Fish 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
MESEA	*The Endangered Species and Ecosystem Act* (C.C.S.M., c. E111) (Manitoba)
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
PEP	public engagement process
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* (S.C. 2002, c. 29)
SLTC	Southern Loop Transmission Corridor
SOCC	species of conservation concern
SOP	standard operating procedure
SRRCD	Seine-Rat River Conservation District
SVTC	St. Vital Transmission Complex
TDR	Technical Data Report
TSS	total suspended solids
µS/cm	microsiemens per centimeter
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* (R.S.C. 1985, c. F-14)
Allochthonous	Material imported into an ecosystem from outside of it, including leaves that fall or are washed into the water, and branches and trees that topple into the stream
Benthic	The ecological area at the deepest level of a waterbody, such as a lake or river, including the sediment surface and biologically inhabited sub-surface layers
Benthic invertebrate	An animal lacking a backbone, which lives on, or in, the bottom sediments of a watercourse or waterbody (*e.g.*, mayfly, clam, aquatic earthworm, crayfish)
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* (R.S.C. 1985, c. F-14)
Commercial, Recreational, and 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 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 waterbodies that contain CRA fisheries, or may reside in waterbodies that are connected by a watercourse to such waterbodies.
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* (S.C. 2002, c. 29)

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* (R.S.C. 1985, c. F-14), fish includes: a) parts of fish b) shellfish, crustaceans, marine animal 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* (R.S.C. 1985, c. F-14)
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* (R.S.C. 1985, c. F-14)
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 considerable portion of the diet of 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 land

Indicator species	Includes large-bodied species with commercial, domestic or sport fishery value; also includes any fish listed in Schedule 1 of the *Species at Risk Act* (S.C. 2002, c. 29) (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 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* (R.S.C. 1985, c. F-14)
Periphyton	A combination of algae, cyanobacteria, heterotropic microbial organisms, and decomposing organic matter that is attached to most 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* (R.S.C. 1985, c. F-14)
Riparian	Refers to terrain, vegetation or simply a position adjacent to or associated with a watercourse, waterbody or flood plain
Serious harm	The death of fish or any permanent alteration to, or destruction of, fish habitat as defined in the *Fisheries Act* (R.S.C. 1985, c. F-14)
Simple habitat	Linear channel having a trapezoidal cross-section, with a fine, uniform substrate and grassed banks or dikes (Milani 2013)

Species at risk	An extirpated, endangered or threatened species or a species of special concern, as defined by the *Species at Risk Act* (S.C. 2002, c. 29)
Species of conservation concern	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* (C.C.S.M., c. E111), 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	Watercourse that 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 or SOCC); flows are intermittent or perennial (Milani 2013)
Type B Habitat	Watercourse that 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 or SOCC); flows are intermittent or perennial (Milani 2013)
Type C Habitat	Watercourse that 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	Watercourse that 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)

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.
Watercourse	A channel that conveys flowing water for at least part of the year, such as a river, brook or creek

8 Assessment of Potential Environmental Effects on Fish and Fish Habitat

8.1 Introduction

Manitoba Hydro is proposing construction of the Manitoba–Minnesota Transmission Project (MMTP, or the Project), which involves the construction of a 500 kilovolt (kV) AC transmission line in southeastern Manitoba. The transmission line would originate at the Dorsey Converter Station northwest of Winnipeg, continue south around Winnipeg and within the Existing Transmission Corridor (Existing Corridor), the Southern Loop Transmission Corridor (SLTC) and the Riel–Vivian Transmission Corridor (RVTC), to just east of Provincial Trunk Highway (PTH) 12. The transmission line then continues southward on a New Right-of-way (New ROW) across the rural municipalities of Springfield, Tache, Ste. Anne, La Broquerie, Stuartburn and Piney to the Manitoba–Minnesota border crossing south of the community of Piney. The Project also includes the construction of terminal equipment at the Dorsey Converter Station, electrical upgrades within the Dorsey and Riel converter stations, and modifications at the Glenboro South Station requiring realignment of transmission lines entering the station.

Based on the above description, the assessment of the Project is divided into three components:

- transmission line construction in the Existing Corridor, extending from Dorsey Converter Station to just east of PTH 12
- transmission line construction in a New ROW, extending south from the Anola area to the border by Piney
- station upgrades—at Glenboro South Station, Dorsey Converter Station and Riel Converter Station—and transmission line realignment work at Glenboro South Station

Because there were no proximate watercourses identified within 30 m of Dorsey Converter Station, Riel Converter Station or Glenboro South Station, an assessment of effects on fish and fish habitat was not carried forward for these stations.

The process of selecting valued components (VCs) relied on input from regulators, First Nations, Metis, public, stakeholders and the professional judgment of the assessors. Fish and fish habitat is defined as a VC based on legislated requirements and interests expressed during the public and First Nation and Metis engagement processes.

Fish and fish habitat is selected as a VC because of its fundamental role in the functioning of natural ecosystems with fish as key indicators of aquatic health and its economic and recreational importance to Canadians. Changes in the distribution or occurrence of fish or fish habitat may strongly affect ecosystem function and environmental cycles and the ability of other organisms,

including humans, to use and benefit from this natural resource. Fish and fish habitat are valued by First Nation and Metis, recreational and commercial users, and the general public for social, recreational, commercial and spiritual reasons. In addition, fish and fish habitat (specifically commercial, recreational and Aboriginal [CRA] fisheries), are protected under the federal *Fisheries Act* (R.S.C. 1985, c. F-14).

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 fish and forage fish that support these fisheries. Aboriginal fishery species are those fish caught by Aboriginal organizations or members for food, social or ceremonial purposes or for purposes set out in a land claims agreement. The definition of fish includes both fish and shellfish (*e.g.*, molluscs) during all of their life stages (egg, sperm, spawn, larvae, spat, juveniles). 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).

The Project is located predominantly within the Red River Basin, where fish habitat has been historically affected by agricultural activity. Channelized waterways and constructed agricultural drains with poor quality riparian vegetation are prevalent in areas under crop production. The Project crosses two major watersheds, the Assiniboine River Basin and the Red River Basin, and seven sub-watersheds, including the Lower Assiniboine, La Salle River, Red River, Seine River, Cooks Creek/Devils Creek, Rat River and Roseau River (Map 8-1 – Sub-Watersheds). The transmission line crosses 75 watercourses, including rivers, streams, creeks and agricultural drains; 31 of these watercourses are potentially fish-bearing waters, inhabited by a possible nine aquatic species of conservation concern (SOCC).

8.1.1 Regulatory and Policy Setting

A list of the various regulatory requirements that were considered in developing this environmental impact statement (EIS) can be found in the Project description (Chapter 2, Section 2.3). Particular consideration was given to the following federal and provincial legislation and guidelines in the preparation of this environmental assessment:

- the Project Final Scoping Document, issued on June 24 2015 by Manitoba Conservation and Water Stewardship's Environmental Approvals Branch, which represents the Guidelines for this EIS;

- the relevant filing requirements under the *National Energy Board Act* (R.S.C., 1985, c. N-7), and guidance for environmental and socio-economic elements contained in the NEB Electricity Filing Manual, Chapter 6; and
- the *Canadian Environmental Assessment Act, 2012* (S.C. 2012, c. 19, s. 52) and its applicable regulations and guidelines.

8.1.1.1 Additional Federal Guidance

8.1.1.1.1 Fisheries Act

The federal *Fisheries Act* (R.S.C. 1985, c. F-14) provides the basis for the protection of CRA fisheries. This is supported through Fisheries and Oceans Canada's (DFO) Fisheries Protection Policy Statement (2013a) which provides information to manage threats to the sustainability and productivity of Canada's CRA fisheries. This policy indicates that decision-making is guided by the application of precaution and a risk-based approach. It applies to projects and activities in or near water.

Section 35(1) of the Act prohibits any work, undertaking or activity that results in serious harm to fish that are part of a CRA fishery, or to fish that support such a fishery, unless authorized under section 35(2) of the Act. Serious harm to fish is defined as the death of fish or any permanent alteration to, or destruction of, fish habitat.

A fishery is an 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. Fish that "are part of" a CRA fishery are those fish that are within the scope of federal or provincial fisheries regulations 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 waterbodies that contain CRA fisheries, or may reside in waterbodies that are connected by a watercourse to such waterbodies.

8.1.1.1.2 Species at Risk Act

The *Species at Risk Act* (S.C. 2002, c. 29) (*SARA*) provides the basis for the protection of species at risk (SAR). Endangered, threatened and species of special concern fish that are protected federally by SARA are listed in Schedule 1 of the Act. The purposes of SARA are to:

"prevent wildlife species in Canada from disappearing, to provide for the recovery of wildlife species that are Extirpated (no longer exist in the wild in Canada), Endangered, or Threatened as a result of human activity, and to manage Species of Special Concern to prevent them from becoming Endangered or Threatened."

Those species listed as Endangered or Threatened in Schedule 2 or 3 are not yet protected under SARA.

8.1.1.1.3 Memorandum of Understanding between NEB and DFO

While the implementation of the *Fisheries Act* (R.S.C. 1985, c. F-14) and the protection of aquatic SAR are the mandate and responsibility of DFO, under the recent Memorandum of Understanding between the NEB and DFO, the NEB assesses potential effects of regulated power line transmission projects on fish or fish habitat and aquatic SAR (NEB 2013). If the NEB determines that a project could result in serious harm to fish or fish habitat, or adverse effects on SAR, the NEB will notify DFO and the proponent that a *Fisheries Act* authorization or a SARA permit may be required. If required, Manitoba Hydro will apply for an authorization for this Project, which the NEB will review prior to its submission to DFO (NEB 2013).

It is anticipated that a *Fisheries Act* authorization will not be required for the Project.

8.1.1.2 Additional Provincial Guidance

8.1.1.2.1 The Endangered Species and Ecosystems Act

Endangered species are protected provincially under *The Endangered Species and Ecosystems Act* (C.C.S.M., c. E111) (MESEA). The purposes of this Act are (a) to ensure the protection, and to enhance the survival of, Endangered and Threatened species and Species of Special Concern in the province; (b) to enable the reintroduction of Extirpated species into the province; and (c) to conserve and protect Endangered and Threatened ecosystems in the province and promote the recovery of those ecosystems. The Threatened, Endangered and Extirpated Species Regulation (M.R. 25/98) lists plants and wildlife considered Threatened, Endangered and Extirpated in the province.

THE CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT (1999) AND *THE WATER PROTECTION ACT*

Surface water quality is managed according to federal guidelines and provincial standards, objectives and guidelines. The Canadian Council of Ministers of the Environment (CCME 1999) maintains guidelines for the protection of aquatic life for many water quality parameters. These guidelines are generally applied in environmental assessment to mitigate project activities so that the CCME (1999) guidelines are not exceeded, where it is considered technically and economically feasible to do so. The water quality of watercourses in Manitoba is protected under *The Water Protection Act* (C.C.S.M. c. W65) through the Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG) (MWS 2011).

8.1.2 Engagement and Key Issues

The public engagement process (PEP) for the Project aided in identifying fish and fish habitat features located on private property, such as water retention projects sponsored by local Conservation Districts, private fish ponds and creeks. The location of identified fish and fish habitat features on private land was noted early in the Project for routing consideration. An ongoing conservation project being conducted by the Seine-Rat River Conservation District (SRRCD) on Fish Creek, was identified based on information received during the engagement process.

In addition, stakeholders identified individual watercourses as important to them: the Red, Seine, Roseau, Rat and English rivers and Fish Creek. Characterization of the baseline environment, conducted as part of the environmental assessment process, has identified watercourse crossings on the Red River, the Assiniboine River, the Seine River and one of its unnamed tributaries, Cooks Creek, Edie Creek, the Rat River and Pine Creek as crossings with high habitat sensitivity (Table 8-7; Section 8.4.5; Map 8-2 – Stream Crossings). Prescribed mitigation measures have also been established (Sections 8.5.2.2 and 8.5.3.2), including a minimum 30 m setback from waterbodies.

Concern regarding the number of times a watercourse will be crossed and an interest in avoidance of waterbodies was raised during engagement. However, stakeholders assigned a low to moderate importance to their general concern regarding watercourse crossings and area of riparian vegetation affected by development, with the heavily regulated nature of development within these areas noted by stakeholders as a mitigating factor. Stakeholders also identified a potential opportunity to direct the route onto, or adjacent to, provincial drains, particularly in agricultural areas. The number of watercourse crossings was included as criteria in the route determination process and reduced, where possible. Linear features, including roads, rail and transmission lines, were identified as routing opportunities in the route selection process to be taken advantage of; however, paralleling smaller provincial drains was noted as technically difficult.

The Pine Creek Hutterite Colony expressed an interest in routing the Project to follow a creek near their property. The Project has been routed to accommodate these concerns along Pine Creek, which borders the Colony's property.

The community reports from Peguis First Nation (Peguis First Nation – Whelan Enns Associates Inc. 2015; Peguis First Nation; Lloyd Stevenson 2015) and Roseau River First Nation (Roseau River Anishinabe First Nation 2015) provided information on fishing activities within the Project area. Watercourses used for fishing and travel were identified. A review of existing data on Metis traditional land use within the Project area reported that fishing near the confluence of the Red and La Salle rivers has historically been important. Fish were abundant there, and species fished included burbot (*Lota lota*), jackfish (northern pike, *Esox lucius*), carp (*Cyprinus carpio)* and catfish (*Ictalurus punctatus)* (North/South Consultants 2014). This was incorporated into the assessment as areas that support CRA fisheries and that are within the scope of the federal

Fisheries Act (R.S.C. 1985, c. F-14). Peguis fishing activities were described to occur year around, with angling and net fishing being the most common methods. Roseau River First Nation stated their activities are practised as sport because it is thought that the rivers are contaminated with poisons such as mercury (*i.e.,* any fish that are caught are not consumed). It was also noted that a decrease in fish spawning has been observed over the last decade (Roseau River Anishinabe First Nation 2015).

The Whitemouth River Natural Watershed Area, located within the Route Planning Area in which alternative transmission line routes for the preferred route were evaluated, was identified by the Nature Conservancy of Canada as an important area for biodiversity. This watershed is the only habitat in Manitoba for carmine shiner (*Notropis percobromus*), a threatened fish species (COSEWIC 2006a; DFO 2013c). The Final Preferred Route is not located in the vicinity of the Whitemouth River Natural Watershed Area; therefore, potential interaction has been avoided through routing.

During Round 3 of the PEP, a candidate ecological reserve was flagged for Manitoba Hydro by Manitoba Conservation and Water Stewardship (MCWS); the Assiniboine River Clam Beds. This is a 100 ha area of river within Beaudry Park that contains eleven of the twelve species of clam, including the mapleleaf mussel (Manitoba Conservation Parks and Natural Areas Branch [MCPNAB] 2014).

8.2 Scope of Assessment

8.2.1 Spatial Boundaries

The following spatial boundaries were used to assess environmental effects from the Project and cumulative environmental effects on fish and fish habitat:

- **Project development area (PDA):** encompasses the Project footprint and is the anticipated area of physical disturbance associated with the construction and operation and maintenance of the Project (Map Series 7-100 - Project Development Area).in the vicinity of the fish-bearing watercourse crossings (Map Series 8-100 – 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 (Map Series 8-100 – 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 Alberta guidelines address the information requirements for a full review pursuant to the *Fisheries Act* (R.S.C. 1985, c. F-14).

- **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 relevant to the Project are likely to occur. This includes portions of a watercourse or waterbody 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 (Map 8-1 – 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 aquatic health.

8.2.2 Temporal Boundaries

The assessment addresses potential effects during Project construction, operation and maintenance. The Project construction schedule is provided in the Project description (Chapter 2). Subject to regulatory approval, construction of the transmission lines will commence in 2017 and continue until 2020; modifications to the Dorsey Converter Station, Riel Converter Station and Glenboro South Station will span the period between Q3 2017 and Q4 2019. The in-service date of D604I is expected to be 2020. The service life is expected to be at least 100 years.

Temporal considerations for fish include those within the life cycle of an individual fish species. Work adjacent to watercourses that provide fish habitat can be restricted to certain periods within the year to avoid effects on fish during the most sensitive part of their lifecycles (*i.e.* during reproduction and early development stages of juveniles). Within fish populations, temporal considerations vary depending on the species. If there were effects on an entire year class (*i.e.* fish spawned in the same year), the implication would be more serious for a fish species with a short lifespan. Fish with lifespans of many years would have adults of other year classes to contribute to the productivity of the population. A population of short-lived species with only one spawning season could result in serious harm if a year class is affected. Other lifecycle factors to consider, particularly in long-lived species, include the age at which the fish matures and their frequency of spawning. For example, lake sturgeon take up to 30 years to mature and reproduce

every 2–6 years (Scott and Crossman 1998; MCWS 2012). This makes them susceptible to population effects.

8.2.3 Learnings from Past Assessments

Public feedback and regulatory recommendations received for the Bipole III Transmission Project environmental assessment conducted by Manitoba Hydro has shaped the fish and fish habitat assessment for this Project. This information was used to better inform the assessment process; demonstrating Manitoba Hydro's commitment to continual improvement and sustainable development.

In their *Report on Public Hearing for the Bipole III Transmission Project*, the Manitoba Clean Environment Commission (CEC) stated that the new environmental assessment process:

"must, at a minimum, address: use of traditional and local knowledge, selection of appropriate valued environmental components, establishment of baseline conditions, and establishment of thresholds in the conduct of environmental assessments" (Manitoba CEC 2013).

Traditional knowledge was used in the fish and fish habitat assessment to identify watercourses that support CRA fisheries within the Project area. Information on fish species that inhabit these watercourses was also provided. A list of Aboriginal traditional knowledge (ATK) reports referenced in this chapter can be found in Section 8.3.1.1.

Change in Fish and Fish habitat was selected as a VC to reflect the primary potential effect that the Project could have on the aquatic environment through clearing of riparian habitat and increased sedimentation. The assessment of the VC measures change in fish mortality or health and changes in fish habitat, corresponding to section 35 of the *Fisheries Act* (R.S.C. 1985, c. F-14), which prohibits serious harm to fish that are part of, or support, a CRA fishery.

Feedback from the Keeyask Generation Project assessment indicated that temporal and spatial boundaries selected for that project were challenged by intervenors as being insufficient. The spatial boundary used for previous cumulative effects assessments has been previously identified as too small or project-centered rather than VC-centered (Luttermann 2013).The temporal boundary of this EIS encompasses trends in fish and fish habitat, specifically the role of agricultural conversion in the channelization of natural waterways and the construction of artificial drainages in the Red River Valley since the 1880s. Additionally, a broad, VC-centered RAA spatial boundary was selected to assess cumulative effects on fish and fish habitat (*i.e.*, sub-watersheds crossed by the Project).

8.3 Methods

8.3.1 Existing Conditions 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 instream work (Section 8.4.4).

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 8-1).

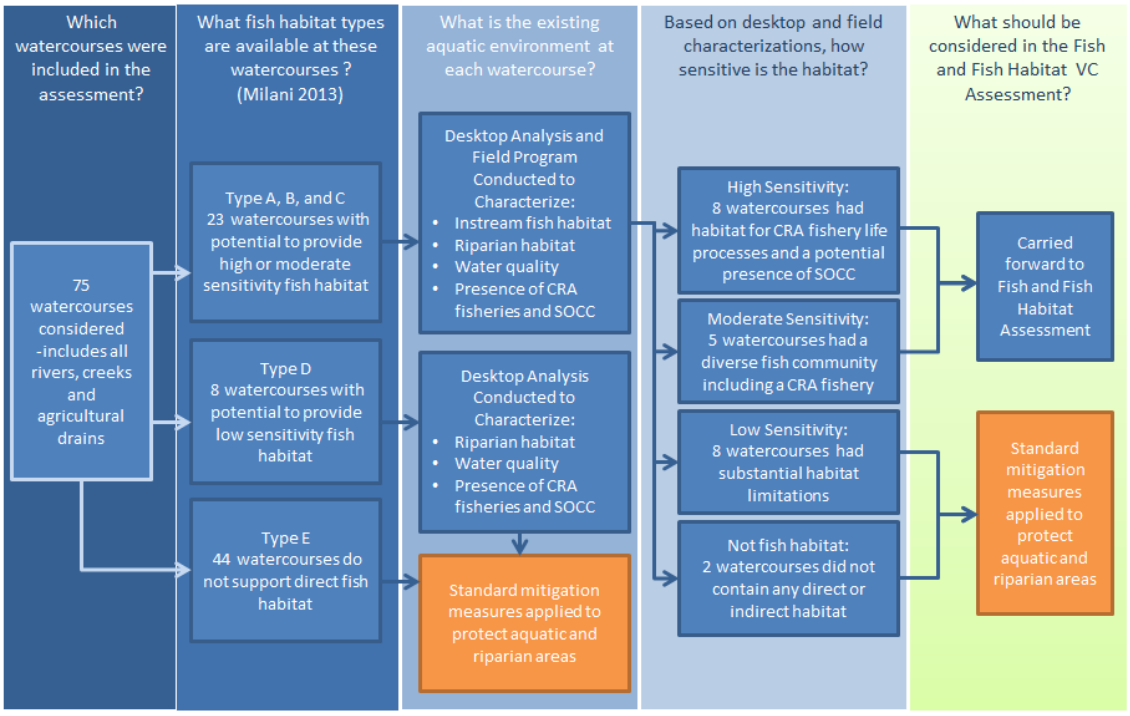

Figure 8-1 Decision Process for Water Crossing Assessment

8.3.1.1 Sources of Information

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

- Government information sources:
    - Manitoba Conservation and Water Stewardship Fish Inventory and Habitat Classification System (FIHCS)
    - Manitoba Conservation and Water Stewardship water quality monitoring data
    - Manitoba Conservation Data Centre
    - Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2014)
    - Species at Risk Public Registry (Government of Canada)
    - City of Winnipeg's Small Streams Survey Monitoring Reports for water quality (2007-2014)
    - 2014 Manitoba Anglers' Guide Government of Manitoba
    - MESEA
    - 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 and Watkinson 2004)
    - A Fish Fauna and Habitat Quality Study of the Seine River, Manitoba (Gaudet 1997)
- Watershed reports and integrated watershed management plans (IWMPs):
    - 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)

Conservation Districts (CDs) are formed as a partnership between the province and local municipalities to protect, restore, and manage land and water resources on a watershed basis. There are four CDs in the RAA: the SRRCD, Cooks Creek CD, La Salle-Redboine CD and Assiniboine Hills CD (AHCD). Where established, CDs lead the development and implementation of Integrated Watershed Management Plans (IWMPs) within their districts. The purpose of the IWMPs is to set programming agendas and direct funds to watershed priority projects. The information and recommendations in the IWMP are intended to facilitate sustainable development and restoration plans by local municipalities and planning districts. The IWMPs for the RAA contains information on watershed and riparian vegetation management issues for those areas. There is good coverage of the PDA by CDs, with the exception of the Piney, Manitoba area (Map 8-3 – Conservation Districts). While the Assiniboine Hills CD is included in the RAA, Project activities in the AHCD are limited to work at the Glenboro South Station and will not involve work within 30 m of a watercourse. IWMPs are available for the Seine River, Rat-Marsh River, Central Assiniboine and La Salle River watersheds. Plans have been initiated, but not yet completed, for the Cooks-Devils Creek Watershed. There is less existing watershed information available for desktop studies in areas not covered by a CD or areas without an IWMP.

- 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 Project 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)

8.3.1.2 Desktop Analysis

A review was conducted of existing fish and fish habitat data for the Project area. Based on a review of desktop mapping, 75 watercourse crossings were identified within the Project PDA. Additionally, the three station sites, Dorsey Converter Station, Riel Converter Station and Glenboro South Station, 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 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 (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 8.3.2.1.1). 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 watercourses, and were carried forward to the field program for further assessment (Figure 8-2). An additional eight Type D Habitat and 44 Type E Habitat watercourses were identified.

Based on a review of aerial imagery and riparian land cover classes (summarized in the Vegetation and Wetlands Technical Data Report), all Type D Habitat watercourses were characterized as likely providing low sensitivity habitat (as defined in Section 8.3.2.1.1) Additionally, by definition, Type E Habitat watercourses do not support direct fish habitat. Therefore, an assessment of effects on fish and fish habitat was not carried forward for Type D and E habitat watercourses. Project-associated practices and standard prescribed mitigation measures for working around water will apply to these crossings (Figure 8-1) (Sections 8.5.2.2 and 8.5.3.2).

A list of fish species (Table 3-3, Fish and Fish Habitat Technical Data Report [TDR]), including SOCC, which could potentially inhabit watercourses crossed by the Project was compiled during a desktop review of government information sources, primary scientific literature and publications and watershed reports. If available, information regarding changes in fish 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 2014a), the City of Winnipeg's Small Stream Water Quality Survey (2013, 2014), Manitoba Water Stewardship's Water Science and Management Branch long-term water quality monitoring data (MCWS 2014b), and Environment Canada's Hydrology website (Government of Canada Water office 2014). A data review was also conducted of the most recent watershed management reports available within the RAA (Section 8.3.1.1).

Information relating to the groundwater pathway and methodology is included in the Physical Environment: Groundwater TDR, and Chapter 16 – Land and Resource Use.

8.3.1.3 Key Person Interviews

- Chris Friesen, Biodiversity Manager at the Manitoba Conservation Data Centre provided data on recorded locations of aquatic SOCC that have been identified throughout the RAA.
- As part of the Project's ATK studies, participants from Black River First Nation, Long Plain First Nation and Swan Lake First Nation took part in memory mapping sessions, community meetings and Elder gatherings, which provided information on fishing activities and locations to further inform the assessment.

8.3.1.4 Field Studies

Watercourse crossings were selected for detailed field assessment based on their DFO ranking as described in Milani (2013). Field assessments were performed at watercourses that crossed the preferred route and were designated to support fish habitat Types A, B, and C (Map 8-2 – Stream Crossings). Field studies were conducted between September 15 and October 28, 2014 to characterize fish habitat within the LAA, to establish in-water and riparian environment conditions, and to conduct water quality measurements at each of the selected 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.

In the absence of Manitoba guidelines, the *Alberta Fish Habitat Manual* (Alberta Transportation 2009) was used as a guideline for watercourse categorization. Each watercourse was categorized in terms of size and flow regime as follows:

- 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

Where a watercourse was present, fish habitat assessments were conducted as outlined by standard operating procedures (SOPs) (Stantec 2014). This SOP for aquatic assessment was adapted from Alberta's *Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body* (Alberta ESRD 2013), and the associated guide (AENV 2001). 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 *Fisheries Act* (R.S.C. 1985, c. F-14).

Habitat requirements of fish species suspected to occur in the RAA and presence of potential fish migration barriers were considered when assessing habitat quality at each site. Sites defined as NDC were photographed, but limited data were collected at these locations because of a lack of fish habitat (e.g., water too shallow, no defined channel).

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 a sample obtained at a single point in time will not characterize a watercourse, long-term (2002 to 2014) ranges for surface water quality parameters were determined through desktop data for larger watercourses. Field and desktop data were combined and ranges expressed as minimum, median and maximum values for each water quality parameter (Fish and Fish Habitat TDR) and compared to applicable provincial and federal water quality guidelines for the protection of aquatic life (MWS 2011; CCME 1999).

8.3.1.5 Addressing Uncertainty

Some uncertainties remain in this assessment as a result of the following:

- 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. Multiple sources were researched to find the most current data available, and field assessments were conducted to ground-truth and fill data gaps.
- Fish sampling was not conducted as part of the field assessment so fish presence data were sourced from desktop historical data. Recent fish species data are available (Milani 2013; Manitoba Integrated Watershed Management Plans) and additional data were provided through key person interviews as part of the Project's ATK studies.
- A one-time field survey was conducted rather than a multi-season survey. Desktop historical data were compiled with field survey data to expand the temporal scale.
- Type D Habitat watercourse crossings were assessed only by aerial imagery review and land cover classifications (Vegetation and Wetlands TDR). Based on the review of these data, all Type D Habitat watercourses were characterized as likely providing low sensitivity habitat.
- Type E Habitat watercourses were not considered to provide fish habitat. By definition, Type E Habitat watercourses are not direct fish habitat and, therefore, additional desktop surveys were determined to be unnecessary.

- The Final Preferred Route crossing of Fish Creek is more than 20 km from the field-assessed Project crossing location. Based on aerial imagery and land cover data provided in Chapter 10 – Vegetation and Wetlands, the surrounding land cover and riparian vegetation at the preferred crossing location of Fish Creek was similar to or lower quality than at the field-assessed crossing location. This is reflected in the DFO assessment (Milani 2013); the field-assessed crossing is characterized as Type B Habitat for fish, and the preferred crossing location is a Type C Habitat watercourse. Data extrapolated from the field-assessed crossing location would be conservative for the new 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. Aerial imagery, land cover data and data from the downstream assessments of these two sites were extrapolated to predict existing conditions at the watercourse crossings.
- A Type C Habitat watercourse 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. Aerial imagery and field observations northeast of the preferred crossing location suggest that it is within a bog that is likely accessible only under frozen conditions. The watercourse crossing is characterized based on existing data sources (*i.e.,* Milani 2013).

8.3.2 Assessment Methods

The overall environmental effects methods are presented in Chapter 7. The specific techniques used to carry out the assessment for the present VC are presented in this section. They include:

- assessment approach
- potential environmental effects, effect pathways and measureable parameters
- environmental effects description criteria for the VC
- significance thresholds for residual environmental effects

8.3.2.1 Assessment Approach

8.3.2.1.1 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* (R.S.C. 1985, c. F-14), based, in part, on the sensitivity of a watercourse. An updated version of the framework that addresses the changes made to the *Fisheries Act* (R.S.C. 1985, c. F-14) has not been released, but the framework in the existing Practitioners Guide was still considered as a useful assessment tool. Following review of existing information and field surveys, the sensitivity of fish and fish habitat in Project watercourse crossings were ranked using criteria adapted from the Guide (DFO 2006).

Each of the 23 watercourses that were carried forward to the field program were assigned habitat sensitivity rankings based on 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
- 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)
- 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
- 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

The assessment of potential effects, including the risk to fish and fish habitat, resulting from Project-related activities was conservatively based on the criteria for moderate to high sensitivity watercourses. Project-related activities, the resulting potential effects on fish and fish habitat, and relevant mitigation measures are described in Section 8.5.

8.3.2.1.2 Measuring Change in Riparian 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 interaction with fish and fish habitat and assigned a value of low, moderate, or high contribution to fish habitat quality (Table 8-1). Geographic information system (GIS) measurements were conducted to determine the area (m^2) of types of riparian vegetation cover (Tables 8-7) from 30 m perpendicular to the high water mark within the width of the ROW. Each land cover type 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 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 8-1 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 runoff 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, used primarily for grazing
Developed		
Low contribution to fish habitat quality – Developed areas provide little shade, contribute to erosion and can be a source of salt, sand, petroleum products, entering into adjacent watercourses.	Roads	Constructed routes for vehicles to be driven on; includes surfaced/paved highways and non-surfaced trails
	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

Land Cover Category/ Interaction with Fish Habitat	Land Cover Class	Land Cover Definition
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) 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 reduce 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

8.3.2.2 Potential Environmental Effects, Effect Pathways and Measurable Parameters

The effect pathways, measureable parameters, and potential environmental effects used in the assessment of effects on fish and fish habitat, and the rationale for their selection are provided below in Table 8-2.

Table 8-2 Potential Environmental Effects, Effect Pathways and Measurable Parameters for Fish and Fish Habitat

Potential Environmental Effect	Effect Pathway	Measurable Parameter(s) and Units of Measurement	Notes or Rationale for Selection of the Measurable Parameters
Change in fish habitat	Direct loss of riparian vegetation via clearing, increased erosion and sedimentation	• areal extent of altered habitat (m^2) • timing and duration of habitat alteration • change in water quality • change in riparian vegetation • change in access to spawning, rearing, and overwintering habitats (*e.g.*, creation of migratory barriers)	Permanent alteration of fish habitat, which cannot be mitigated, may result in serious harm to fish and may require offsetting or authorization.
Change in fish mortality or health	Increased recreational fishing pressure, increased erosion and sedimentation, use of herbicides	• direct mortality • change in fish health which could reduce fish productivity (*e.g.*, produce fewer eggs) • change in population structure, age/growth relationships from increased fishing pressure • change in baseline water quality beyond the capacity for fish to survive or maintain productivity: water quality parameters include TSS, DO, pH, turbidity, water temperature, as outlined in the CCME Guidelines for the Protection of Aquatic Life (CCME 1999)	Serious harm to fish due to the death of fish occurs when fishery productivity is adversely affected and where recovery to baseline levels is uncertain. Mortality refers to the killing of fish, at any life stage, by any human activity other than fishing. Changes in fish health may lead to mortality, but are often unobserved. Changes in fish health can also lead to lower productivity levels in fish, such as reduced reproductive success.

8.3.2.3 Residual Environmental Effects Description Criteria

This assessment considers residual effects on fish and fish habitat after general mitigation has been implemented. Residual effects are characterized based on several criteria (Table 8-3) and on the expected effectiveness of mitigation measures (Sections 8.5.2.2 and 8.5.3.2).

Table 8-3 Characterization of Residual Environmental Effects on Fish and Fish Habitat

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Direction	The trend of the residual effect	**Positive**—an increase in fish habitat availability, fish survival or health **Adverse**—a decrease in fish habitat availability, fish survival or health **Neutral**—no net change in fish habitat availability, fish survival or health
Magnitude	The amount of change in measurable parameters or the VC relative to existing conditions	**Negligible**—no measurable change in fish habitat availability, fish mortality or health **Low**—a measurable change in fish habitat, fish mortality or health, but within the range of natural variation **Moderate**—measurable change in fish habitat, fish mortality or health outside of natural variation that does not cause serious harm to fish that are part of, or support, a CRA fishery **High**—measurable change in fish habitat, fish mortality or health that results in the serious harm to fish that are part of or support a CRA fishery
Geographic Extent	The geographic area in which an environmental effect occurs	**PDA**—residual effects are restricted to the PDA **LAA**—residual effects extend into the LAA **RAA**—residual effects extends into RAA
Frequency	Identifies when the residual effect occurs and how often during the Project or in a specific phase	**Single event**—effect occurs once **Multiple irregular event (no set schedule)**—effect occurs multiple times at irregular intervals **Multiple regular event**—effect occurs multiple times at regular intervals **Continuous**—residual effect occurs continuously

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Duration	The period of time required until the measurable parameter or the VC returns to its existing condition, or the effect can no longer be measured or otherwise perceived	**Short-term**—residual effect restricted to construction phase **Medium-term**—residual effect extends more than the construction phase **Permanent**—residual effect extends for the lifetime of the Project or more
Reversibility	Pertains to whether a measurable parameter or the VC can return to its existing condition after the Project activity ceases	**Reversible**—the effect is likely to be reversed after activity completion and natural revegetation **Irreversible**—the effect is unlikely to be reversed after activity completion and natural revegetation
Ecological Context	Existing condition and trends in the area where environmental effects occur	**Undisturbed**—area is relatively undisturbed or not adversely affected by human activity **Disturbed**—area has been substantially previously disturbed by human activity or human activity is still present

8.3.2.4 Significance Thresholds for Residual Environmental Effects

A significant adverse residual environmental effect on fish and fish habitat is defined as one that results in serious harm to fish that are part of, or support, a CRA fishery, where the effect cannot be avoided or mitigated. Significant adverse effects may include:

- permanent alteration to fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use sensitive habitats, including spawning grounds, nursery, rearing, or food supply areas, or as a migration corridor, in order to carry out one or more of their life processes
- the likelihood of fish mortality (including eggs) or reductions in fish health, after mitigation measures are implemented, at a level that reduces the productivity of a fishery, particularly on SOCC, including SAR
- water quality parameters not returning to within the limits of natural variation of baseline conditions or exceeding CCME Guidelines for the Protection of Aquatic Life (CCME 1999) and Manitoba Water Quality Standards (2011), following construction and implementation of erosion and sediment control measures

The thresholds are regulatory-based requirements and derived from guidance provided by DFO related to the federal *Fisheries Act* (R.S.C. 1985, c. F-14) and SARA. As identified in Section 8.1.1, the *Fisheries Act* (R.S.C. 1985, c. F-14) prohibits activities that result in serious harm to fish.

The goal of the Fisheries Protection Policy (DFO 2013a) is to provide for the sustainability and ongoing productivity of CRA fisheries. Similarly, the purpose of SARA is to manage SOCC to prevent them from becoming endangered or threatened and to provide for the recovery of those species that are endangered or threatened. Increased mortality of fish species that support the productivity of CRA fisheries or SOCC would be contrary to the goals and purposes of this legislation and policy.

The CCME Guidelines for the Protection of Aquatic Life (CCME 1999) provide science-based goals for maintaining the quality of aquatic ecosystems, as part of the suite of Canadian Environmental Quality Guidelines. The intent of the guidelines is to protect freshwater life from anthropogenic stressors, such as chemical inputs or changes in physical components (*e.g.*, pH, water temperature, debris) of the environment.

8.4 Existing Conditions for Fish and Fish Habitat

This section presents existing fish and fish habitat conditions in the RAA. Additional information regarding existing conditions is provided in the Fish and Fish Habitat TDR.

The Project is located predominantly within the Red River Basin, where fish habitat has been historically affected by agricultural activity. Channelized waterways and constructed agricultural drains are prevalent in areas under crop production. 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 accommodate 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 is directly affected by soil, terrain, vegetation and human activities.

These agriculture and drainage practices continue to the present day throughout the Project area. Historical and present day land use practices have directly influenced existing ecological conditions, including fish and fish habitat. Long-term effects include changes in riparian ecosystem structure (*i.e.*, decreased vegetation cover and bank stability) and surface water quality (*i.e.*, increased sedimentation and water temperature).

8.4.1 Overview of Sub-watersheds and Watercourse Crossings

The Project crosses 75 watercourses within 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) (Map 8-1 – Sub-Watersheds).

The dominant land use in two of the seven sub-watersheds (*i.e.*, Rat River and Roseau River sub-watersheds) is forestry; whereas, dominant land use in the remaining five sub-watersheds 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 *et al.* 2006), watercourse modifications and channelization, cattle wading into watercourses, use of terrestrial fertilizers that are transported 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 and surface water quality.

Riparian vegetation was characterized at watercourse crossings that were carried forward to the field program (Map Series 8-100 – Stream Crossings). Surface water quality was also characterized at watercourse crossings that were carried forward to the field program, including parameters that directly affect habitat suitability for fish (*i.e.*, pH, DO, conductivity and turbidity) (Fish and Fish Habitat TDR, Table 3-1).

As described in the Fish and Fish Habitat TDR, 23 watercourse crossings were carried forward to the field program; eight of these watercourse crossings were ranked as highly sensitive habitat, five watercourse crossings were ranked moderately sensitive, and eight watercourse crossings were ranked as low sensitivity habitat. Additionally, two watercourse crossings were found to be not fish habitat. Three of the 23 watercourse crossings were not field-assessed; therefore, desktop and data applied from other field sites were used in the analysis (Table 8-7). An overview of existing conditions specific to each sub-watershed follows.

8.4.1.1 Lower Assiniboine River Sub-watershed (05MJ)

The Lower Assiniboine River sub-watershed encompasses an area of approximately 2485 km^2 (Stantec 2011). Land use in the watershed is dominated by agriculture, and many of the riparian areas have been influenced by those practices (North/South Consultants 2010).

The Project crosses 15 watercourses in this sub-watershed; two were classified Type A Habitat, and one each of Types B and C habitat. There was one Type D Habitat watercourse crossing and the remaining 10 were Type E Habitat. (Milani 2013). One watercourse, the Assiniboine River, is known to support aquatic SOCC, including the mapleleaf mussel (*Quadrula quadrula*), chestnut lamprey (*Ichthyomyzon castaneus*) and lake sturgeon (*Acipenser fulvescens*).

The fish habitat sensitivity for the Assiniboine River is moderate to high due to its diverse fish community that supports CRA fisheries. The presence of aquatic SOCC (Table 8-5) increases the sensitivity rating to high. There is also an ecological reserve candidate, the Assiniboine River Clam Beds, which contains the SOCC (MCPNAB 2014). Fish habitat sensitivity of Sturgeon Creek is moderate due to the presence of a diverse fish community and its uniform habitat extends well outside of the LAA. The remaining 13 crossings are considered low sensitivity.

8.4.1.2 La Salle River Sub-watershed (05OG)

The drainage area of the La Salle River sub-watershed is 2426 km^2. Approximately 60% of the land use in this area is for agriculture, with an added 16% for drains. Urban and residential land use accounts for approximately 6% of the watershed area, and 8% is deciduous forest. Aquatic habitats in this watershed are moderately to severely affected by anthropogenic activities (Graveline *et al.* 2006), including cultivation practices, livestock operations, wastewater lagoon discharges and urban storm water drains.

The transmission line crosses 14 watercourses in the La Salle River sub-watershed. One of these watercourses supports high sensitivity fish habitat (*i.e.*, the La Salle River), and is known or suspected to support aquatic SOCC (Table 8-5). The other 13 watercourse crossings are of agricultural drains (*i.e.,* three low sensitivity Type D Habitat watercourse crossings and 10 Type E Habitat watercourse crossings that do not support fish habitat).

The fish habitat in the La Salle River was evaluated as moderately sensitive from the field assessment as it contains a diverse fish community, habitat that supports various life stages of CRA fisheries species, and this habitat is typical in this region. However, the potential presence of aquatic SOCC within the LAA increases the sensitivity rating to high.

8.4.1.3 Red River Sub-watershed (05OC)

The drainage area of the Red River sub-watershed is approximately 96,716 km^2. The transmission line crosses two watercourses in the Red River sub-watershed; the Red River itself and the Red River Floodway. The Red River is a Type A Habitat watercourse, and the Floodway is a Type B Habitat watercourse (Milani 2013).

The riparian area and banks at the Red River crossing are covered in grasses/sedge with a few shrubs and deciduous trees along the southwestern bank. The river is characterized by a wide, deep channel with very turbid water and little in-water vegetation.

The Red River Floodway is a human-made channel with long sloping banks that was completed in 1968 to protect the City of Winnipeg against spring flooding. Water flow is intermittent as the floodway is activated primarily in the spring to manage high water levels on the Red River. 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.

The Red River supports a diverse fish community, and habitat to support spawning, rearing, overwintering and migration. This river is also known to provide habitat for aquatic SOCCs (Table 8-5) and, therefore, is highly sensitive. The habitat sensitivity ranking for the Red River Floodway is moderate due to the potential for supporting CRA for part of the year.

8.4.1.4 Seine River Sub-watershed (05OH)

The Seine River sub-watershed is similar to the La Salle River sub-watershed in that more than 60% is dominated by agricultural land use. Annual crops comprise almost half of the 1196 km^2 land base (SRRCD 2009). Urban development in the sub-watershed includes the southeast corner of the city of Winnipeg, the City of Steinbach, and the towns of Ste. Anne and Niverville. This sub-watershed contains a network of watercourses, including more than 600 km of provincial drains (SRRCD 2009), some of which were constructed as early as the turn of the last century (Ledohowski 2003). Only 41% of the sub-watershed's riparian vegetation area land cover has been classified as native cover (grass, shrubs and trees) (SRRCD 2009).

There are 15 watercourse crossings in the Seine River sub-watershed. Three of these crossings are of Type A Habitat; there are two crossings of the Seine River and one crossing on its unnamed tributary. There is one Type B Habitat crossing, three Type C, two Type D and six Type E habitat crossings. Additionally, one of these watercourses (*i.e.*, the Seine River) is suspected to support aquatic SOCC (Table 8-5).

The Project crosses the Seine River in two locations, once in the south-east near the headwaters in the new right of way portion (Site 17), and again just before the Seine River Siphon (Site 8) where it is channeled under the Red River Floodway in the Existing Corridor. The southern crossing of the Seine River and its unnamed tributary support the highest quality fish habitat and riparian areas of the assessed watercourse crossings in this sub-watershed and are highly sensitive. The Seine River is suspected to support aquatic SOCC (Table 8-5).

Fish habitat at the crossing of the Seine River near the Floodway was assessed as moderate sensitivity, due to the moderate spawning, rearing and overwintering habitat for forage fish. Of the remaining 12 sites, 10 were categorized as low sensitivity; many of these crossings had been channelized, with low flow and riparian areas vegetated with grasses only. Two crossings were deemed not fish habitat.

8.4.1.5 Cooks Creek/Devils Creek Sub-watershed (05OJ)

The northern portion of the preferred route lays within the southern-most portion of the Cooks Creek/Devils Creek sub-watershed. The drainage area is approximately 4251 km^2, and the land use in this area is predominantly agriculture, comprising mainly forage and grain crops. Key surface water issues in this area include flooding, drainage and water retention, which are reflected in the 440 km of provincial drains and 850 km of municipal drains in this sub-watershed (MWS 2013).

There are 18 watercourse crossings in the Cooks Creek/Devils Creek sub-watershed. Two watercourses, Cooks Creek and Edie Creek, are crossed twice by the Project. Both Cooks Creek crossings and the northern crossing of Edie Creek are classified as Type A Habitat (Milani 2013). The southern upstream crossing of Edie Creek is Type B Habitat. There is one Type D Habitat crossing in this sub-watershed and the remaining 13 are Type E Habitat.

The habitat sensitivity ranking for these Cooks Creek crossings are high due to the potential presence of SOCC. The habitat is also used by one or more CRA fish species for spawning, rearing and growth, and overwintering is possible for small-bodied fish. The habitat sensitivity ranking for the remaining crossings including Edie Creek is low. This is due to poor spawning and rearing habitat, likely limited to forage fish only, and no overwintering capacity due to shallow water and no flow.

8.4.1.6 Rat River Sub-watershed (05OE)

The Rat River sub-watershed covers approximately 3193 km^2 and has an expansive natural floodplain that frequently floods in the spring. Water is retained in the watershed by wetlands, and the construction of dams and retention projects constructed by Ducks Unlimited Canada (MWS 2012). The eastern portion of the watershed is poorly drained and also contains many wetlands (Agriculture and Agri-Food Canada - Prairie Farm Rehabilitation Administration 2005). In terms of land use and cover, this sub-watershed can be divided into two distinct halves; the Lower Rat River area is used primarily for agriculture, while the Upper Rat River Area is predominantly forested (SRRCD 2014).

The Project crosses three watercourses in the Rat River sub-watershed; one watercourse, the Rat River itself, is assumed to be the only fish-bearing watercourse in the sub-watershed and is classified as Type A Habitat. The other two crossings are classified as Type E Habitat.

The Rat River's habitat sensitivity ranking is high because of its diverse fish community that supports CRA fisheries (Table 8-4). This watercourse contains moderate to good migration, overwintering, spawning and rearing habitats, and habitats that support SOCC (Table 8-5).

8.4.1.7 Roseau River Sub-watershed (05OD)

The most southerly section of the preferred route crosses into the Roseau River sub-watershed and the Rural Municipality (RM) of Piney before entering the United States. The total sub-watershed drainage area is approximately 5349 km^2, with the Canadian portion accounting for approximately 2500 km^2 or 44.4% (Roseau River International Watershed 2007a). The predominant land use in the RM of Piney is agriculture and forestry, with approximately 6% as annual crops and 50% forest. Much of this portion of the watershed is undisturbed; 7% is native grassland and wetlands account for 29% of the area (Roseau River International Watershed 2007a). Increases in the frequency and duration of flooding events have been observed throughout the watershed over the last decade. Activities along the riparian areas, including river channel modifications, cattle wading into watercourses, and increased use of fertilizers and land

use practices that increase erosion, have been suggested as factors in water quality degradation in this area (RRIW 2007b).

There are eight watercourse crossings traversed by the Project in the Roseau River sub-watershed. There is one Type A Habitat crossing, Pine Creek, one Type B Habitat crossing, Pine Creek Diversion and two Type C Habitat watercourses, including Pine Creek Arm. There is also one Type D Habitat and three Type E Habitat crossings in this sub-watershed.

The habitat sensitivity rankings for Pine Creek and Pine Creek diversion is moderate because of the moderate to good spawning and rearing habitat and possible overwintering habitat. The habitat supports predominantly forage fish, with the potential for a CRA fishery. There are no known SOCC in these watercourses. 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 depth, and only indirect contribution to a CRA fishery. The remaining 5 watercourse crossings are considered to be low sensitivity.

8.4.2 Commercial, Recreational and Aboriginal Fisheries

More than 75 fish species are known or expected to be in the RAA. For a complete species list, see the Table 3-2 in the Fish and Fish Habitat TDR. DFO's Fisheries Protection Policy Statement (2013a) focuses on fish that are part of, or support, CRA fisheries. Manitoba Conservation (2010) identifies 42 sport fish species that are targeted recreationally in Manitoba. More than 30 of these species are part of, or support, a CRA fishery in the RAA, with most found in the Assiniboine, Red, La Salle, Seine and Rat rivers. The sub-watersheds where these species could be present are summarized in Table 8-4.

There are 13 fish species commonly targeted by the Aboriginal Fishery of Lake Winnipeg (Peguis First Nation and Lloyd Stevenson 2015) for subsistence and commercial use. An Aboriginal Traditional Knowledge survey conducted with Peguis First Nation identified 16 species that are fished for within the RAA (Table 8-4).

Table 8-4 Commercial, Recreational and Aboriginal (CRA) Fishery Species Known or 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

Common Name	Scientific Name	Contributes to a CRA Fishery	Sub-watershed
smallmouth bass	*Micropterus dolomieu*	1	RR
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 Aboriginal Traditional Knowledge data – Peguis MMTP survey – Whelan Enns Associates Inc. 2015

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

8.4.3 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 (Fish and Fish Habitat TDR, Table 3-3). Habitat requirements for the eight fish and one freshwater mussel are described below, and are considered in the context of the effects assessment presented in Section 8.5.

Banded killifish (*Fundulus diaphanus*) habitat requirements include shallow water, low water velocity, soft substrates, and abundant aquatic vegetation (COSEWIC 2014). Banded killifish is known to occur in the RAA in the Red River (MBCDC 2013a). Its range in Manitoba is likely limited due to the absence of suitable habitat (NatureServe 2015a).

Bigmouth buffalo (*Ictiobus cyprinellus*) habitat preferences include oxbows and pools associated with large, slow moving rivers with variable substrates (COSEWIC 2009). The species also “appears” to be tolerant to highly turbid water. Bigmouth buffalo is known to occur in the RAA, in the La Salle River and Red River (MCWS-FIHCS 2015). 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*) prefers small streams that are less than 12 m wide and less than 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). 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)* are typically found in open-water environments, where water clarity and velocity are high, and substrates consist of clean gravel or rubble (DFO 2013c). Carmine shiner is known to occur in the RAA, in the Seine River, Rat River, and Roseau River sub-watersheds (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 is poorly understood (DFO 2013c).

Chestnut lamprey (*Ichthyomyzon castaneus*) 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). 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 through runoff of fertilizers, as well as pesticide and herbicide pollution (COSEWIC 2010).

Lake sturgeon (*Acipenser fulvescens*) requires 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” (COSEWIC 2006b).

Mapleleaf (*Quadrula quadrula)* requires slow to moderately moving waters with sand, gravel, or mud substrate (COSEWIC 2006c). 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 typically found in watercourses with clear water. Larval lamprey reside in burrows in silt and sand substrate. Adult northern brook lamprey spawn over substrates of coarse gravel, in fast water (COSEWIC 2007). Northern brook lamprey is known to occur in the RAA, in the Seine River, Rat River and Roseau River sub-watersheds (MBCDC 2014). Low water levels and changes in water temperature are considered threats to the success of northern brook lamprey (COSEWIC 2007).

Shortjaw cisco (*Coregonus zenithicus)* is found in deep, open-water environments in small and large lakes. Spawning takes place in shallower water, over variable substrate (COSEWIC 2003b). Shortjaw cisco is known to occur in the RAA, in the Red River sub-watershed (MBCDC 2014).

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 included as Table 8-5.

Table 8-5 Aquatic Species of Concern 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*	MESEA - Endangered	COSEWIC – Endangered; SARA – Endangered (Schedule 1)	AR, RR, LSR, SR, CDC, RTR, ROR
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

Conservation Status: MBCDC – Manitoba Conservation Data Centre; COSEWIC – Committee on the Status of Endangered Wildlife in Canada; SARA – *Species at Risk Act* (S.C. 2002, c. 29); MESEA - *The Endangered Species and Ecosystem Act (C.C.S.M., c. E111)*

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

8.4.4 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). The RAPs take into consideration the species inhabiting the watercourse, and their spawning periods. Table 8-6 provides an overview of seasonal spawning times for common species within the RAA and the corresponding restricted activity periods.

Table 8-6 Restricted Activity Periods for Southern Manitoba

Location	Spring Spawning	Summer Spawning	Fall Spawning
Southern Manitoba	April 1 – June 15	May 1 – June 30	September 15 – April 30
	northern pike, walleye	channel catfish	lake whitefish
	sauger, white sucker	lake sturgeon, goldeye	lake trout
	yellow perch	freshwater drum	burbot

SOURCE: DFO 2013b

8.4.5 Riparian Vegetation Cover at Watercourse Crossings

Riparian vegetation was characterized at each potential fish-bearing watercourse crossing (Type A-D Habitat (Milani 2013)). 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 8-1). The expected change in riparian vegetation associated with Project activities was estimated (Table 8-10, Section 8.5.2.3). Analysis of the areal extent of riparian vegetation is focused on land cover types that can have a moderate to high contribution to fish habitat quality (see Table 8-1 for definitions).

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. These classes are considered to provide low contributions to fish habitat quality. Within these 15 crossings, soil erosion risk was negligible to low. Nine of the 15 crossings have a habitat sensitivity ranking of low (Table 8-7). The other six crossings have habitat that supports CRA or SOCC, which increases their sensitivity to moderate or high.

At least half of the PDA land cover in the remaining 14 crossings is forested. The soil erosion risk ranges from low to moderate. Seven of the 14 crossings were ranked as highly sensitive habitat and contain CRA species or SOCC.

Table 8-7 Riparian Vegetation Cover at Potential Fish-bearing Watercourses Crossed by the Project

Site	Watercourse Name	Habitat Sensitivity Ranking	Soil Erosion Risk	Existing Land Cover within the Riparian PDA (% of Riparian PDA)				
				Agriculture	Developed	Wetland	Native Grassland and Shrubland	Forested
1	Sturgeon Creek	Moderate	Negligible to Low	41.0	43.7	15.3	0	0
2	Third Creek	Low	Low	82.5	0	3.2	14.3	0
3	Unnamed Watercourse	Low	Low	81.5	0	0	0	18.5
4	Assiniboine River	High	Low	25.4	0.03	28.3	0	46.2
5	La Salle River	High	N/A	0	0	20.9	0	79.1
6	Red River	High	N/A	34.1	0.70	40.7	0	25.1
7	Red River Floodway	Moderate	N/A	94.5	5.50	0	0	0
8	Seine River at Floodway	Moderate	Negligible to Moderate	87.8	0	12.2	0	0
9	Cooks Creek	High	Negligible	90.3	0	9.7	0	0
10	Edie Creek	Low	Negligible to Low	40.5	0	6.9	0	52.6
11	Edie Creek South Crossing	Low	Negligible	0	29.9	0	0	70.1

Site	Watercourse Name	Habitat Sensitivity Ranking	Soil Erosion Risk	Existing Land Cover within the Riparian PDA (% of Riparian PDA)				
				Agriculture	Developed	Wetland	Native Grassland and Shrubland	Forested
12	Cooks Creek South Crossing	High	Negligible	0	0	2.5	0	97.5
13	Fish Creek	Low	Low	0	0	16.6	0	83.4
14	Unnamed Watercourse	Not Fish Habitat	N/A	N/A	N/A	N/A	N/A	N/A
15	Unnamed Watercourse	Not Fish Habitat	Negligible	0	0	100	0	0
16	Seine River Tributary	High	Negligible	26.4	0	3.2	0	70.4
17	Seine River	High	Negligible	33.2	0	13.3	0	53.2
18	La Broquerie Drain	Low	Negligible	97.7	2.3	0	0	0
19	Rat River	High	Moderate	28.8	0	16.4	0	54.8
20	Pine Creek Diversion	Moderate	Negligible	93.9	0	0	6.1	0
21	Pine Creek	Moderate	Negligible	71.7	0	5.7	0	22.6
22	Pine Creek Arm	Low	Negligible	19.3	0	4.0	62.3	14.4
23	Unnamed Watercourse	Low	Negligible	0	0	0	0	100.0

Site	Watercourse Name	Habitat Sensitivity Ranking	Soil Erosion Risk	Existing Land Cover within the Riparian PDA (% of Riparian PDA)				
				Agriculture	Developed	Wetland	Native Grassland and Shrubland	Forested
D1	Unnamed Watercourse	Low	Low	80.4	17.4	2.2	0	0
D2	Unnamed Watercourse	Low	Negligible	96.0	0	4.0	0	0
D3	Unnamed Watercourse	Low	Negligible	100.0	0	0	0	0
D4	Unnamed Watercourse	Low	Negligible	52.7	47.3	0	0	0
D5	Unnamed Watercourse	Low	Negligible	16.8	54.2	29.0	0	0
D6	Unnamed Watercourse	Low	Negligible	31.1	0	0	0	68.9
D7	Unnamed Watercourse	Low	Negligible	100.0	0	0	0	0
D8	Unnamed Watercourse	Low	Negligible	0	0	100.0	0	0

8.4.6 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 characterized as shown in Table 8-8.

Table 8-8 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	Cooks/Devils Creek	B	Low	Small Permanent	671723	5523621	unknown	none	unknown
12	Cooks Creek	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
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

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			
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, golden 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, lowa 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, lowa 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

8.5 Assessment of Project Environmental Effects on Fish and Fish Habitat

8.5.1 Project Interactions with Fish and Fish Habitat

Table 8-9 identifies physical activities and components that might interact with fish and fish habitat resulting in a potential effect. These interactions are identified by check marks and are discussed in detail in Sections 8.5.2 and 8.5.3.

Table 8-9 Potential Project-Environment Interactions and Effects on Fish and Fish Habitat

Project Components and Physical Activities	Change in Fish Habitat	Change in Fish Mortality or Health
Transmission Line Construction Activities		
Mobilization	–	✓
Access Route and Bypass Trail Development	✓	✓
Right-of-Way Clearing / Geotechnical Investigation	✓	✓
Marshalling Yards, Borrow Sites, Temporary Camp Setup	–	–
Transmission Tower Construction and Conductor Stringing	✓	✓
Demobilization	–	–
Transmission Line Operation/Maintenance		
Transmission Line Operation/Presence	–	–
Inspection Patrols	–	–
Vegetation Management (tree control)	✓	✓
Station Construction		
Station Site Preparation	–	–
Electrical Equipment Installation	–	–
Station Operation/Maintenance		
Station Operation/Presence	–	–
Vegetation Management (weed control)	–	–

NOTE:
"✓" = Potential interactions that might cause an effect
"–" = Interactions between the Project and the VC are not expected

Key issues associated with fish and fish habitat are potential disturbance to riparian vegetation and in-water habitat at transmission line watercourse crossing locations during Project construction and operation and maintenance. Activity near water has the potential to affect water quality. In addition, there is a potential for the Project to create increased access to fishable areas. Manitoba Hydro is experienced in the construction, operation and maintenance of transmission lines near aquatic environments, and the potential effects, mitigation measures and monitoring outcomes are well understood. The pathway of potential effects for each of the activities that could interact with fish and fish habitat during construction, and operation and maintenance of the Project are identified in Figure 8-2.

Details on mitigation can be found in the general mitigation tables (Chapter 22 – Environmental Protection, Follow-Up and Monitoring).

Project activities that can avoid changing in-water habitat, riparian vegetation cover, water quality, sediment load and turbidity, and direct fish mortality are described below. By avoiding changes in these measureable parameters, the Project activities listed below are not likely to have an effect on fish habitat and fish mortality.

Marshalling yards and borrow sites will be sited at least 30 m from watercourses to avoid interaction with fish and fish habitat. Similarly, station components are located at least 30 m from watercourses; therefore, modifications at the stations are not anticipated to interact with fish and fish habitat. A 30 m setback from a watercourse is recommended as an acceptable distance to protect the riparian vegetation area and buffer overland effects that construction could have on fish and fish habitat (NEB 2015).

Industrial equipment will not be operated within established buffer zones and setback distances from waterbodies, wetlands and riparian areas. Construction vehicles, machinery and heavy equipment will not be permitted in designated machine-free zones except at designated crossings, therefore, use of industrial equipment associated with mobilization, ROW clearing and other construction and operation activities is not anticipated to interact with fish and fish habitat. Spills and leaks are discussed in Chapter 21 – Accidents, Malfunctions and Unplanned Events.

Transmission line and station operation/presence will not interact with fish and fish habitat because the tower and station components are located at least 30 m away from watercourses (NEB 2015).

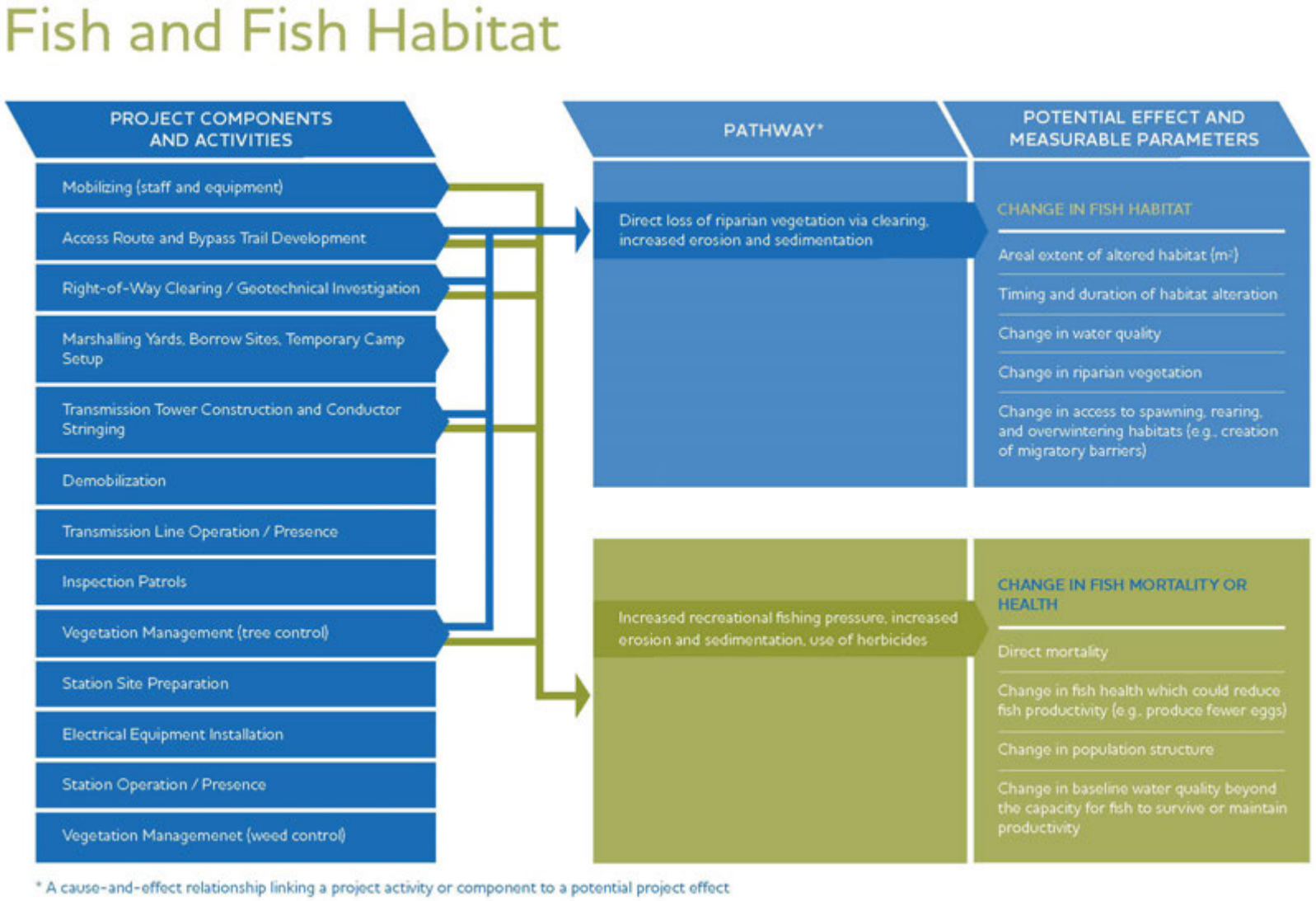

Figure 8-2 Potential Project Pathways of Effect on Fish and Fish Habitat

8.5.2 Assessment of Change in Fish Habitat

8.5.2.1 Pathways for Change in Fish Habitat

Potential Project effects are related to construction and operation of the transmission line and permanent access roads, if required, that are necessary for the Project. The construction and operation and maintenance phases of the Project will interact with fish and fish habitat in different ways (Figure 8-2). As such, these two phases are discussed separately. Construction activities that could potentially interact with fish and fish habitat include clearing the ROW, and development of access routes/trails. During operation and maintenance, activities that could also interact with fish and fish habitat involve vegetation management of trees within the transmission line ROW. Details of the pathways for potential effects on fish and fish habitat for each of the activities are outlined below.

8.5.2.1.1 Construction

Construction activity and access requirements will be subject to standard environmental protection measures associated with Manitoba Hydro's transmission line construction practices. These will be identified and cross-referenced in site-specific Environmental Protection Plans (to be submitted for review and approval), and adherence to them will be stipulated in related contract specifications.

ACCESS ROUTE AND BYPASS TRAIL DEVELOPMENT

Access for construction and subsequent line maintenance activities will generally occur along the ROW using existing public access roads or trails wherever possible. This enables maximum use of existing road access and reduces the requirement for the development of new temporary trail access, and the associated environmental effects (Chapter 2 – Project Description). Where required, the construction of temporary or permanent roads has the potential to increase erosion and sedimentation by disrupting the stability of associated banks. These roads or trails may also require clearing of trees. Potential effects of clearing and increased sedimentation are described below.

The peak construction periods will take place during the winter months (Chapter 2). This will be outside of the restricted activity periods for spring and summer spawning fish species.

RIGHT-OF-WAY CLEARING

Construction activities associated with site preparation include ROW clearing. Trees within the ROW will be cleared to a maximum height of approximately 10 cm (4 inches) above the ground. Clearing requirements for the new transmission line rights-of-way will also require selective clearing of "danger trees" beyond the ROW. Such trees could potentially affect the function of the transmission line or result in safety concerns, and are normally identified during initial ROW clearing activities and removed. Apart from removal of danger trees along the ROW edges, clearing procedures are normally confined to the ROW.

A variety of methods are available for ROW clearing. These include conventional clearing done by “V” and KG” blades on tracked bulldozers (Photos 8-1 and 8-2), mulching by rotary drums, selective tree removal by feller bunchers (*e.g.,* for removal of danger trees with minimal adverse effect to adjacent vegetation and trees) and hand clearing with chain saws in environmentally sensitive sites. Final clearing methods will be determined on the basis of detailed surveys of the transmission line routes, and site-specific identification of environmentally sensitive features (Chapter 2 – Project Description). Riparian buffers will be applied to watercourse crossings in which shrub and herbaceous vegetation will be retained, including trees that do not violate Manitoba Hydro vegetation clearance requirements (Photo 8-3).

Photo 8-1 Clearing of ROW

Photo 8-2 Equipment used for clearing ROW in winter

Photo 8-3 Newly cleared ROW at watercourse crossing showing riparian buffer

During the construction phase, tall treed vegetation located within riparian areas will be selectively cleared by hand to retain roots in the ground and reduce erosion and sedimentation. Low shrubs and ground vegetation will be retained within 30 m of watercourse crossings, but might be affected as a result of vehicle access requirements and staging operations; this is called the Management Zone (Photo 8-3). The Machine Free Zone is approximately 7 m wide. Trees are cleared by hand, and equipment is only allowed to reach into this area. Results for measured changed in riparian vegetation described in Section 8.3.2.1.2 can be found in Table 8-7.

Tree clearing for site preparation of the ROW is a direct loss of riparian vegetation with potential effects on fish and fish habitat. Loss of tall treed vegetation adjacent to watercourses could reduce cover for fish, reduce shade which moderates water temperature, and reduce habitat for insects which can be a food source for fish (DFO 2002; Government of Manitoba 2015; Manitoba Riparian Health 2015). Increases in water temperature can encourage the microbial breakdown of organic matter, leading to a depletion of DO in the watercourse, which is essential for sustaining aquatic life. Low order stream communities in deciduous woodlands are energetically dependent upon litter materials contributed by riparian vegetation (Vannote *et al.* 1980; Benfield and Webster 1985; Malmqvist and Oberle 1995). Changes in litter inputs can have effects on invertebrate abundance, and in turn decrease food availability for fish. The potential effect of tree clearing will decrease with increasing stream size. As stream size increases, the reduced importance of

terrestrial organic input coincides with enhanced importance of allochthonous primary production and organic transport from upstream (Vannote *et al.* 1980).

Riparian vegetation clearing can increase erosion and sedimentation, resulting in a change in substrate composition, and altering food supply through turbidity-related reductions in algae and aquatic insect production (Studinski *et al.* 2012). Increased siltation can also damage spawning grounds for species that require cobble substrate for spawning (*e.g.,* trout and walleye) (Fudge *et al*. 2008). Increased turbidity can decrease light transmission through the water column, decreasing in-water vegetation growth, which is habitat for young fish.

TRANSMISSION TOWER CONSTRUCTION AND CONDUCTOR STRINGING

At waterway crossings, towers will be located as far back from the water's edge as possible, to enhance stability and prevent bank erosion. Construction procedures used at each required crossing will be based on site-specific considerations, such as existing soil and subsurface conditions, biophysical sensitivities, and operational requirements. Site-specific construction techniques will be developed where necessary for difficult terrain or steep slope conditions. Contractors will be required to develop sediment and erosion control plans (Chapter 2 – Project Description).

Conductor stringing requires the transmission line to cross the water. In many cases, the stringing of conductors will take place during the winter when the watercourses can be crossed on foot or by vehicle. During months of open water, the conductors will be transported across watercourses by boat. At watercourses that do not have existing nearby boat launches, launching the boat from shore could introduce bank materials into the watercourse and increase sedimentation. Operation of a motor boat near shore in shallow water can also stir up sediment. Effects of sedimentation on fish habitat are discussed above.

POTENTIAL EFFECTS ON SPECIES OF CONSERVATION CONCERN

Habitat changes may have a greater effect on SOCC than on common fish species because of specialized habitat or biological requirements for species that have narrow tolerances to habitat alterations. Sensitive habitat generally includes areas that are important for completing essential life processes, such as spawning, rearing, migration, and overwintering areas for species that support CRA fisheries or SOCC. The general effects on fish habitat described for CRA fisheries apply to SOCC.

Banded killifish and bigmouth buffalo are unlikely to be affected by the potential Project-related changes in fish habitat described above because they prefer warm water habitats containing fine substrates (banded killifish) (NatureServe 2015a) and turbid water (bigmouth buffalo) (COSEWIC 2009) which are not likely to be negatively affected by any potential changes in the stream riparian environment.

Shortjaw cisco is unlikely to be affected by the potential Project-related changes in fish habitat described above, since they are typically found in the deepest areas of lakes they inhabit, and are open-water feeders (COSEWIC 2003b). These areas are not likely to be negatively affected by any potential changes in the stream riparian environment.

The principal threat to bigmouth shiner is an increase in siltation, resulting primarily from agriculture and forestry operations (COSEWIC 2003a). An increase in siltation might alter benthic macroinvertebrate communities and reduce the foraging success of bigmouth shiner because its diet consists of benthic macroinvertebrates. Changes in siltation described above could effect this species.

Habitat requirements of mapleleaf include slow to moderately moving waters with sand, gravel, or mud substrates. (COSEWIC 2006c). Freshwater mussels are benthic organisms with limited mobility and, as a result, they are susceptible to potential Project-related increases in siltation. Additionally, the larval stage of freshwater mussels is parasitic, and relies on its host fish species as a means of dispersal (COSEWIC 2006c). Therefore, alterations to the habitat of the fish host species for the mussel species might result in reduced reproductive success, survival, and slow recovery of the species. Fish hosts of mapleleaf are likely channel catfish and brown bullhead (COSEWIC 2006c). Changes in siltation and the stream environment described above could effect this mussel species.

Carmine shiner, chestnut lamprey, and northern brook lamprey spawn in watercourses with fast-flowing water over clean, coarse substrate material (COSEWIC 2006a; COSEWIC 2010; COSEWIC 2007). The primary threat to these species resulting from potential Project-related activities is an increase in siltation of substrates used for spawning. This might reduce survival and recovery of the three species.

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). Potential Project-related activities that might alter substrate through siltation have potential to affect lake sturgeon habitat.

8.5.2.1.2 Operation and Maintenance

VEGETATION MANAGEMENT – TREES ON TRANSMISSION LINE

Vegetation management is required on an ongoing basis so that re-growth in the cleared rights-of-way does not interfere with transmission line operations. Under Manitoba Regulation 25/2012, vegetation control will be conducted along ROWs to prevent situations from arising where trees can cause an outage on transmission lines 200 kV or greater (Chapter 2 – Project Description).

Vegetation management involves a variety of methods, including hand cutting using chainsaws, brush saws, axes or brush hooks. Brush mowing with rotary and drum cutters (typically rubber-tired equipment), and herbicide treatments are also used. The methods above are typically

conducted on foot, or by all terrain or flex-tracked vehicles. Due to access constraints in some areas, brushing may be completed during the winter months using the shear blading method. The vegetation maintenance brushing cycle for transmission line rights-of-way typically ranges between 8 and 10 years (Chapter 2).

Riparian vegetation management can have similar effects on fish and fish habitat as clearing of the ROW described in the construction phase. Trees that will grow taller than approximately 2.5 m within the ROW are removed so that they will not interfere with the transmission lines. The maintained reduction in treed canopy can result in increased water temperature, decreased dissolved oxygen and decreased food availability. Reduced riparian vegetation as a result of localized vegetation management might increase sediment loads and turbidity because of erosion and runoff. Riparian vegetation management could potentially involve the use of herbicides to control noxious or invasive riparian vegetation species. Increased runoff could also facilitate the transport of herbicides into watercourses. Herbicide exposure might result in alterations to in-water vegetation communities, thereby altering fish habitat by decreasing food supplies and affecting spawning and rearing grounds.

As discussed in Section 8.5.2, habitat changes may have a greater effect on aquatic SOCC than on common fish species because these species have specialized habitat or biological requirements and narrow tolerances to habitat alterations. The general effects on fish habitat described above apply to SOCC.

Transmission line maintenance activities that might alter riparian vegetation, stream substrate and in-water vegetation have the potential to affect SOCC. Although these activities tend to have a small footprint and do not typically affect large reaches of watercourses, the habitat specificity and biological characteristics of several aquatic SOCC, especially those that migrate long distances (*i.e.*, lake sturgeon, MCWS 2012), make aquatic SOCC highly susceptible to changes in their habitat.

The potential Project-related effects discussed in Section 8.5.2 are applicable to transmission line operation and maintenance activities. Additionally, the use of herbicides to control vegetation on the ROW might affect SOCC.

Potential effects on specific SOCC are summarized below.

Bigmouth shiner, carmine shiner, chestnut lamprey, lake sturgeon, mapleleaf, northern brook lamprey and shortjaw cisco do not have critical habitat requirements that include aquatic vegetation. Additionally, the probable host fish species of mapleleaf (*i.e.*, channel catfish and brown bullhead) do not have habitat requirements that include aquatic vegetation. Therefore, it is unlikely that runoff from the use of herbicides to control riparian vegetation will negatively alter the habitats of these species.

Banded killifish and bigmouth buffalo rely on aquatic vegetation for cover and foraging opportunities (COSEWIC 2009; NatureServe 2015a). Therefore, runoff of herbicides used to control riparian vegetation might result in a reduction of aquatic plant density and reduce foraging success, survival, and recovery of these species. During the operation and maintenance phase of

the Project, Manitoba Hydro's general mitigation measures avoids general herbicide use within 30 m of the high water mark of watercourses, except where site-specific or individual tree application is warranted. General mitigation practices for the use of herbicides should protect instream vegetation and habitat required by the banded killifish and bigmouth buffalo.

8.5.2.2 Mitigation for Change in Fish Habitat

The following measures will be implemented to mitigate potential effects on fish and fish habitat (including SOCC) during construction, and operation and maintenance. General mitigation measures can be found in the Construction Environmental Protection Plan (CEnvPP; Appendix 22A).

8.5.2.2.1 Construction

- Construction activities surrounding watercourses will take place within Reduced Risk Timing Windows.
- Disturbances to waterbodies, shorelines and riparian areas will be rehabilitated immediately upon completion of construction activities.
- Wherever possible, existing trails, roads and cut lines will be used as access routes.
- Disturbance to the bed and banks of the watercourses will be limited to the extent possible.
- Shrub and herbaceous understory vegetation along with tree root systems will be retained to the greatest extent possible in order to enhance bank stability.
- Within 30 m of watercourse crossings, removal of riparian vegetation in the ROW will be limited to select plants required to accommodate overhead lines, and uprooting of plants will be limited.
- Aggregate materials will not be removed from the bed or bank of any watercourse or waterway.
- Where marshy floodplain areas must be crossed, the work will be carried out under frozen conditions. Riparian buffers will be a minimum of 30 m and increase in size based on slope of land entering waterway. Within these buffers, shrub and herbaceous understory vegetation will be maintained along with trees that do not violate Manitoba Hydro Vegetation Clearance Requirements.
- If minor rutting is likely to occur, watercourse bank and bed protection methods (*e.g.*, construction mats) should be used provided they do not constrict flows or block fish passage.
- Grading of the watercourse banks for the approaches should not occur.
- Construction vehicles, machinery and heavy equipment will not be permitted in designated machine-free zones, except at designated crossing locations.

- Erosion protection and sediment control measures will be put in place at all Project locations where surface drainage is likely to flow into fish-bearing waters (Table 8-8).
- Property limits, ROW boundaries, buffers and sensitive areas (where applicable) will be clearly marked with stakes or flagging tape prior to clearing.
- Where possible, transmission line approaches and crossings will be perpendicular to the watercourse and will avoid unstable features such as meander bends, braided watercourses and active floodplains.
- Disturbed riparian areas will be revegetated following completion of works.
- Use only clean ice/snow for construction of an ice/snowfill or ice bridge. Approaches to the bridge should be constructed with compacted snow and ice of sufficient thickness to protect the watercourse channel and banks. Sand, gravel and soils are not to be used for ice bridge approaches.
- A qualified drilling contractor with appropriate experience will be present for work in areas underlain by artesian aquifers.
- Monitoring of groundwater levels in drill holes will be conducted during drilling and foundation installation.
- Drill holes will be sealed as soon as possible in the case of a groundwater level rise.
- Precautions will be taken where there is potential for mixing surface and groundwater to prevent interconnection of these waters.
- Emergency response plans will be in place for sealing/grouting and pumping out drill holes in artesian well areas.
- Follow-up inspections during regular Line Maintenance patrols of installed foundations will be conducted to monitor for excess water leakage.
- If herbicides are required to control vegetation growth, all applicable permits will be obtained and provincial regulations adhered to for use.

8.5.2.2.2 Operation and Maintenance

- All waste materials (slash) will be stabilized above the HWM to prevent entry into the watercourse.
- In riparian areas, vegetation will be maintained in a way that leaves root systems intact.
- Riparian vegetation maintenance will be conducted by a method that limits watercourse bank disturbance, and if rutting or erosion is likely, appropriate bank protection measures will be implemented prior to machinery use.
- Herbicides are to be applied in accordance with a Pesticide Use Permit and Pesticide Application Requirements for Manitoba Hydro Employees and Contractors Publication.

- Only chemicals approved by the Pesticide Use Permit are to be used.
- Application of herbicides will adhere to appropriate general mitigation measures and all chemical applications will be conducted by a certified licensed applicator.
- Herbicides will not be applied, other than backpack applications or handgun spot applications, within 30 meters of open water areas.
- Herbicides will not be applied to open water or to areas where fish habitat may be affected.
- If minor rutting is likely to occur, watercourse bank and bed protection methods (e.g., construction mats) should be used provided they do not constrict flows or block fish passage.

8.5.2.3 Characterization of Residual Environmental Effects for Change in Fish Habitat

This assessment considers residual effects on fish and fish habitat after mitigation is implemented. Residual effects are characterized based on several criteria (Table 8-3) and on the expected effectiveness of mitigation measures (Section 8.5.2.2).

Land use in the LAA can be characterized as disturbed because in many areas it is dominated by agricultural and urban development (Table 8-7). Activities associated with these land uses can increase suspended sediments and sediment in the bedload of adjacent watercourses. This was reflected in periodic high turbidity measurements (>10% increase above background NTUs) recorded at many proposed watercourse crossing locations during field investigations. With the implementation of mitigation measures, land-based, Project-related construction activities are not expected to increase sedimentation within the watercourses.

Analysis of the potential change in percent coverage of riparian vegetation types is focused on land cover categories that can have a moderate to high contribution to fish habitat quality, most notably shrubland and forested areas (Table 8-10). Shrubland provides moderate shade, and forested and treed areas provide good shade which moderates water temperature. Shrubland and forest also provide habitat for insects which can be a food source for fish. In 15 of 29 watercourses analyzed (*i.e.,* 52% of the watercourses analyzed) land cover within the riparian area within the PDA was predominately agriculture and developed, which are considered to provide low contributions to fish habitat quality, and it is expected that changes in riparian vegetation at these crossing would be nil to minimal. Therefore, although Project construction may change the type of riparian vegetation land cover, its contribution to fish habitat quality will not be affected. At crossings where the PDA was moderately to predominantly treed, the expected change in riparian vegetation is determined to be minimal because equivalent riparian vegetation was abundant within the LAA and beyond (Fish and Fish Habitat TDR).

Fish that are part of, or support, a CRA fishery, and particularly SOCC, could potentially have life processes affected by increased sedimentation, particularly sensitive early life stages. Mitigation measures such as limiting instream work to outside the RAP, particularly winter construction, would reduce the potential effects of increased sedimentation.

Table 8-10 Change in Riparian Vegetation Cover at Watercourse Crossings

Site	Watercourse Name	Habitat Sensitivity Ranking	Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
			Hectares	% of PDA	
1	Sturgeon Creek	Moderate	0	0	No expected change in riparian vegetation
2	Third Creek	Low	0	0	No expected change in riparian vegetation
3	Unnamed Watercourse	Low	0.64	18.5	No expected change in riparian vegetation
4	Assiniboine River	High	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 habitat change is minimal.
5	La Salle River	High	2.52	79.1	The banks within the LAA have fully intact riparian vegetation buffer. This extends upstream for many kilometres and downstream to meet the Red River. Expected habitat change is minimal.
6	Red River	High	1.65	25.1	The LAA is predominately grassland and borders the floodway. The southwest bank has some treed areas. Expected habitat change is minimal.
7	Red River Floodway	Moderate	0	0	No expected change in riparian vegetation
8	Seine River at Floodway	Moderate	0	0	No expected change in riparian vegetation
9	Cooks Creek	High	0	0	No expected change in riparian vegetation

Site	Watercourse Name	Habitat Sensitivity Ranking	Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
			Hectares	% of PDA	
10	Edie Creek	Low	1.51	52.6	No expected change in riparian vegetation; Project PDA runs parallel with Existing Corridor
11	Edie Creek South Crossing	Low	0	70.1	The LAA is predominately forested except where it crosses a road. Expected habitat change is minimal.
12	Cooks Creek South Crossing	High	1.05	97.5	The banks within the LAA have fully forested riparian vegetation buffer. This extends upstream for many kilometres. Expected habitat change is minimal.
13	Fish Creek	Low	0.57	83.4	The LAA is predominantly forested. This type of habitat extends upstream and downstream for several kilometres. Expected change in riparian vegetation is minimal.
14	Unnamed Watercourse	Not Fish Habitat	N/A	N/A	Channel no longer exists; no expected change in riparian vegetation.
15	Unnamed Watercourse	Not Fish Habitat	0	0	No expected change in riparian vegetation
16	Seine River Tributary	High	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 habitat change is minimal.
17	Seine River	High	0.74	53.2	The banks within the LAA have fully intact riparian vegetation buffer. This extends upstream and downstream for many kilometres. Expected habitat change is minimal.
18	La Broquerie Drain	Low	0.00	0	No expected change in riparian vegetation

Site	Watercourse Name	Habitat Sensitivity Ranking	Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
			Hectares	% of PDA	
19	Rat River	High	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 kilometres. Expected habitat change is minimal.
20	Pine Creek Diversion	Moderate	0.00	0	Extensive agriculture in riparian area No expected change in riparian vegetation
21	Pine Creek	Moderate	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. Downstream and across the border the land cover consists of more wetlands. Expected habitat change is minimal.
22	Pine Creek Arm	Low	0.12	14.4	The riparian zone within the LAA contains a mixture of shrubs and grasses. This extends upstream for many kilometres. Expected habitat change is minimal.
23	Unnamed Watercourse	Low	0.75	100.0	The LAA is predominantly forested. This type of habitat extends upstream and downstream for several kilometres. Expected change in riparian vegetation is minimal.
D1	Unnamed Watercourse	Low	0	0	No expected change in riparian vegetation
D2	Unnamed Watercourse	Low	0	0	No expected change in riparian vegetation

Site	Watercourse Name	Habitat Sensitivity Ranking	Expected Change in Forested Cover within the Riparian PDA		Expected Change in Riparian Vegetation within the LAA
			Hectares	% of PDA	
D3	Unnamed Watercourse	Low	0	0	No expected change in riparian vegetation
D4	Unnamed Watercourse	Low	0	0	No expected change in riparian vegetation
D5	Unnamed Watercourse	Low	0	0	No expected change in riparian vegetation
D6	Unnamed Watercourse	Low	0.34	0	No expected change in riparian vegetation
D7	Unnamed Watercourse	Low	0	0	No expected change in riparian vegetation
D8	Unnamed Watercourse	Low	0	0	No expected change in riparian vegetation

8.5.2.3.1 Residual Effects from Construction Activities

For change in fish habitat during construction, the residual environmental effects have been characterized as follows:

- Direction is neutral: There will be no serious harm to fish and fish habitat. Erosion and sedimentation will be mitigated by selective clearing of trees within the ROW; brush and small trees provide root systems that stabilize soils. Watercourses will not be forded during construction or stringing of the conductor lines which reduces the risk of sedimentation. There is no net change in fish habitat availability because similar habitat is available within and beyond the LAA.
- Magnitude is low: Mitigation measures will reduce sedimentation. Construction will occur outside the RAP which will reduce disturbance to fish habitat, and avoid disruption of sensitive fish species or habitat for spawning and rearing. There will be minimal change in fish habitat availability because similar habitat is available beyond the LAA.
- Geographic extent: is the LAA. Habitat loss would potentially occur in the ROW as a result of riparian vegetation clearing. Habitat disturbance from sedimentation could potentially occur in the LAA.
- Frequency: is multiple irregular events. Disturbance will occur only once at most watercourses during construction. In some cases, disturbances may occur several times throughout the construction process as activity progresses.
- Duration: is permanent. The ROW removal of trees that will grow taller than approximately 2.5 m from the riparian zone during construction will be maintained for the life of the Project. However, shrubs will be allowed to grow after the construction phase is completed, and these provide moderate contributions to fish habitat in terms of shade and a food source for benthos.
- Ecological context: is disturbed. The area has been previously disturbed by human development (*e.g.,* agriculture) and human development is still present, Approximately 85% of the watercourse crossings occur within agricultural areas. These watercourses are either absent of complex riparian forest habitat or a treed buffer has been maintained with agricultural land surrounding.

8.5.2.3.2 Residual Effects from Operation and Maintenance Activities

For change in fish habitat during operation and maintenance, the residual environmental effects have been characterized as follows:

- Direction is neutral: No serious harm to fish and fish habitat is anticipated. Erosion and sedimentation are not likely to increase from levels recorded during the construction phase. Only trees that grow to a size that could affect transmission lines will be selectively removed within the ROW. Runoff into watercourses that could affect aquatic vegetation will be mitigated through compliance with Manitoba Hydro's herbicide application program.
- Magnitude is negligible: There will be no measurable change in fish habitat availability. Operation and maintenance activities will occur outside the RAP, reducing sedimentation that could affect spawning habitat. Aquatic vegetation will not be affected by on-land herbicide applications.
- Geographic extent: is the LAA. Habitat disturbance from sedimentation may occur in the LAA. Aquatic vegetation within the ROW and LAA will not be affected by on-land herbicide applications.
- Frequency: is multiple irregular events. Operation and maintenance activities are not regular, and herbicide applications are only as needed and will vary from location to location. The vegetation maintenance brushing cycle for transmission line rights-of-way typically ranges between 8 and 10 years (Chapter 2 – Project Description).
- Duration is permanent: the removal of trees taller than 2.5 m from the riparian zone during operation and maintenance must be maintained for the life of the Project.
- Ecological context: is disturbed. The area has been previously disturbed by human development (*e.g.,* agriculture) and human development is still present. Approximately 85% of the watercourse crossings occur within agricultural areas. These watercourses are either absent of complex riparian forest habitat or a treed buffer has been maintained with agricultural land surrounding.

8.5.3 Assessment of Change in Fish Mortality or Health

8.5.3.1 Pathways for Change in Fish Mortality or Health

Fish may be subject to increased mortality during transmission line construction, operation and maintenance. The construction and operation and maintenance phases of the Project will potentially interact with fish mortality. Construction activities that could potentially interact with fish mortality include clearing the ROW, development of access routes and trails, mobilizing staff and equipment, and tower construction with conductor stringing. During operation and maintenance, the primary activity that could also interact with fish mortality is vegetation management of trees within the transmission line ROW. Details of the pathways for potential effects on fish and fish habitat for each of the activities are outlined below.

8.5.3.1.1 Construction

MOBILIZING STAFF AND EQUIPMENT

Mobilizing staff and equipment requires the construction of temporary camps and accessible roads or trails (see Access Route and Bypass Trail Development below). Activities associated with the mobilization of staff and equipment have the potential to cause fish mortalities. DFO's pathways of effects models (DFO 2010) identify use of heavy equipment in, or adjacent to, fish habitats as a potential source of contaminants. Noise and vibration from equipment can have a local effect on fish populations during sensitive spawning times. Avoidance of sensitive periods, together with no operation of industrial equipment within established buffer zones and setback distances from waterbodies, wetlands and riparian areas will mitigate fish mortality. Construction vehicles, machinery and heavy equipment will not be permitted in designated machine-free zones (Photo 8-4), and there will be no fording of watercourses. Hydrocarbons, such as oil, gasoline, lubricants and hydraulic fluids, might enter surface water from machinery used for construction activities carried beyond 30 m from a watercourse. Ecological effects might range from direct mortality of fish or other aquatic biota to persistent and progressive accumulation in sediment or biological tissues, which could impair health, vigour, or productive capacity (Alberta Transportation 2009). The extent of the effect is determined by the amount of the release, the type of hydrocarbon (which affects the residence time in the aquatic system) and the flow rate in the watercourse (which determines the extent of downstream transport). A hydrocarbon spill is considered an accident, malfunction, or unplanned event and is assessed separately in Chapter 21 – Accidents, Malfunctions, and Unplanned Events.

Photo 8-4 Machinery and heavy equipment will not be permitted in designated machine-free zones

Increased staff presence during the construction phase could increase recreational fishing pressure in the RAA, and also contribute to a change in fish mortality. Peak staff mobilization will occur during the winter months, outside of the restricted activity windows for spring and summer spawning fish. This will aid in minimizing fish mortality during sensitive spawning times.

ACCESS ROUTE AND BYPASS TRAIL DEVELOPMENT AND MOBILIZING EQUIPMENT

As previously described, access for construction and subsequent line maintenance activities will generally occur along the ROW using existing public access roads or trails wherever possible. Site access arising from construction of temporary or permanent roads, where required, has the potential to increase erosion and sedimentation by disrupting the stability of associated banks. These roads or trails may also require clearing of trees. Potential effects of clearing and increased sedimentation are described below.

RIGHT-OF-WAY CLEARING

A variety of methods are available for ROW clearing, including blades on tracked bulldozers, rotary drums, feller bunchers and hand clearing with chain saws, in environmentally sensitive sites (Chapter 2 – Project Description).

During the construction phase, tall treed vegetation located within riparian areas will be selectively cleared by hand to retain roots in the ground and reduce erosion and sedimentation. Low shrubs and ground vegetation will be retained within 30 m of watercourse crossings (Photo 8-5). Riparian vegetation and bank stability are important watercourse characteristics because they influence the potential or degree of soil erosion, provide filtration of overland flow from the surrounding land, and provide cover, cooling shade and food (*e.g.*, terrestrial invertebrates) for fish. Clearing and site preparation activities during the construction phase could introduce sediment into watercourses traversed by, or near, the Project which may induce biological effects. Clearing the transmission line ROW could contribute debris and sediment which can cause fish mortality as a result of heavy gill abrasion at high sediment concentrations (Herbert and Merkins 1961; Robertson *et al.* 2006). At lower suspended sediment concentrations, the effects could include subtle behavioural changes in fish, such as avoidance reactions. These reactions could lead to higher energy expenditures by individual fish and affect territorial responses in some species (Newcombe and Jensen 1996; Robertson *et al.* 2006).

Photo 8-5 **Low shrubs and vegetation management to reduce erosion and sedimentation at watercourse crossing**

At higher sublethal concentrations, the introduction of fine suspended sediment, such as silts and clays that increase turbidity, could induce effects such as reduced feeding efficiency, sense of smell in fish, decreased visual acuity and predator/prey interactions (Newcombe and Jensen 1996). Silts and clay from erosion can carry contaminants such as pesticides into watercourses increasing fish exposure and causing harm to fish (increased mortality, reduced physiological function in adult fish and reduced egg survival) (Levasseur *et al.* 2006).

Clearing of riparian vegetation can affect fish mortality and health by reducing shade cover and increasing local water temperatures. Increases in water temperature can diminish egg survival in species with lower thermal thresholds, as well as increasing fungal growth on eggs of summer spawning species (Carter 2005).

Increased sedimentation from site preparation and construction activities could also change the availability of invertebrates needed as food sources for fish (Suttle 2004; Ramezani *et al.* 2014). The reduced food source for fish due to sedimentation can affect fish mortality and health by reducing their growth (Harvey *et al.* 2009; Sullivan and Watzin 2010; Kemp *et al.* 2011).

TRANSMISSION TOWER CONSTRUCTION AND CONDUCTOR STRINGING

Conductor stringing requires the transmission line to cross the water. In many cases, the stringing of conductors will take place during the winter when the watercourses can be crossed on foot or by vehicle. During months of open water, the conductors will be transported across watercourses by boat. At watercourses that do not have existing nearby boat launches, launching the boat from shore could introduce bank materials into the watercourse and increase sedimentation. Operation of a motor boat near shore in shallow water can also stir up sediment.

Effect of sedimentation on fish mortality are described above. Also, operation of a motor boat near shore in shallow water can result in physical contact with mussels causing mortalities. Hydrocarbons from boat motors can leak into the watercourse affecting fish health.

POTENTIAL EFFECTS ON SPECIES OF CONSERVATION CONCERN

Potential effects on specific SOCC are summarized below:

Changes in fish mortality or health might have a greater effect on SOCC than on common species because SOCC populations are already approaching critical levels for sustainability as a result of threats to their environment. For many SOCC, biological characteristics make these populations slow to recover from increased mortality. The general effects of changes in fish mortality or health described for recreational fisheries apply to SOCC.

Banded killifish, bigmouth shiner, carmine shiner, chestnut lamprey, northern brook lamprey and shortjaw cisco are relatively short-lived species (NatureServe 2015a; COSEWIC 2003a; COSEWIC 2006a; COSEWIC 2010; COSEWIC 2007; COSEWIC 2003b); however, reduced population sizes inherent with being a SOCC mean that increased mortality might affect recovery or survival of the population. Therefore, in-water crossing techniques without the proper use or

implementation of mitigation measures, increased turbidity, and introduction of deleterious substances have potential to increase fish mortality or decrease fish health.

Bigmouth buffalo, lake sturgeon and mapleleaf are relatively long-lived species. The biological characteristics of these species (*e.g.*, longevity, delayed maturity, low mobility (mussels only)) make them susceptible to increased mortality and slow to rebound from low population levels (COSEWIC 2009; SRD 2002; COSEWIC 2006c). With the use of proper mitigation measures, incidental mortality for mussels is expected to be low. Mortality for bigmouth buffalo and lake sturgeon resulting from in-water crossings techniques is likely to be low as a result of their size and ability to avoid affected reaches. Potential Project-related activities that might alter substrate through siltation have potential to affect lake sturgeon habitat.

8.5.3.1.2 Operation and Maintenance

Operation and maintenance activities that could potentially interact with a change in fish mortality involve vegetation management of trees on the transmission line ROW.

VEGETATION MANAGEMENT – TREES ON TRANSMISSION LINE

The focus of vegetation management is on the tall growing tree species that have the potential to grow or fall into, or within, the arcing distance of the transmission lines and or facilities and cause an outage. Herbicide treatments are formulated to target undesirable tall growing trees but are also effective on broadleaf weeds, leaving grasses unaffected. Manitoba Hydro has developed a pesticide applicator requirements document that provides information to make sure pesticide management at all Manitoba Hydro facilities is consistent and reduces environmental effects.

Herbicides are applied to foliage during the warmer months while dormant stem applications are typically applied in the fall and winter. Permits for pesticide use are obtained as required. Spraying equipment includes backpack sprayers, truck-mounted power sprayers equipped with a broadcast applicator system, hose and handgun, and all-terrain vehicle (ATV) mounted power sprayers.

Riparian vegetation management and potential use of herbicides to control noxious or invasive riparian vegetation species could affect fish health and mortality if the chemicals were sprayed, rinsed or carried by sediment into watercourses. The pH of watercourses may also be altered if contaminated sediments are washed into the watercourse. A change in watercourse pH can affect fish mortality and health; guidance for acceptable change is provided by the CCME (1999).

Spills and inadvertent release of herbicides or the introduction of substances affecting fish health or increasing mortality are discussed in Chapter 21 – Accidents, Malfunctions and Unplanned Events.

Changes in fish mortality or health might have a greater effect on SOCC than on common species because SOCC populations are already approaching critical levels for sustainability as a result of threats to their environment. For many SOCC, biological characteristics make these

populations slow to recover from increased mortality. The general effects of changes in fish mortality or health described for CRA fisheries apply to SOCC.

The species-specific potential effects presented in Section 8.5.3.1.1 are also applicable to transmission line maintenance.

8.5.3.2 Mitigation for Change in Fish Mortality or Health

The following mitigation measures will be implemented to control potential effects on fish mortality or health during construction and operation and maintenance. General mitigation measures can be found in the Construction Environmental Protection Plan (CEnvPP; Chapter 22 – Environmental Protection, Follow-up and Monitoring).

8.5.3.2.1 Construction

- Appropriate erosion and sediment control measures will be implemented to mitigate sediment introduction into watercourses.
- Contractor will be restricted to established roads and trails, and cleared construction areas in accordance with the AMP.
- Construction activities surrounding watercourses will take place within Reduced Risk Timing Windows.
- Slash/debris piles will be adequately stabilized and stored above the HWM.
- Project personnel will be prohibited from fishing at Project locations or along rights-of-way.
- Fuel storage and equipment servicing areas will be located a minimum of 100 m away from the ordinary high water mark of any watercourse.
- In watercourses where mussel SOCC are known to occur, watercourse crossings may occur by boat or barge, or during winter (*i.e.*, under frozen conditions) to prevent mortality of the mussels.
- Machinery operation will take place outside the water in a manner that limits disturbance to the watercourse shorelines and riparian vegetation.
- Vehicle, equipment and machinery operators will perform a daily inspection for fuel, oil and fluid leaks and will immediately shutdown and repair any leaks found. All machinery working near watercourses will be kept clean and free of leaks.
- Equipment or machinery will not be washed in, or within 100 m, of watercourses.
- An emergency spill kit will be available on site in case of fluid leaks or spills from machinery.
- Use only clean ice/snow for construction of an ice/snowfill or ice bridge. Approaches to the bridge should be constructed with compacted snow and ice of sufficient thickness to protect the watercourse channel and banks. Sand, gravel and soils are not to be used for ice bridge approaches.

8.5.3.2.2 Operation and Maintenance

- Herbicides are to be applied in accordance with a Pesticide Use Permit and Pesticide Application Requirements for Manitoba Hydro Employees and Contractors Publication.
- Only chemicals approved by the Pesticide Use Permit are to be used.
- Application of herbicides will adhere to appropriate general mitigation measures and all chemical applications will be conducted by a licensed applicator.
- Herbicides will not be applied, other than backpack applications or handgun spot applications, within 30 meters of open water areas.
- Herbicides will not be applied to open water or to areas where fish habitat may be affected.

8.5.3.3 Characterization of Residual Environmental Effects for Change in Fish Mortality or Health

This assessment considers residual effects on fish mortality after mitigation is implemented. Residual effects are characterized based on several criteria (Table 8-3) and on the expected effectiveness of mitigation measures (Section 8.5.3.2).

The presence of construction personnel has the potential to increase fishing pressure on local fish populations. Through adherence to the no-fishing policy, potential effects on fish mortality and health from staff mobilization and equipment are expected to be negligible and no further assessment of this physical activity with respect to fish mortality and health is warranted.

The ecological context of the LAA is disturbed based on the presence of agricultural land use at most watercourse crossings, which can affect water chemistry, sediment load and turbidity, and subsequently fish mortality and health. Selective removal of only those trees that reach heights above approximately 2.5 m, which could interfere with the transmission lines during maintenance, will reduce sedimentation and risk of smothering eggs, gill abrasion and foraging.

Mortality of fish can be reduced by restricting construction near watercourses to periods outside of Manitoba's RAPs, particularly by employing winter construction. Incidental mortality of mussels can be mitigated by crossing in boats or during frozen winter conditions.

Risks of pesticide exposure during vegetation management practices can be avoided by following beneficial management practices.

Previous transmission line construction projects have shown that beneficial management practices and applied mitigation measures have reduced sedimentation, and increases in turbidity were only of short-term duration (Keeyask Infrastructure Project - Water Quality Monitoring Report 2013).

8.5.3.3.1 Residual Effects from Construction Activities

For the change in fish mortality and health during construction, the residual environmental effects have been characterized as follows:

- Direction is neutral: No net change in fish mortality and health is anticipated. Erosion and sedimentation from riparian vegetation clearing will be mitigated by selective clearing of trees within the ROW; the root systems of the remaining undisturbed brush and small trees will aid in holding soils in place.
- Magnitude is low: No measurable change in fish mortality and health is anticipated. Mitigation measures including RAPs and alternatives to fording are expected to limit fish mortality. Following DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat* during operation of machinery (DFO 2013d) is expected to limit the introduction of hydrocarbons or other deleterious substances related to equipment use.
- Geographic extent is the LAA. Change to fish mortality will be limited to the construction area in the PDA only. Changes in fish mortality as a result of sedimentation may occur within the LAA.
- Duration is short term: Changes in fish mortality and fish health associated with construction activities will be restricted to the construction phase. No permanent changes in fish mortality or health of CRA fisheries is expected.
- Frequency is multiple irregular events within the LAA. Changes in fish mortality will occur only once at most watercourse crossings during construction. In some cases, fish mortality may occur several times at a watercourse throughout the construction process.
- Ecological context is disturbed: the area has been previously disturbed by human development or human development is still present, (*i.e.,* agriculture and urban development, in Southern Loop Transmission Corridor the ROW follows an existing transmission line).

8.5.3.3.2 Residual Effects from Operation and Maintenance Activities

- Direction is neutral: No net change in fish mortality and health related to operation and maintenance activities is anticipated. Fish mortality resulting from herbicide applications will be mitigated by following the Pesticide Use Permit, which is issued to Manitoba Hydro under *The Environment Act* (C.C.S.M. c. E125) by Manitoba Conservation and Water Stewardship. Fish mortality resulting from the introduction of hydrocarbons and other deleterious substances will be negligible with the implementation of mitigation measures for safe operation of machinery near watercourses. Inspection activities will occur under frozen conditions.

- Magnitude is low: There will be no measurable change in fish mortality and health during the operation and maintenance phase of the Project. Mitigation measures including RAPs and alternatives to fording are expected to limit fish mortality. Following mitigation measures for the operation of machinery and herbicide applications will limit the introduction of hydrocarbons, herbicide or other deleterious substances into the watercourses, which might increase fish mortality.
- Geographic extent is the LAA. Fish mortality during operation and maintenance as a result of sedimentation, herbicide application or hydrocarbons in the watercourse has the potential to occur within the LAA.
- Duration is permanent: the ROW riparian vegetation tree removal and herbicide application during operation and maintenance must be maintained for the life of the Project.
- Effect is reversible: while mortality of an individual is irreversible, the effect at the population level is reversible.
- Ecological context: is disturbed. The area has been previously disturbed by human development or human development is still present, such as agriculture. Approximately 85% of the watercourse crossings occur within agricultural areas where, typically, riparian vegetation is limited to a treed buffer.

8.5.4 Summary of Environmental Effects on Fish and Fish Habitat

The Project will alter fish habitat primarily through the selective removal of riparian vegetation within the ROW near waterbodies, and through direct disturbance to watercourse banks during activities for site access. Short-term and localized sedimentation within the LAA may occur during construction and maintenance activities at watercourse crossings. Previous monitoring programs of transmission projects during construction have shown that increases in turbidity and sedimentation have not gone outside of the LAA, and quickly return to baseline conditions with the implementation of mitigation measures (Keeyask Infrastructure Project - Water Quality Monitoring Report 2013). By working outside of the RAP, it is anticipated that mortality of fish eggs and young of the year from increased sedimentation will be mitigated.

Localized changes in water temperature may occur during the initial period after selective riparian vegetation clearing for the transmission line crossing construction, but because this activity will be limited to the ROW, the changes are predicted to be negligible. Vegetation will be allowed to naturally regenerate along the ROW, with the exception of trees that could exceed guidelines and come into contact with the transmission lines.

The risk of fish exposure to deleterious chemicals, such as herbicides, oils, and fuels, is expected to be low because of the implementation of standard mitigation practices regarding herbicide application and the use of machinery near watercourses.

Increases in fishing pressure on fish populations are expected to be negligible because Manitoba Hydro will implement a no fishing policy for construction or maintenance personnel on the Project. Fishing pressure increase due to increased accessibility to the watercourse is anticipated to be negligible as many of the crossing locations are near existing access points.

With the implementation of standard mitigation, effects on fish health and mortality are expected to be low, localized, short in duration for construction activities and permanent (for life of the Project) for maintenance activities and reversible for the population (Table 8-11).

Table 8-11 Summary of Residual Environmental Effects on Fish and Fish Habitat

Project Phase	Residual Environmental Effects Characterization						
	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological Context
Change in Fish Habitat							
Construction	N	L	LAA	ST	IR	R	D
Operation and Maintenance	N	L	LAA	P	IR	R	D
Change in Fish Mortality or Health							
Construction	N	L	LAA	ST	IR	R	D
Operation and Maintenance	N	L	LAA	P	IR	R	D

KEY

See Table 8-2 for detailed definitions

Direction: *A: Adverse; N: Neutral; P: Positive*

Magnitude: *N: Negligible; L: Low; M: Moderate; H: High*

Geographic Extent: PDA: *ROW/Site; LAA: Local; RAA: Regional*

Duration: *ST: Short-term; MT: Medium-term; P: Permanent*

Frequency: *S: Single event; IR: Irregular event; R: Regular event; C: Continuous*

Reversibility: *R: Reversible: I: Irreversible*

Ecological Context: *U:Undisturbed, D:Disturbed*

N/A Not applicable

8.6 Assessment of Cumulative Environmental Effects on Fish and Fish Habitat

The Project effects described in Section 8.5.4 were assessed as neutral (*i.e.,* no net change in fish habitat availability, fish survival or health). Because there is no predicted adverse or positive residual effects from Project construction, operation or maintenance, the Project is not anticipated to contribute residual effects on fish and fish habitat that would have the potential to act cumulatively with the effects of other past or reasonably foreseeable future projects. The influence of past projects and physical activities on the baseline condition of fish and fish habitat in the assessment area was described in Section 8.4. Accordingly, no further cumulative effects assessment was undertaken.

8.7 Determinations of Significance

8.7.1 Significance of Environmental Effects from the Project

The assessment of potential Project effects considers effects that might occur during each phase of the Project (*i.e.*, construction and operation and maintenance) with the potential to cause alterations to fish and fish habitat. According to the Fisheries Protection Policy Statement (DFO 2013a), DFO defines a permanent alteration to fish habitat to mean changes "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". A permanent alteration to fish habitat is not anticipated for this Project.

Characterizing the potential risk of serious harm to fish and fish habitat resulting from Project-associated effects can be determined based on the sensitivity of a fishery and the negative effect of the activity. DFO's Fisheries Protection Policy (2013a) and Measures to Avoid Harm (DFO 2013d) provide guidance for identifying potential Project-associated effects, applying appropriate mitigation measures to reduce effects on fish and fish habitat, and determining the potential for residual serious harm.

For all but two watercourse crossings, the potential for negative residual effects of the Project is low. The potential for negative residual effects of the Project at the Assiniboine and Red Rivers is moderate because the watercourses support highly sensitive habitat (including CRA fisheries and SOCC) and are large, permanent watercourses with high flow. With mitigation, potential alteration to fish habitat from Project activities will be negligible at all watercourse crossings.

More specifically, after mitigation measures are implemented, the Project is not anticipated to result in:

- permanent alteration to fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use sensitive habitats, such as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, in order to carry out one or more of their life processes
- the likelihood of fish mortality (including eggs) or reductions in fish health at a level that reduces the productivity of a fishery, particularly on SOCC, including SAR
- water quality parameters not returning to within the limits of natural variation of baseline conditions or exceeding CCME Guidelines for the Protection of Aquatic Life (1999) and Manitoba Water Quality Standards (2011), following construction and implementation of erosion and sediment control measures

The implementation of Manitoba Hydro's standard mitigation measures, provincial guidelines for watercourse crossings, and protection principles outlined in the Fisheries Protection Policy Statement (DFO 2013a) and in the CEnvPP during construction, operation and maintenance is anticipated to result in minimal effects on fish and fish habitat, including CRA fisheries and SOCC. With environmental protection measures, mitigation and follow-up monitoring, the Project will not cause serious harm to fish and fish habitat, and residual environmental effects on fish and fish habitat are predicted to be not significant.

8.7.2 Significance of Cumulative Environmental Effects

No cumulative environmental effects on change in fish mortality or health have been identified (Section 8.6).

8.7.3 Sensitivity of Prediction to Future Climate Change

According to the climate change scenarios presented in Manitoba-Minnesota Transmission Project Historic and Future Climate Study, temperature and precipitation are expected to increase in the future. Predicted monthly mean temperatures during the spring and summer months (May through September) are projected to increase by 1.3°C, 2.5°C, and 3.5°C in the 2020s, 2050s and 2080s, respectively. Predicted total precipitation amounts during this period are projected to increase by 2.5%, 1.5%, and 2.8% in the 2020s, 2050s and 2080s, respectively. However, precipitation amounts are projected to be lower than current levels for the month of July based for the 2050s and 2080s scenarios.

Effects of climate change on fish and fish habitat are expected to be a function of this anticipated increase in temperature and associated extreme weather events (*e.g.,* flooding, wildfires). Resulting effects on fish and fish habitat in the RAA may include:

- higher mean monthly temperature could produce increases in maximum water temperatures that could exceed the lethal threshold for some species
- increased total precipitation, heavy rain events and flooding could increase erosion from agricultural areas and stream banks resulting in higher sediment loads entering watercourses
- change in riparian habitat resulting from wildfires caused by extreme weather events
- reduced food availability due to shifts in the seasonal timing of insect emergence associated with warmer temperatures
- shifts in species ranges with could have implications for SOCC

Given the timelines associated with the projected precipitation and temperature changes, there is uncertainty in predicting how these physical changes may affect fish species and their habitat. Fish species within the Project area will likely be able to overcome these challenges through shifts in spawning windows and species ranges (Chetkiewicz *et al*. 2012). Subtle changes in flow and temperature will alter thresholds of susceptibility, however, with adaptive management and close regulatory involvement the relative changes in effects of this Project due to climate change are anticipated to be negligible. The predicted climate change scenarios would not change the significance determinations for fish and fish habitat, as they are not anticipated to measurably increase the magnitude of effects of the Project on fish habitat availability or fish health and mortality.

8.8 Prediction Confidence

The pathways of environmental effects on fish and fish habitat, as a result of transmission line and station development, are well understood and mitigation measures have been successfully implemented in the past for transmission lines and other developments.

8.9 Follow-up and Monitoring

Environmental Inspections carried out during construction will verify the effectiveness of the mitigation strategies used during construction and identify additional remedial action required.

The following are the key measures recommended for the effects identified for fish and fish habitat:

- Change in fish habitat: During construction, inspection of sedimentation and erosion control structures and visual site inspections in the LAA are recommended to confirm that mitigation measures are effective.
- Change in fish mortality or health: If in water work is required during construction, regular inspection of surface water quality by Manitoba Hydro's Construction Monitor in watercourses adjacent to Project construction activities is recommended for the following parameters: TSS, pH, DO, water temperature, and water depth. No post-construction monitoring programs are anticipated. All proposed mitigation is standard practice for the transmission industry, and has been previously approved by regulators for use on other Manitoba Hydro projects.

8.10 Summary

The Project is located predominantly within the Red River Basin, where fish habitat has been historically affected by agricultural activity. Channelized waterways and constructed agricultural drains with poor quality riparian vegetation are prevalent in areas under crop production. The Project crosses two major watersheds, the Assiniboine River Basin and the Red River Basin, and seven sub-watersheds, including the Lower Assiniboine, La Salle River, Red River, Seine River, Cooks Creek/Devils Creek, Rat River and Roseau River (Map 8-1 – Sub-Watersheds). The transmission line crosses 75 watercourses, including rivers, streams, creeks and agricultural drains; 31 of these watercourses are potentially fish-bearing waters.

More than 75 fish species are known or expected to be in the RAA. More than 30 of these species are part of, or support, a CRA fishery in the RAA, with most found in the Assiniboine, Red, La Salle, Seine and Rat rivers. Nine aquatic SOCC with the potential to occur in the RAA have been identified by the Manitoba Conservation Data Centre (Fish and Fish Habitat TDR, Table 3-3).

The sensitivity of fish and fish habitat in Project watercourse crossings were ranked using criteria adapted from the *Practitioners Guide to the Risk Management Framework* (DFO 2006). Data collected during desktop and field assessments determined that 8 watercourses crossed by the Project were high sensitivity habitat on the basis of supporting SOCC, including SAR, CRA fisheries and because they contain habitat for CRA fishery life processes. There were five watercourses assessed to be moderately sensitive due to the diverse fish community, including the presence of a CRA fishery. Eight of the watercourses contained fish habitat, but were assessed as low sensitivity sites. These watercourses supported forage fish, but did not contain SOCC or a CRA fishery. Of the remaining crossings assessed, 44 watercourses did not support direct fish habitat, and two watercourses did not contain any direct or indirect fish habitat.

Riparian vegetation was characterized at each of the potential fish-bearing watercourses crossed by the Project. Within the PDA, riparian vegetation was classified as predominately agricultural land and developed in 15 of the 29 watercourses analyzed (52%). 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 8-7) because of low flows, poor spawning and rearing habitat and no overwintering capacity. The other six crossings have habitat that supports CRA 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 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.

Potential Project effects on fish and fish habitat are related to construction of the transmission line with mobilization, conductor stringing, development of access routes and trails, and vegetation management of trees within the transmission line ROW. However, construction activities in the vicinity of watercourses will take place outside of restricted activity periods (RAPs), based on DFO recommendations (DFO 2013b). This means much of the work will occur during the winter months, avoiding sensitive life-stage activities of fish, like spawning and rearing of young, which occur during the spring and summer.

Tree clearing for site preparation of the ROW and for the development of access roads is a direct loss of riparian vegetation with potential effects on fish and fish habitat. Loss of tall treed vegetation adjacent to watercourses could reduce cover for fish, reduce shade which moderates water temperature, and reduce habitat for insects which can be a food source for fish (DFO 2002; Government of Manitoba 2015; Manitoba Riparian Health 2015). Localized changes in water temperature may occur during the initial period after selective riparian vegetation clearing for the transmission line crossing construction, but because this activity will be limited to the ROW, the changes are predicted to be negligible due to the presence of similar habitat within and outside of the LAA. Vegetation will be allowed to naturally regenerate along the ROW, with the exception of trees that could exceed the 2.5 m height guideline and come into contact with the transmission lines.

Riparian vegetation clearing can also increase erosion and sedimentation, resulting in a change in substrate composition, and altering food supply through turbidity-related reductions in algae and aquatic insect production (Studinski *et al.* 2012). Several measures will be applied to mitigate potential effects of ROW clearing and associated increases in sedimentation at the watercourse crossings traversed by the Project. Access for construction and subsequent line maintenance

activities will generally occur along the ROW using existing public access roads or trails wherever possible. This enables maximum use of existing road access and reduces the requirement for the development of new temporary trail access, and the associated environmental effects. In many cases, the stringing of conductors will take place during the winter when the watercourses can be crossed on foot or by vehicle. During months of open water, the conductors will be transported across watercourses by boat. There will be no fording of streams. The risk of fish exposure to deleterious chemicals, such as herbicides, oils, and fuels, is expected to be low with the adoption of standard mitigation practices regarding herbicide application and the use of machinery near watercourses is followed.

Erosion and sedimentation from riparian vegetation clearing will be reduced by other measures, including retaining low shrubs and ground vegetation within 30 m of watercourse crossings. The root systems of the remaining undisturbed brush and small trees will aid in holding soils in place. A Machine Free Zone of approximately 7 m from the high water mark will also be maintained where trees will be cleared by hand. Equipment will only be allowed to reach into this area. Short-term and localized sedimentation within the LAA may occur during construction and maintenance activities at watercourse crossings. By working outside of the RAP, it is anticipated that mortality of fish eggs and young of the year from potentially increased sedimentation will be mitigated.

Increased access to fishing areas during the construction phase could increase recreational fishing pressure in the RAA, and contribute to a change in fish mortality. However, Project personnel will be prohibited from fishing at Project locations or along the ROWs. Fishing pressure increase due to increased accessibility to the watercourse is anticipated to be negligible as many of the crossing locations are near existing access points.

The Project effects were assessed as neutral (*i.e.,* no net change in fish habitat availability, fish survival or health). Because there is no predicted adverse or positive residual effects from Project construction, operation or maintenance, the Project is not anticipated to contribute residual effects on fish and fish habitat that would have the potential to act cumulatively with the effects of other past or reasonably foreseeable future projects. Accordingly, no further cumulative effects assessment was undertaken**.**

The Project is not anticipated to cause serious harm to fish and fish habitat. Residual environmental effects on fish and fish habitat are also predicted to be not significant. With the predicted climate change scenarios of precipitation and temperature changes, there will be alterations in thresholds of susceptibility. However, with adaptive management and close regulatory involvement, the relative changes in effect of this Project due to climate change are anticipated to be negligible. The predicted significance determinations for fish and fish habitat would not likely change, as they are not anticipated to measurably increase the magnitude of effects of the Project on fish habitat availability or fish health and mortality.

8.11 References

8.11.1 Literature Cited

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