13. FISH AND FISH HABITAT

This section describes and summarizes an assessment of the effects of the Project on fish and fish habitat. The assessment follows the general approach and concepts described in Section 5. The main steps in the assessment include:

- consideration of input from Indigenous communities, government representatives and agencies, other communities, property owners and people or groups interested in the Project during the ongoing consultation process;
- identification of information and data sources used in the assessment;
- identification and rationale for selection of criteria and indicators for fish and fish habitat;
- establishment of temporal and spatial boundaries for the assessment of effects on these criteria;
- description of the existing environment to gain an understanding of baseline conditions for these criteria;
- identification and screening of effect pathways that could link Project activities to changes in these criteria;
- characterization of predicted net effects (after mitigation) of the Project on criteria (if required);
- assessment and determination of significance of cumulative effects from the Project and previous, existing, and RFDs on criteria (if required);
- assessment of uncertainty in the effects predictions, indicating how uncertainties are addressed; and,
- identification of proposed monitoring or follow-up to confirm predictions and address uncertainty.

As outlined in Section 5.2.1, the assessment is structured around three assessment cases:

- Base Case;
- Project Case; and,
- Cumulative Effects Case.

For the purposes of this document, water bodies are defined as areas with defined bed and banks, whether or not water is continuously present, and is consistent with the general definition used under the *Conservation Authorities Act* (Government of Ontario 2003) and Ontario Stream Assessment Protocol (Stanfield 2010). A water body may be permanent, intermittent, or ephemeral. Types of water bodies include watercourses (e.g., streams, rivers), lakes, ponds, and wetlands (Government of Ontario 2011).

13.1 Input from Consultation and Engagement

The following issues pertaining to fish and fish habitat were raised during consultation and engagement for the Project:

- concerns regarding effects on fish habitat quality as a result of Project construction;
- concerns regarding effects of vegetation maintenance (herbicide use) on fish habitat quality; and,
- concerns regarding Project-related effects on surface water and groundwater resulting in effects to aquatic ecosystems.

These issues have been considered and addressed in this section of the EA Report. A detailed consultation and engagement record is provided in Appendices 2-III and 2-IX.

13.2 Information Sources

Information for the fish and fish habitat baseline was collected from review of the following sources:

- baseline natural heritage existing conditions report for the Project (Dillon 2015, 2016);
- other EA reports in northwestern Ontario (Government of Ontario 2016a; Mucha and Mackereth 2008; MNRF 2016a; Nature Conservancy 2015);
- Forest Management Plans (686860 Ontario Ltd. 2006; AbiBow Canada Inc. 2010; Clergue Forest Management Inc. 2009; Domtar Inc. 2008; Government of Ontario 2004a,b; Great West Timber Ltd. 2005; GreenForest Management Inc. 2010; Greenmantle Forest Inc. 2006; Terrace Bay Pulp 2010);
- electronic data obtained from the MNRF through Land Information Ontario (LIO) and the Natural Heritage Information Centre (NHIC) (Government of Ontario 2011, 2015, 2016b);
- aerial imagery provided by NextBridge (acquired 2013-2014) and publicly available aerial imagery (MNRF 2016b; Google 2016);
- surficial geology, bedrock geology, topographic mapping, and available existing geological and hydrogeological reports (Government of Ontario 2015; MNRF 2016b,c);
- other applicable reports and documentation from publicly available sources (DFO 2015; Eakins 2016; Government of Ontario 2014, 2016c; MNRF 2016c,d);
- MNRF's Fish ON-line (MNRF 2016c) database;
- Lists of species of conservation significance developed by federal (e.g., Committee on the Status of Endangered Wildlife in Canada [COSEWIC 2016], *Species at Risk Act* [SARA] [Government of Canada 2016]) and provincial (e.g., *Endangered Species Act, 2007* [Government of Ontario 2007] under the Species At Risk in Ontario list developed by the Committee on the Status of Species at Risk in Ontario [COSSARO] [Government of Ontario 2016d], NHIC species of conservation concern [Government of Ontario 2016b]) authorities and expert committees; and,
- fish and fish habitat information collected during engagement activities for the Project (Bobrowicz 2014; Hawkins 2016).

For the purposes of the EA, sufficient information was deemed to be available from the references listed above to assess the potential effects of the Project on fish and fish habitat.

13.3 Criteria, Assessment Endpoints and Indicators

Criteria are components of the environment that are considered to have economic, social, biological, conservation, aesthetic, or ethical value (Section 5.1). Fish species that are part of a fishery can be an important cultural, subsistence, and economic resource for people in Ontario, as well as species that support the fishery. For the EA, four fish species with different life history strategies and aquatic ecosystems were selected as criteria for assessing the effects of the Project on fish and fish habitat:

- **Brook Trout (*Salvelinus fontinalis*):** Brook Trout, also known as Speckled Trout, occur in clear, cool, well-oxygenated watercourses and lakes. Brook Trout typically rely on gravel areas of cold water tributary watercourses for spawning in the fall.
- **Northern Pike (*Esox lucius*):** Northern Pike occur in weedy areas of lakes and marshes and in watercourses with slow to moderate current. Northern Pike spawn in early spring soon after the ice melts on inundated vegetation along the floodplains of rivers, streams, marshes, or shallow areas of lakes.
- **Walleye (*Sander vitreus*):** Walleye, also known as Yellow Pickerel, occur primarily in lakes and large rivers. Walleye spawn in late spring, primarily along gravel, boulder, or cobble along inshore areas of lakes, or nearby tributaries.
- **Lake Sturgeon (*Acipenser fulvescens*):** Lake Sturgeon inhabit large river and lake systems. Lake Sturgeon spawn in late spring/early summer in relatively shallow, fast-flowing water (usually below waterfalls, rapids, or dams) with gravel and boulders at the bottom, or on shoals in large rivers with strong currents.
- **Aquatic Ecosystems**: an aquatic ecosystem is a group of organisms interacting and dependent upon one another and their aquatic environment. Aquatic ecosystems contain a diverse variety of aquatic organisms including but not limited to bacteria (i.e., microscopic single-celled organisms), fungi (i.e., eukaryotic organisms that are unicellular or multicellular), benthic invertebrates (i.e., organisms that live in or on the sediment in water bodies), phytoplankton (i.e., microscopic plants that live in the water column), zooplankton (i.e., tiny organisms that live in the water column), aquatic plants, and fish.

The four fish species were identified as criteria for fish and fish habitat, in part because they are species of value to communities, government agencies, and the public based on input from consultation, and because they are representative harvested species and include representative species of conservation concern. Brook Trout, Northern Pike, Walleye, and Lake Sturgeon are fish species that can be part of a commercial, recreational, or Aboriginal fishery; therefore, including these species as criteria is consistent with DFO's legislation and policy (i.e., *Fisheries Act* [Government of Canada 1985] and *Fisheries Protection Policy* [DFO 2013]). Lake Sturgeon is also listed as "Threatened" under provincial legislation and under COSEWIC. The Project also crosses the proposed Moose Lake Highlands Enhanced Management Area (EMA), also known as the Brook Trout Triangle (Hawkins 2016). The EMA has been proposed to protect a number of small lakes that contain resident lake spawning Brook Trout populations where there are concerns about effects to Brook Trout through increased public access via transmission and access corridors (Hawkins 2016).

Aquatic ecosystems were identified as a criterion for the fish and fish habitat assessment based on consultation with MOECC (2016). In addition to the four fish species, the aquatic ecosystems criterion provides an assessment of the broad-scale ecosystem that is likely to be influenced by the Project (i.e., examines aquatic biodiversity of the region at the broadest level). Ecosystems can be conceptually defined as the complex of interactions and fluxes of matter and energy among living (plants, animals, micro-organisms) and non-living (minerals, water, air) components of an environment acting as a functional unit (Waring 1989; Austin et al. 2008). Assessing and managing biodiversity at the aquatic ecosystem level means that large numbers of biodiversity elements are addressed together. For example, analysis of the availability, distribution and function of aquatic ecosystems provides an assessment of plankton, benthic invertebrates, aquatic plants, and forage fish species, which provide the food base for large-bodied predatory fish species. The structure and functions of aquatic ecosystems can be affected by human activity and disturbances through, for example, indirect changes to the quantity and quality of groundwater and surface water flows, or direct loss of habitat.

Assessment endpoints represent the key properties of each criterion that should be protected (Section 5.1). The assessment endpoint for the fish and fish habitat criteria is maintenance of self-sustaining and ecologically effective fish populations and aquatic ecosystems. The sustainability of the fish population(s) and aquatic ecosystems depends on the quantity and quality of the habitats required for each species and their respective life history stages. While recognizing that fish populations can fluctuate naturally, sustainable or self-sustaining populations are defined as those with the inherent capacity to be productive when their habitats and environmental conditions permit (Randall et al. 2013); in other words, the population is not affected to the point where future recruitment (i.e., organisms reaching a certain life history stage such as settlement or maturity) is diminished. Self-sustaining ecosystems are healthy, functioning, and robust entities that are capable of withstanding environmental change and accommodating stochastic processes. Ecologically effective ecosystems are those that can support the range of native species and ecological and evolutionary processes normally provided by the ecosystem (Noss 1990). These processes vary by ecosystem type and are not easily quantified.

Indicators represent attributes of the environment that can be used to characterize changes to criteria and the assessment endpoint in a meaningful way. The indicators for fish and fish habitat are defined as follows:

- **Habitat availability:** includes habitat quantity **(**the amount of habitat available for aquatic organisms and various life history stages of fish) and habitat quality (the quality of habitat available for aquatic organisms and various life history stages of fish).
- **Distribution:** the spatial configuration and connectivity of habitats for aquatic organisms and fish in the study areas, and the spatial distribution and movement of fish.
- **Abundance:** applies to the four fish species criteria. Abundance is the amount of fish in the population (i.e., based on survival and reproduction).
- **Community composition:** applies to the aquatic ecosystems criterion. Community composition is the assemblage of aquatic organisms in the aquatic ecosystem, and takes into account species richness, species abundance, and species diversity.

The criteria, assessment endpoints and indicators selected for the assessment of Project effects on fish and fish habitat, and the rationale for their selection, are provided in Table 13-1.

Table 13-1: Fish and Fish Habitat Criteria, Indicators, and Assessment Endpoints

Criteria	Rationale	Indicators	Assessment Endpoints
Brook Trout *(Salvelinus fontinalis)*	■ Stringent habitat requirements (e.g., cold water) and is sensitive to disturbance ■ Representative recreational harvested species for cold water fish and fish habitat ■ Important recreational (catch and release and harvested) species ■ Fall spawning species that primarily spawn in watercourse habitat with gravel substrates. This type of habitat is common in the fish and fish habitat LSA ■ Prevalent in lakes and watercourses in the fish and fish habitat LSA	■ Habitat availability ■ Abundance ■ Distribution	Maintenance of self-sustaining and ecologically effective population

Table 13-1: Fish and Fish Habitat Criteria, Indicators, and Assessment Endpoints

Criteria	Rationale	Indicators	Assessment Endpoints
Northern Pike *(Esox lucius)*	■ Representative recreational and Aboriginal harvested species for cool water fish and fish habitat ■ Spring spawning species that spawn in slow moving watercourses with instream vegetation. This type of habitat is common in the study areas ■ Important recreational (catch and release and harvested) species ■ Prevalent in lakes and watercourses in the fish and fish habitat LSA	■ Habitat availability ■ Abundance ■ Distribution	Maintenance of self-sustaining and ecologically effective population
Walleye *(Sander vitreus)*	■ Representative recreational species for cool and warm water lake and large water body fish and fish habitat ■ Spring spawning species that spawn in lakes or larger tributaries with coarse substrates. This type of habitat is present in the fish and fish habitat LSA ■ Important harvested species ■ Prevalent in lakes in the fish and fish habitat LSA	■ Habitat availability ■ Abundance ■ Distribution	Maintenance of self-sustaining and ecologically effective population
Lake Sturgeon *(Acipenser fulvescens)*	■ Listed as "Threatened" under the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2016) and the provincial *Endangered Species Act, 2007* under the Species at Risk in Ontario list (Government of Ontario 2016d) ■ Less prevalent in the fish and fish habitat LSA compared to the species above, but are a concern from a regulatory perspective ■ Primarily inhabit lakes and move into large watercourses in spring to spawn ■ Long-lived sensitive fish species that are vulnerable to habitat loss and overharvest	■ Habitat availability ■ Abundance ■ Distribution	Maintenance of self-sustaining and ecologically effective population
Aquatic Ecosystems	■ Aquatic ecosystems contain a diverse variety of aquatic organisms (e.g., bacteria, fungi, benthic invertebrates, phytoplankton, zooplankton, aquatic plants, and fish) that interact and are dependent upon one another ■ Conservation concern ■ Social importance ■ Sensitive to development	■ Habitat availability ■ Distribution ■ Community composition	Maintenance of self-sustaining and ecologically effective aquatic ecosystems

13.4 Assessment Boundaries

13.4.1 Temporal Boundaries

The Project is planned to occur during two phases (Section 5.2.1):

- **construction phase:** the period from the start of construction to the start of operation (approximately two years); and,
- **operation phase:** encompasses operation and maintenance activities throughout the life of the Project, which is anticipated to be indefinite.

The assessment of Project effects on fish and fish habitat considers effects that occur during the construction and operation phases. These periods are sufficient to capture the effects of the Project.

13.4.2 Spatial Boundaries

Spatial boundaries for the assessment are provided in Table 13-2 and shown on Figure 13-I in Appendix 13-I.

Table 13-2: Fish and Fish Habitat Spatial Boundaries

Spatial Boundaries	Area (ha)	Description	Rationale
Project footprint	4,832	The Project footprint is the preferred route ROW, laydown yards, storage yards, construction camps, temporary construction easements and new access roads	Designed to capture the potential direct effects of the physical footprint of the Project
Fish and Fish Habitat LSA	211,638	Includes the Project footprint and extends 1 km from the preferred route ROW boundary and 500 m from the access roads, and boundaries of storage yards, laydown yards, storage yards and construction camps, unless intersected by the shoreline of Lake Superior. The fish and fish habitat LSA boundary is where the shoreline is intersected.	Designed to capture local effects of the Project on fish and fish habitat criteria that may extend beyond the Project footprint
Fish and Fish Habitat Regional Study Area	6,180,600	Encompasses the catchment areas (as defined on a tertiary watershed scale) of each water body crossed by the Project footprint, upstream to the headwaters and downstream to Lake Superior	Designed to provide a large enough area to assess the cumulative and regional effects on the fish and fish habitat criteria

13.5 Description of the Existing Environment

This section provides a summary of the existing environment for fish and fish habitat based on review of desktop information, field reconnaissance, and aerial reconnaissance.

13.5.1 Baseline Data Collection Methods

The fish and fish habitat baseline program involved the development of water body crossing lists, desktop study including a review of aerial imagery, and aerial reconnaissance. The water body crossing lists were completed for water bodies potentially crossed by the preferred route ROW and access roads. Water bodies crossed by access roads where no work is proposed below the high water mark because there is an existing crossing structure that is sufficient for the Project were excluded from the desktop study and aerial reconnaissance. These water body crossings were not assessed as part of the fish and fish habitat baseline program. Water bodies located near or in off-ROW workspaces (e.g., laydown yards, storage areas, and construction camps) were also excluded from the desktop study and aerial reconnaissance because no work is proposed within 30 m of the high water mark of these water bodies. These water bodies were not assessed as part of the fish and fish habitat baseline program.

The desktop study was completed for water bodies potentially crossed by the preferred route ROW and crossed by access roads where new crossing structures are proposed. The desktop study incorporated information from field reconnaissance completed along the ROW in 2014 (Dillon 2015, 2016). The review of aerial imagery and aerial reconnaissance was completed in 2016. The aerial reconnaissance was completed along the preferred route ROW and included the access roads where the preferred route ROW and access roads were parallel.

13.5.1.1 Water Body Crossing List Development

The fish and fish habitat baseline program started with the development of water body crossing lists for the preferred route ROW and access roads. The water bodies crossed by the preferred route ROW and/or access roads are included in the water body crossing lists. The water body crossing lists were developed using GIS to overlay the proposed Project footprint with the Ontario Hydro Network (Government of Ontario 2011) and identify hydrology features crossed by the Project. Additional water bodies that were identified during the desktop study and aerial reconnaissance were added to the water body crossing lists.

Proposed water body crossings were assigned an identifying site number that consisted of a minimum two digit number with two decimal points, followed by "-WC" (water body crossing) for the preferred route, or "-WC-A" for the access roads (Appendix 13-II, Tables 13-II-1 and 13-II-2).

13.5.1.2 Desktop Study

The purpose of the desktop study was to collate information relating to fish and fish habitat at each proposed water body crossing. Information was collected from review of the sources outlined in Section 13.2.

Using the references in Section 13.2, for each water body, the following habitat variables were documented, where available:

- location (Universal Transverse Mercator [UTM] coordinates, North American Datum [NAD] 83) for each water body crossing;
- water body name (according to the Ontario Hydro Network [Government of Ontario 2011] or local name, if known);
- if the water body is mapped (i.e., present) or unmapped (i.e., not present) on the Ontario Hydro Network (Government of Ontario 2011);

- flow regime (visually assessed at the crossing location):
  - ephemeral – flows only during and after large precipitation events for a period of a few days to a few weeks;
  - intermittent – flows during wet seasons and in the summer after a major rain event, a non-permanent flowing drainage feature with a defined channel and evidence of annual scour or deposition; or,
  - permanent – flows for most of the year but can run dry during drought conditions;
- water body type (based on MNRF sensitive values database [MNRF 2016d]):
  - watercourse – a flowing body of water within a defined channel (includes rivers, creeks, streams); or,
  - lake/pond – water body that is surrounded by land and has no discernible flow;
- thermal regime – the MNRF sensitive values database (Government of Ontario 2015) includes thermal regime designations for most water bodies in Ontario. The thermal regimes are classified as follows (MNRF 2016d):
  - cold – water bodies where water temperatures range from 7 degrees Celsius (ºC) to 18ºC;
  - cool – water bodies where water temperatures range from 18ºC to 25ºC; and,
  - warm – water bodies where water temperatures can be greater than 25ºC.

  These designations are based on existing knowledge of fish species present (e.g., a cold water designation indicates high probability of the presence of salmonids). If a thermal regime was not classified for a water body, but the upstream or downstream water body was classified and there were no major changes in aquatic habitat (e.g., change from pond to watercourse), the thermal regime was extrapolated to the unclassified water body;
- major habitat types (visually assessed in the survey reach) in accordance with the classification system outlined in O'Neil and Hildebrand (1986):
  - riffle – portion of channel with increased velocity relative to run and pool habitat types; broken water surface due to effects of submerged or exposed bed materials; relatively shallow (less than 0.25 m) during moderate to low flow periods;
  - rapids – portion of channel with highest velocity relative to other habitat types. Deeper than riffle (ranging from approximately 0.25 m to 0.5 m); often formed by channel constriction. Substrate extremely coarse; dominated by large cobble and boulder material. Instream cover provided in pocket eddies and associated with cobble/boulder substrate;
  - run – portion of channel characterized by moderate to high current velocity relative to pool and flat habitat; water surface largely unbroken. Deeper than riffle habitat type;
  - flat – area of channel characterized by low current velocities (relative to riffle and run cover types); near-laminar (i.e., non-turbulent) flow character. Depositional area featuring predominantly sand/silt substrate. Differentiated from pool habitat type on basis of high channel uniformity and lack of direct riffle/run association. More depositional in nature than run habitat (e.g., sand/silt substrate, lower food production, low cover);
  - pool – discrete portion of channel featuring increased depth and reduced velocity (downstream oriented) relative to riffle and run habitat types; formed by channel scour (i.e., removal of bed or bank material by flowing water);

  - impoundment – pools formed behind dams; tend to accumulate sediment/organic debris more than scour pools; may have cover associated with damming structure;
  - backwater – discrete, localized area of variable size, exhibiting reverse flow direction; generally produced by bank irregularities; velocities variable but generally lower than the main flow; substrate similar to adjacent channel, but with higher proportion of fines;
- bank-full width (visually estimated at the crossing location to the nearest 1 m, if possible) – width of channel where the water level would be at the top of the channel banks;
- wetted width (visually estimated at the crossing location to the nearest 1 m, if possible) – width of the water at the time of the survey;
- mean bank-full depth (m) (visually estimated in the survey reach to the nearest 0.1 m, if possible [Dillon 2015, 2016]) – depth of the water if water level was at the top of the channel banks);
- bank shape (visually assessed at the crossing location as sloping, vertical, or undercut);
- bank stability (visually assessed at the crossing location as protected [i.e., stable], vulnerable [i.e., potentially unstable], eroding [i.e., active erosion of bank] , or depositional [i.e., active deposits on the bank]);
- instream cover (visually assessed in the survey reach as overhanging vegetation, substrate, depth/turbulence, aquatic vegetation, undercut banks, and woody debris);
- substrate type (visually assessed in the survey reach) using the Modified Wentworth Scale (Wentworth 1922):
  - organic – organic material;
  - silt – particles less than 0.06 mm in diameter;
  - sand – particles between 0.06 mm and 2.00 mm in diameter;
  - gravel – particles between 2 mm and 64 mm in diameter; range of sizes may be present;
  - cobble – particles between 64 mm and 256 mm in diameter;
  - boulder – particles greater than 256 mm in diameter; and,
  - bedrock – consolidated rock;
- presence of fish passage barriers (visually assessed in the survey reach);
- documented fish species; and/or,
- documented fish species in upstream and downstream water bodies.

Using the available habitat data:

- Based on the habitat features described above, the likelihood of each water body to support forage fish and large-bodied fish was rated as:
  - nil – the water body had no habitat available and would not support fish because of unsuitable habitat conditions, which may include no instream cover, an ephemeral flow regime, and a permanent large barrier (e.g., dam) preventing fish access to the waterbody,
  - low – the water body had low-quality habitat available, which may include an ephemeral to semi-permanent flow regime, limited abundance of habitat and substrate types to provide life history functions for fish (e.g., only pool habitat with silt substrate), partial barriers to fish movement (e.g., beaver dams, log jams), and minimal instream cover,

- moderate – the water body had moderate-quality habitat available, which may include an ephemeral to semi-permanent flow regime, some habitat and substrate type variety (e.g., more than two types available), absence of barriers to fish movement in the vicinity of the crossing, and multiple sources of instream cover,
- high – the water body had high-quality habitat available, which may include a permanent flow regime, a variety of habitat and substrate types to meet life history requirements for fish (including spawning habitat), absence of barriers, and variety of instream cover,

Forage fish, also called baitfish, are generally small fish (total lengths generally less than 200 mm) that may serve as food for larger predators. Forage fish species would include the Cyprinidae (e.g., Lake Chub [*Couesius plumbeus*]) and Cottidae (e.g., Slimy Sculpin [*Cottus cognatus*]) families. Large-bodied fish, including sport fish species, generally have fork lengths (length of a fish measured from the tip of the snout to the end of the middle caudal fin rays) greater than 200 mm when they are adults, and would include species from the Acipenseridae (e.g., Lake Sturgeon [*Acipenser fulvescens*]), Salmonidae (e.g., Brook Trout [*Salvelinus fontinalis*]), and Catostomidae (e.g., White Sucker [*Catostomus commersonii*]) families. Large-bodied fish that are targeted by anglers (e.g., species from the Acipenseridae and Salmonidae families) are considered sport fish.

- Fish habitat potential was rated for each water body. Specifically, each water body was rated as having "No Fish Habitat" or "Fish Habitat". This rating was determined using the habitat variables described above. If the likelihood that a water body could support forage or large-bodied fish was rated as low, moderate, or high (i.e., not nil), it was rated as having "Fish Habitat". If a water body had an ephemeral flow regime, moderate channel definition (e.g., poorly defined bed and banks), substantial barriers (e.g., subsurface flow, dams), or the likelihood that the water body would support forage or large-bodied fish was rated as nil, the water body may be rated as having "No Fish Habitat". If not enough habitat data were available, a precautionary approach was employed and it was assumed that the water body has "Potential Fish Habitat".
- If there was potential for the water body to support fish (i.e., there is Fish Habitat or Potential Fish Habitat), a list of fish species, including the four criteria species, that may be present was generated, including species documented in the water body or in upstream or downstream water bodies. Where there were no known documented fish species, species composition was inferred using professional judgement, taking into consideration aspects such as common fish species in the area, thermal regime, habitat conditions and flow status (e.g., permanent, intermittent).

For the preferred route ROW, the main information sources were data collected from the 2014 field reconnaissance, the review of aerial imagery, and the aerial reconnaissance. In 2014, field reconnaissance was completed for water bodies along the planned ROW at that time. The baseline reports (Dillon 2015, 2016) include baseline fish habitat data (e.g., channel widths, notes on habitat potential, habitat types) for potentially affected water bodies along the planned ROW at that time. Fish habitat data for 255 water body crossings were available from these reports (Dillon 2015, 2016). Due to logistics of access and landowner approval, not all of the water bodies along the ROW that was proposed in 2014 were assessed. Furthermore, since 2014, the alignment of the route has been revised in response to input from interested parties, and therefore, there were water bodies along the preferred route ROW that were not assessed as part of the 2014 field reconnaissance. Some of the sites surveyed in 2014 were no longer on the current route because of reroutes; however, if the water body was still crossed at a different location, the data were reviewed to see if they were applicable to the current crossing location. Water bodies where there was insufficient information available from the 2014 field reconnaissance were reviewed using aerial imagery or surveyed during the aerial reconnaissance.

For access roads that were parallel to the preferred route ROW, the data collated for a water body crossing along the preferred route ROW were reviewed to see if they were applicable to the water body crossing on the access road. For the remainder of the access road water body crossings, high quality aerial imagery was not available and, due to timing logistics, the water body crossings were not surveyed during the aerial reconnaissance. Therefore, where the access roads were not parallel to the preferred route ROW or where there were no applicable data, publicly available aerial imagery (MNRF 2016b; Google 2016) was reviewed to obtain general habitat descriptions.

13.5.1.3 Aerial Imagery Review and Aerial Reconnaissance

The aerial imagery review and aerial reconnaissance were designed to collect information on selected water bodies. The aerial imagery review was completed at 48 water body crossings along the preferred route ROW that were not surveyed in 2014 or where there was not enough background information to confidently classify fish habitat in the water body, and where there was adequate imagery to assess fish habitat. A precautionary approach was used when assessing fish habitat where the aerial imagery was deemed inadequate (e.g., along sections of the access roads). The aerial imagery review could be used for assessing fish habitat on larger water bodies or water bodies where there was limited overhanging vegetation. After completion of the desktop study and aerial imagery review, 127 water body crossings along the preferred route ROW were surveyed as part of the aerial reconnaissance because there was not enough background information to confidently classify the fish habitat availability in the water body. The aerial reconnaissance was completed from June 9 to 12, 2016. A total of 38 water body crossings in the preferred route ROW were surveyed using aerial imagery from publicly available sources (MNRF 2016b; Google 2016) and were not assessed in the field because of land access logistics, availability of aerial imagery, and changes in the route alignment since field work was completed.

During the aerial imagery review and aerial reconnaissance, each water body was surveyed in a section with a minimum length of 500 m, including 200 m upstream from the crossing and 300 m downstream from the crossing. Construction has the potential to affect the water body downstream from the crossing through sedimentation; therefore, the distance surveyed downstream is greater than the distance surveyed upstream. The aerial imagery review and aerial reconnaissance were designed to collect the necessary information for the Project and to align with the data collected in 2014. A description of the fish habitat visually assessed during the aerial imagery review and aerial reconnaissance was documented, based on the variables listed in Section 13.5.1.2, including major habitat types, substrate type, flow regime, presence of fish passage barriers, bank-full width, and bank shape and stability. Along the access roads where high quality aerial imagery was unavailable, the aerial imagery review included documenting the presence of fish passage barriers and bank-full width. The data were entered onto a datasheet. During the aerial reconnaissance, photographic documentation from the air was completed.

13.5.1.4 Data Quality and Control

A quality assurance / quality control (QA/QC) program was used for the Project to minimize the possibility of error during data collection, data entry and data interpretation. Standardized datasheets and methods were used as a means of consistency and to control the quality of data collected. Specific work instructions were written for this purpose. Datasheet QA/QC was completed in the field for all datasheets completed for that day. The QA/QC check included an exchange of datasheets between field crews or team members so that all fields were legible and properly entered. Field photos and Global Positioning System (GPS) coordinates were backed up to laptops daily. Data entry was evaluated for errors or omissions by reviewing each datasheet to verify that the electronic database accurately reflected field observations.

QA/QC for the water body crossing lists and fish data lists involved the following tasks:

- review by more than one person, including a senior fish biologist to ensure accuracy; and,
- review by a fish biologist and a water resources engineer to ensure all water bodies were included and to QA/QC the data.

13.5.2 Baseline Conditions

The following sections provide a summary of the results of the desktop study.

13.5.2.1 Fish Habitat Availability

The existing environment was described for the four species selected as criteria for the fish and fish habitat assessment (Section 13.3) to provide context for the assessment. The description of existing conditions considered the measurement indicators for the criteria, including the existing fish habitat quantity and quality in the fish and fish habitat LSA.

The fish and fish habitat LSA contains many water bodies that provide fish habitat and have potential to support many different fish species. The larger water bodies in the fish and fish habitat LSA provide fish habitat year-round, including spawning, rearing, feeding and overwintering habitat. The smaller water bodies in the fish and fish habitat LSA may not provide overwintering habitat, as oxygen levels in shallow lakes and wetlands can drop to hypoxic conditions and the watercourses may freeze to bottom. Smaller water bodies can be suitable habitat for spawning, rearing, and feeding for portions of the year, typically in early spring and after the spring freshet. Spring and fall spawning habitat is available in the fish and fish habitat LSA for a variety of species. For example, the smaller watercourses with slow moving water and instream vegetation would provide spring spawning habitat for Northern Pike or forage species. The watercourses with faster moving water and coarse substrates (i.e., gravel or cobble) would provide fall spawning habitat for Brook Trout or spring spawning habitat for Rainbow Trout (*Oncorhynchus mykiss*). Some of the larger watercourses may provide spawning habitat for Lake Sturgeon. The lakes in the fish and fish habitat LSA may also provide spawning habitat for lake spawning species including Walleye and Lake Trout (*Salvelinus namaycush*).

A summary of the water body crossings including a detailed description of fish habitat in each watershed is provided in the following section. The habitat potential for each water body will vary depending on location (e.g., habitat potential may be higher in lower reaches near a major water body than in upper reaches in a watershed); the discussion below is for the habitat potential at the crossing location in the fish and fish habitat LSA.

13.5.2.1.1 Summary of Water Body Crossings for the Project

There are 459 water bodies crossed by the preferred route ROW, and in-water work may occur to create access along the route at each of these water body crossings (Table 13-3; Appendix 13-II, Table 13-II-2). Along the access roads, there are 871 water body crossings, including 426 where work below the high water mark is likely to occur (Table 13-4; Appendix 13-II, Table 13-II-2). The remainder of the water body crossings along the access roads (*n*[1] = 445) will not affect fish and fish habitat as there is no work proposed below the high water mark because there are existing crossing structures that are sufficient and can be used for the Project. These 445 crossings and the aquatic habitat at these crossings are therefore not discussed further. The majority of the water bodies are crossed by both the preferred route ROW and access roads and several of the water bodies are crossed more than once.

For the preferred route ROW, 356 of the water body crossings are on watercourses and 102 are on lakes or ponds (Table 13-3). The majority (*n* = 398) of the crossings are on permanent (i.e., flows for most of the year but can run dry during drought conditions) water bodies, and there are also 38 crossings on ephemeral (i.e., flows only during and after large precipitation events for a period of a few days to a few weeks) water bodies, and 23 crossings on intermittent (i.e., flows during wet seasons and in the summer after a major rain event) water bodies. Thermal regimes (i.e., MNRF's classification of water bodies based on water temperature and fish species present) are unclassified at the majority (*n* = 324) of the water body crossings, but there are water bodies with designated cold, cool, and warm thermal regimes. The bank-full widths range from approximately 0.2 to 382 m and the majority (*n* = 261) of channels are considered small (i.e., have bank-full widths less than 5 m). The majority (*n* = 398) were determined to have Fish Habitat; 23 water bodies were determined to have No Fish Habitat, and 38 water bodies were rated as having Potential Fish Habitat (Table 13-5).

For the access roads, 418 of the water body crossings are on watercourses and 8 are on lakes or ponds (Table 13-4). The majority (*n* = 381) of the crossings are on permanent water bodies. There are 19 crossings on ephemeral water bodies and 26 crossings on intermittent water bodies. Thermal regimes are unclassified at the majority (*n* = 352) of the water body crossings, but there are water bodies with designated cold and cool thermal regimes (there were no water bodies with warm water thermal regimes on the access roads). The bank-full widths range from approximately 0.6 m to 100 m and the majority (*n* = 377) of channels are considered small (i.e., have bank-full widths less than 5 m). The majority (*n* = 218) were determined to have Fish Habitat; 21 water bodies were determined to have No Fish Habitat, and 187 water bodies were rated as having Potential Fish Habitat (Table 13-5).

[1] *n* refers to sample size.

Table 13-3: Summary of Fish Habitat Variables of Water Bodies Crossed by the Preferred Route Right-of-Way

Tertiary Watershed	Number of Water Body Crossings			Flow Regime			Thermal Regime				Bank-full Width			
	Watercourse	Lake / Pond	Total	Eph	Int	Perm	Cool	Cold	Warm	No Data	<5 m	>5 m	Min	Max
Lake Superior	0	2	2	0	0	2	0	0	0	2	0	2	246	365
Black Sturgeon	79	12	91	10	6	75	2	48	2	39	58	33	0.3	200
Nipigon	8	0	8	0	2	6	0	7	0	1	5	3	1.0	358
Jackpine	48	9	57	8	2	47	0	37	0	20	36	21	0.4	273
Little Pic	68	25	93	11	3	79	1	18	0	74	48	45	0.3	382
Pic	25	0	25	1	0	24	0	0	0	25	19	6	0.4	45
White	63	28	91	1	3	87	6	5	0	80	49	42	0.4	230
Michipicoten-Magpie	66	26	92	7	7	78	2	7	0	83	46	46	0.2	377
Total	**357**	**102**	**459**	**38**	**23**	**398**	**11**	**122**	**2**	**324**	**261**	**198**	**0.2**	**382**

Cold water fish species include the criteria species Brook Trout and Lake Sturgeon, and cool water fish species include the criteria species Northern Pike and Walleye.
Eph = Ephemeral; Int = intermittent; Perm = permanent; <= less than; >= greater than; m = metre; Min = minimum; Max = maximum.

Table 13-4: Summary of Fish Habitat Variables of Water Bodies Crossed by the Access Roads Rights-of-Way

Tertiary Watershed	Number of Water Body Crossings			Flow Regime			Thermal Regime				Bank-full Width			
	Watercourse	Lake / Pond	Total	Eph	Int	Perm	Cool	Cold	Warm	No Data	<5 m	>5 m	Min	Max
Black Sturgeon	51	1	52	6	1	45	1	29	0	22	47	5	0.6	100
Nipigon	4	0	4	0	0	4	0	4	0	0	3	1	<1	6
Jackpine	50	0	50	4	0	46	0	25	0	25	42	8	<1	16
Little Pic	94	0	94	3	1	90	2	8	0	84	89	5	<1	21
Pic	29	0	29	1	0	28	0	0	0	29	26	3	<1	12
White	63	4	67	1	1	65	0	4	0	63	63	4	<1	93
Michipicoten-Magpie	127	3	130	4	23	103	0	1	0	129	107	23	<1	47
Total	**418**	**8**	**426**	**19**	**26**	**381**	**3**	**71**	**0**	**352**	**377**	**49**	**0.6**	**100**

Cold water fish species include the criteria species Brook Trout and Lake Sturgeon, and cool water fish species include the criteria species Northern Pike and Walleye.
Eph = Ephemeral; Int = intermittent; Perm = permanent; <= less than; >= greater than; m = metre; Min = minimum; Max = maximum.

Table 13-5: Summary of Fish Habitat Potential for Water Bodies Crossed by the Preferred Route Right-of-Way and Access Road Rights-of-Way

Tertiary Watershed	Preferred Route Right-of-Way			Access Road Rights-of-Way		
	Fish Habitat	No Fish Habitat	Potential Fish Habitat	Fish Habitat	No Fish Habitat	Potential Fish Habitat
Lake Superior	2	0	0	0	0	0
Black Sturgeon	46	8	37	27	8	17
Nipigon	8	0	0	4	0	0
Jackpine	53	3	1	32	5	13
Little Pic	89	4	0	48	2	44
Pic	24	1	0	24	1	4
White	87	4	0	40	3	24
Michipicoten-Magpie	89	3	0	43	2	85
Total	**398**	**23**	**38**	**218**	**21**	**187**

13.5.2.1.2 Lake Superior

Lake Superior covers 8,210,000 hectares, has a maximum depth of 406 m, an average depth of 147 m (MNRF 2016b) and supports a productive aquatic ecosystem with 79 species of fish, including all four of the fish criteria species. It is also the largest freshwater lake by surface area in the world. The two proposed preferred route crossings of Lake Superior (sites 2080.00-WC and 2290.00-WC) are south from the Little Pic watershed. The bank-full widths at these crossings are approximately 246 m and 365 m, respectively. The fish habitat availability at these crossings was rated as moderate to high.

13.5.2.1.3 Black Sturgeon Tertiary Watershed

The water bodies located on the western end of the fish and fish habitat LSA for the preferred route ROW and access roads are in the Black Sturgeon tertiary watershed. Water bodies in this watershed flow into northwestern Lake Superior. Named watercourses crossed by the preferred route ROW in this watershed include Wild Goose Creek, the Mackenzie River, Coldwater Creek, the Wolf River, the Black Sturgeon River, Moseau Creek, and South Trout Creek. Named lakes crossed include Raymore Lake, Hades Lake, Beaver Lake, and Granite Lake. Named water bodies crossed by the access roads, where works below the high water mark may be needed, are Wild Goose Creek, Blind Creek, Wolf Lake, Moseau Creek and South Trout Creek. The majority of the crossings are on watercourses that have cold water thermal regimes; however, some cool water thermal regimes occur in the southern portions of the watershed near Thunder Bay and Hades Lake has a warm water thermal regime.

In the Black Sturgeon watershed, habitat data were available for 54 of the 91 water body crossings for the preferred route ROW and at 35 of the 52 water body crossings for access roads. At the crossings, the bank-full widths are generally less than 5 m wide; however, there are several larger watercourses and lakes. Where data were available, banks were generally sloping and protected, with vulnerable banks also present (Appendix 13-II, Tables 13-II-1 and 13-II-2). Overhanging vegetation was the dominant instream cover type and cobble was the dominant substrate type. Beaver activity was prevalent in the watershed. At the crossings, the likelihood of the water body to support fish was rated as nil to high for forage and large-bodied fish. The majority of the watercourses had fall spawning habitat for salmonid species including Brook Trout and there was some spring spawning habitat for forage species. Spawning habitat for Walleye and Northern Pike was uncommon. Lake Sturgeon are known to occur in the Black Sturgeon River; however, migration barriers likely limit access to the crossing location. There was No Fish Habitat potential at eight water body crossings along the preferred route ROW and at eight water body crossings along the access roads.

The Lakehead Region Conservation Authority overlaps the Black Sturgeon tertiary watershed and 42 of the water body crossings along the preferred route ROW and 23 of the water body crossings along the access roads are located in the Lakehead Region Conservation Authority's area of jurisdiction.

Three of the water body crossings along the preferred route ROW are in the proposed Moose Lake Highlands Enhanced Management Area (EMA), also known as the Brook Trout Triangle (Hawkins 2016). The EMA has been proposed to protect a number of small lakes that contain resident lake-spawning Brook Trout populations where there are concerns about effects to Brook Trout through increased public access via transmission and access corridors (Hawkins 2016). None of the water body crossings where work may be needed below the high water mark are in the proposed Moose Lake Highlands EMA.

13.5.2.1.4 Nipigon Tertiary Watershed

The fish and fish habitat LSA crosses the southern portion of the Nipigon tertiary watershed. This watershed drains into northwestern Lake Superior. The named watercourses crossed by the preferred route ROW in this watershed are Stillwater Creek and the Nipigon River; no lakes or ponds are crossed. The access roads, where works below the high water mark may be needed, cross Stillwater Creek and three unnamed watercourses. The crossings are on watercourses and the majority have a cold water thermal regime. There are no cool or warm water thermal regimes and one water body crossing has no classified thermal regime.

In the Nipigon watershed, habitat data were available for all eight water body crossings along the preferred route ROW and at all four of the water body crossings along access roads. At the crossings, the bank-full widths are generally less than 5 m wide; however, the Nipigon River has a bank-full width of approximately 358 m at the preferred route ROW. Where recorded, banks were generally sloping and protected or vulnerable (Appendix 13-II, Tables 13-II-1 and 13-II-2). Overhanging vegetation was the dominant instream cover type and organics and sand were the dominant substrate type. Beaver activity was prevalent (i.e., recorded at 50% of the water bodies) near the crossing locations. All of the water bodies had Fish Habitat potential. At the crossings, the likelihood of the water body to support fish was rated as low to moderate for forage and large-bodied fish. Approximately half of the watercourses had fall spawning habitat for Brook Trout and the other half had some spring spawning habitat for forage species. Spawning habitat for Walleye and Northern Pike was uncommon. Lake Sturgeon are known to occur in the Nipigon River, and may be present at the crossing location.

13.5.2.1.5 Jackpine Tertiary Watershed

The Jackpine watershed drains into north-central Lake Superior. Named watercourses along the preferred route ROW include the Jackfish River, Ozone Creek, the Jackpine River, the Cypress River, the Little Cypress River, the Little Gravel River, Paddy Creek, and the Gravel River. Named lakes crossed include Ivan Lake, Claire Lake, Hydro Lake, and Nishin Lake. The access roads, where works below the high water mark may be needed, also cross most of these named water bodies, but not the Jackfish River, Ozone Creek, the Jackpine River or the named lakes. The majority of the crossings are on watercourses that have cold water thermal regimes.

In the Jackpine watershed, habitat data were available for 56 of the 57 water body crossings in the preferred route ROW and at 37 of the 50 water body crossings along access roads. At the water body crossings, the bank-full widths are generally less than 5 m wide; however, there are several larger watercourses and lakes. Where data were available, banks were sloping and generally protected, with vulnerable and eroding banks also present (Appendix 13-II, Tables 13-II-1 and 13-II-2). Notably, eroding banks were prevalent at the Little Gravel River (1370.00-WC) and Paddy Creek (1400.00-WC) crossings. Overhanging vegetation was the dominant instream cover type, with woody debris also common. Fines, organics, and detritus were the dominant substrate type. Beaver activity was common in the watershed.

At the crossings, the likelihood of the water body to support fish was rated as nil to high for forage and large-bodied fish. Ozone Creek, Dublin Creek, the Cypress River, the Little Gravel River, and Paddy Creek had high potential to support fish. The majority of these watercourses had fall and spring spawning habitat for smaller salmonid species including Brook Trout and Rainbow Trout. The Gravel River crossing along the preferred route ROW was located immediately downstream from a large waterfall that could potentially provide spawning habitat for Lake Sturgeon. The Cypress River may provide spawning habitat for Brook Trout, Rainbow Trout, Walleye, and Northern Pike in the fish and fish habitat LSA. There was No Fish Habitat potential at three water body crossings along the preferred route ROW and at five water body crossings along the access roads.

13.5.2.1.6 Little Pic Tertiary Watershed

The Little Pic watershed drains into north-central Lake Superior. Named watercourses along the preferred route ROW include the Pays Plat River, Ansell Creek, Aguasabon River, the Steel River, the Prairie River and the Little Pic River. Named lakes include Moberley Lake, Lyne Lake, McLean's Lake, and Elbow Lake. The access roads, where works below the high water mark may be needed, also cross most of these named water bodies, but not the Pays Plat River, the Aguasabon River, Little Pic River, or any of the named lakes. The majority of the crossings are on watercourses that have no designated thermal regime. However, a large proportion (27%) of the crossings along the preferred route ROW in this watershed are on lakes or ponds.

In the Little Pic watershed, habitat data were available for all of the 93 water body crossings along the preferred route ROW and at 50 of the 94 water body crossings along access roads. At the crossings, the bank-full widths ranged from approximately 0.3 m on an unnamed watercourse to approximately 382 m on Lyne Lake. Along the preferred route ROW, the bank-full widths were considered small (i.e., less than 5 m) at 48 of the crossings, moderate (i.e., between approximately 5 m and 20 m) at 14 of the crossings, and large (i.e., greater than 20 m) at 31 of the crossings. Where data were available, banks were sloping and generally protected, with vulnerable banks also present (Appendix 13-II, Tables 13-II-1 and 13-II-2). Overhanging vegetation was the dominant instream cover type, with woody debris also common. Sand and cobble were the dominant substrate type. Beaver activity was common in the watershed.

At the crossings, the likelihood of the water body to support fish was rated as nil to high for forage and large-bodied fish. The Pays Plat River, Elbow Lake, McLean's Lake, Antler Lake, Whitesand Lake, and the Steel River all had high potential to support fish. The majority of the watercourses provide fall and spring spawning habitat for salmonid species including Brook Trout and the lakes provide spawning habitat for lake spawning species including Cisco (Lake Herring) (*Coregonus artedi*). Some of the larger watercourses (e.g., Pays Plat River) provide spawning habitat for Walleye. Spawning habitat for Northern Pike was common. There was No Fish Habitat potential at four water body crossings along the preferred route ROW and at two water body crossings along the access roads.

13.5.2.1.7 Pic Tertiary Watershed

The Pic watershed drains into northeastern Lake Superior, south from Marathon. The water body crossings are on watercourses; no lakes or ponds are crossed by the preferred route ROW or access roads. Named watercourses along the preferred route ROW include the Pic River, the Black River, Wabikoba Creek, and Alder Creek. The access roads, where works below the high water mark may be needed, also cross the named creeks, but none of the named rivers are crossed. None of the watercourses in the Pic watershed have a designated thermal regime.

In the Pic watershed, habitat data were available for the 25 watercourse crossings along the preferred route ROW and at 25 of the 29 watercourse crossings along access roads. At the crossings, the bank-full widths ranged from approximately 0.4 m to 45 m and along the preferred route ROW, the majority (n=19) of watercourses are considered small (i.e., bank-full widths less than 5 m). Where data were available, banks were sloping and generally vulnerable, with protected banks also present (Appendix 13-II, Tables 13-II-1 and 13-II-2). Overhanging vegetation was the dominant instream cover type and detritus was the dominant substrate type. Beaver activity was noted at three of the watercourses.

At the crossings, the likelihood of the water body to support fish was rated as nil to high for forage fish and nil to moderate for large-bodied fish. The majority of the watercourse crossings had spring spawning habitat for species that spawn in slower moving waters (e.g., Northern Pike, Walleye), but in general, there was a lack of fall spawning habitat for salmonid species (i.e., Brook Trout). The crossing on Wabikoba Creek along the preferred route ROW is in a fish sanctuary, and the creek is closed to fishing from March 15 to June 15 (Government of Ontario 2014). There was No Fish Habitat potential at one water body crossing along the preferred route ROW and at one water body crossings along the access roads.

13.5.2.1.8 White Tertiary Watershed

The White watershed drains into northeastern Lake Superior. Named watercourses along the preferred route ROW include the Pukaskwa River, the White River, and Pokei Creek. Named lakes include White Lake, North Buck Lake, and Doss Lake. The access roads, where works below the high water mark may be needed, cross the majority of the named watercourses, but not the named lakes. The majority of the crossings are on watercourses that have no designated thermal regime. A large proportion (31%) of the crossings along the preferred route in this watershed are on lakes or ponds.

In the White watershed, habitat data were available for all of the 91 water body crossings along the preferred route ROW and at 43 of the 67 water body crossings along access roads. At the crossings, the bank-full widths ranged from approximately 0.4 m to 230 m. Along the preferred route ROW, the bank-full widths were considered small (i.e., less than 5 m) at 49 of the crossings, moderate (i.e., between approximately 5 and 20 m) at 16 of the crossings, and large (i.e., greater than 20 m) at 26 of the crossings. Where data were available, banks were sloping and generally protected, with vulnerable banks also present (Appendix 13-II, Tables 13-II-1 and 13-II-2). Overhanging vegetation was the dominant instream cover type and organics was the dominant substrate type. Beaver activity was prevalent in the watershed.

At the crossings, the likelihood of the water body to support fish was rated as nil to high for forage and large-bodied fish. Overall, habitat for large-bodied fish was limited (e.g., nil to low fish habitat availability). However, White Lake, the White River, Whitehead's Creek, and the Pukaskwa River all had high potential to support fish. The majority of the water bodies had some spring spawning habitat, but only the larger watercourses had fall spawning habitat. Spawning habitat for Brook Trout, Northern Pike and Walleye was common. There was No Fish Habitat potential at four water body crossings along the preferred route ROW and at three water body crossings along the access roads.

13.5.2.1.9 Michipicoten-Magpie Tertiary Watershed

The Michipicoten-Magpie watershed drains into eastern Lake Superior. Named watercourses along the preferred route ROW include the Dog River, the Jimmy Kash River, the Makwa River, the Magpie River, the Michipicoten River, and the Anjigami River. One named lake, Cinders Lake, is crossed. The access roads, where works below the high water mark may be needed, also cross the Dog River, the Jimmy Kash River, and the Makwa River, as well as Molybdenite Lake and Molybdenite Creek. The majority of the crossings are on watercourses that have no designated thermal regime. However, a large proportion (28%) of the crossings along the preferred route ROW are on lakes or ponds and there are some water bodies with designated cool or cold water thermal regimes.

In the Michipicoten-Magpie watershed, habitat data were available for all of the 93 water body crossings along the preferred route ROW and at 45 of the 130 water body crossings along access roads. At the crossings, the bank-full widths ranged from approximately 0.2 to 377 m. Along the preferred route ROW, the bank-full widths were considered small (i.e., less than 5 m) at 46 of the crossings, moderate (i.e., between approximately 5 and 20 m) at 17 of the crossings, and large (i.e., greater than 20 m) at 30 of the crossings. Where data were available, banks were sloping and generally protected, with vulnerable banks also present. Overhanging vegetation was the dominant instream cover type and organics was the dominant substrate type. Beaver activity was common in the watershed.

At the crossings, the likelihood of the water body to support fish was rated as nil to high for forage and large-bodied fish. The Dog River and the Makwa River had high potential to support fish. The majority of the water bodies had some spring spawning habitat, but only the larger watercourses had fall spawning habitat. Spawning habitat for Brook Trout, Northern Pike, and Walleye was common. There was No Fish Habitat potential at three water body crossings along the preferred route ROW and at two water body crossings along the access roads.

13.5.2.2 Fish Abundance and Distribution

The existing environment was described to provide context for the assessment for the four fish species selected as criteria for the fish and fish habitat assessment (Section 13.3). The description of existing conditions considered the measurement indicators for the criteria, including the existing fish abundance and distribution in the fish and fish habitat LSA.

Lake Superior is known to support 79 fish species, including the four criteria species (Brook Trout, Northern Pike, Walleye, and Lake Sturgeon). Of these 79 species, 67 have the potential to occur in the tributaries to the lake in the fish and fish habitat LSA (Table 13-6) (686860 Ontario Ltd. 2006; AbiBow Canada Inc. 2010; Bobrowicz pers. comm. 2014; Clergue Forest Management Inc. 2009; Dillon 2015, 2016; Domtar Inc. 2008; Eakins 2016; Government of Ontario 2004a, 2004b, 2014, 2015, 2016a,b,c; Great West Timber Ltd. 2005; GreenForest Management Inc. 2010; Greenmantle Forest Inc. 2006; Hawkins 2016; MNRF 2016a,c; Mucha and Mackereth 2008; Nature Conservancy 2015, Terrace Bay Pulp 2010). The fish and fish habitat LSA contains a diverse fishery consisting of many species important for commercial, recreational, and Aboriginal fishing, including forage fish, sport fish and species of conservation concern. This species list is typical of cold and cool water thermal regimes in Ontario (Dillon 2015, 2016). Brook Trout, Northern Pike, and Walleye are species that are targeted by anglers in the area and are therefore part of a commercial, recreational, or Aboriginal fishery.

Numerous water bodies in the fish and fish habitat LSA have documented fish presence (Appendix 13-II, Table 13-II-3). The majority of the named water bodies, and some of the smaller unnamed watercourses, have documented fish presence. The water bodies in the fish and fish habitat LSA are known to be productive from a fisheries perspective, and it is likely that the majority of the water bodies have fish present even if there is no documented fish presence. The most common fish species (i.e., recorded in the most water bodies) were Brook Trout, Northern Pike, Walleye, and White Sucker. Brook Trout are documented throughout the fish and fish habitat LSA, while Northern Pike, Walleye, and White Sucker are more common along the eastern portion of the fish and fish habitat LSA. It is likely that species in the Cyprinidae family (i.e., minnows) are common in the fish and fish habitat LSA, as there is moderate quality forage fish habitat in the majority of the water bodies. Lake Sturgeon are less common in the fish and fish habitat LSA than the other selected criteria species due to their habitat requirements for lakes or larger watercourses.

Spawning habitat was prevalent for Brook Trout and Northern Pike in the majority of the water bodies in the fish and fish habitat LSA and, given the distribution of these species, it is likely that all life stages (i.e., fry, juvenile and adult) may be present in the fish and fish habitat LSA. Both fall and spring spawning species were prevalent in the water bodies of the fish and fish habitat LSA. Fall spawning species in the fish and fish habitat LSA water bodies included Brook Trout, Lake Trout, Lake Whitefish (*Coregonus clupeaformis*) and Cisco. Spring spawning species included Rainbow Trout, Northern Pike, Lake Sturgeon, and Walleye. Spawning habitat for Lake Sturgeon in the fish and fish habitat LSA was limited as they typically spawn in larger water bodies in relatively shallow, fast-flowing water (usually below waterfalls, rapids, or dams) with gravel and boulders at the bottom, or on shoals in large rivers with strong currents.

Table 13-6: Fish Species Documented in the Fish and Fish Habitat Local Study Area and Their Conservation Concern

Family	Common Name[(a)]	Scientific Name	Native/ Exotic	Spawning Season	Documented Presence		Federal		Provincial	
					Lake Superior	Tributaries in the LSA	COSEWIC[(b)]	SARA[(c)]	SAR[(d)]	S Rank[(e)]
Acipenseridae	Lake Sturgeon[(f)]	*Acipenser fulvescens*	Native	spring	✓	✓	threatened	n/a	threatened	S2
Anguillidae	American Eel	*Anguilla rostrata*	Native	winter	✓	n/a	threatened	n/a	endangered	S1
Catostomidae	Silver Redhorse	*Moxostoma anisurum*	Native	spring	✓	✓	n/a	n/a	n/a	S4
	Longnose Sucker	*Catostomus catostomus*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Shorthead Redhorse	*Moxostoma macrolepidotum*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	White Sucker	*Catostomus commersonii*	Native	spring	✓	✓	n/a	n/a	n/a	S5
Centrarchidae	Black Crappie	*Pomoxis nigromaculatus*	Native	spring	✓	✓	n/a	n/a	n/a	S4
	Largemouth Bass	*Micropterus salmoides*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Pumpkinseed	*Lepomis gibbosus*	Native	spring/ summer	✓	n/a	n/a	n/a	n/a	S5
	Rock Bass	*Ambloplites rupestris*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Smallmouth Bass	*Micropterus dolomieu*	Native	spring	✓	✓	n/a	n/a	n/a	S5
Clupeidae	Alewife	*Alosa pseudoharengus*	Exotic	summer	✓	✓	n/a	n/a	n/a	SNA
Cottidae	Deepwater Sculpin	*Myoxocephalus thompsonii*	Native	summer/ fall	✓	✓	special concern	special concern	n/a	S3
	Mottled Sculpin	*Cottus bairdii*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Slimy Sculpin	*Cottus cognatus*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Spoonhead Sculpin	*Cottus ricei*	Native	spring/ summer	✓	✓	n/a	n/a	n/a	S4

Table 13-6: Fish Species Documented in the Fish and Fish Habitat Local Study Area and Their Conservation Concern

Family	Common Name[a]	Scientific Name	Native/ Exotic	Spawning Season	Documented Presence		Federal		Provincial	
					Lake Superior	Tributaries in the LSA	COSEWIC[b]	SARA[c]	SAR[d]	S Rank[e]
Cyprinidae	Blackchin Shiner	*Notropis heterodon*	Native	summer	✓	✓	n/a	n/a	n/a	S4
	Blacknose Dace	*Rhinichthys obtusus*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Blacknose Shiner	*Notropis heterolepis*	Native	summer	✓	✓	n/a	n/a	n/a	S5
	Bluntnose Minnow	*Pimephales notatus*	Native	summer	✓	✓	n/a	n/a	n/a	S5
	Brassy Minnow	*Hybognathus hankinsoni*	Native	spring/ summer	✓	-	n/a	n/a	n/a	S5
	Common Carp	*Cyprinus carpio*	Exotic	spring/ summer	✓	✓	n/a	n/a	n/a	SNA
	Common Shiner	*Luxilus cornutus*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Creek Chub	*Semotilus atromaculatus*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Emerald Shiner	*Notropis atherinoides*	Native	summer	✓	✓	n/a	n/a	n/a	S5
	Fathead Minnow	*Pimephales promelas*	Native	spring/ summer	✓	✓	n/a	n/a	n/a	S5
	Finescale Dace	*Phoxinus neogaeus*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Golden Shiner	*Notemigonus crysoleucas*	Native	summer	✓	✓	n/a	n/a	n/a	S5
	Goldfish	*Carassius auratus*	Exotic	spring / summer	✓	✓	n/a	n/a	n/a	SNA
	Lake Chub	*Couesius plumbeus*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Longnose Dace	*Rhinichthys cataractae*	Native	spring/ summer	✓	✓	n/a	n/a	n/a	S5
	Mimic Shiner	*Notropis volucellus*	Native	summer	✓	✓	n/a	n/a	n/a	S5
	Northern Redbelly Dace	*Phoxinus eos*	Native	spring/ summer	✓	✓	n/a	n/a	n/a	S5
	Northern Pearl Dace	*Margariscus nachtriebi*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Sand Shiner	*Notropis stramineus*	Native	summer	✓	n/a	n/a	n/a	n/a	S4
	Spottail Shiner	*Notropis hudsonius*	Native	spring	✓	✓	n/a	n/a	n/a	S5

Table 13-6: Fish Species Documented in the Fish and Fish Habitat Local Study Area and Their Conservation Concern

Family	Common Name[a]	Scientific Name	Native/ Exotic	Spawning Season	Documented Presence		Federal		Provincial	
					Lake Superior	Tributaries in the LSA	COSEWIC[b]	SARA[c]	SAR[d]	S Rank[e]
Esocidae	Muskellunge	*Esox masquinongy*	Native	spring	✓	✓	n/a	n/a	n/a	S4
	Northern Pike[f]	*Esox lucius*	Native	spring	✓	✓	n/a	n/a	n/a	S5
Gadidae	Burbot	*Lota lota*	Native	winter	✓	✓	n/a	n/a	n/a	S5
Gasterosteidae	Brook Stickleback	*Culaea inconstans*	Native	spring/ summer	✓	✓	n/a	n/a	n/a	S5
	Ninespine Stickleback	*Pungitius pungitius*	Native	summer	✓	✓	n/a	n/a	n/a	S5
	Fourspine Stickleback	*Apeltes quadracus*	Exotic	spring/ summer	✓	✓	n/a	n/a	n/a	SNA
	Threespine Stickleback	*Gasterosteus aculeatus*	Native	spring/ summer	✓	n/a	n/a	n/a	n/a	S4
Gobiidae	Round Goby	*Neogobius melanostromus*	Exotic	spring/ summer	✓	n/a	n/a	n/a	n/a	SNA
	Tubenose Goby	*Proterorhinus marmoratus*	Exotic	spring/ summer	✓	n/a	n/a	n/a	n/a	SNA
Ictaluridae	Black Bullhead	*Ameiurus melas*	Native	spring	✓	✓	n/a	n/a	n/a	S4
	Brown Bullhead	*Ictalurus nebulosus*	Native	spring	✓	✓	n/a	n/a	n/a	S5
Lepisosteidae	Longnose Gar	*Lepisosteus osseus*	Native	spring	✓	-	n/a	n/a	n/a	S4
Osmeridae	Rainbow Smelt	*Osmerus mordax*	Native	spring	✓	✓	n/a	n/a	n/a	S5
Percidae	Eurasian Ruffe	*Gymnocephalus cernuus*	Exotic	spring	✓	✓	n/a	n/a	n/a	SNA
	Iowa Darter	*Etheostoma exile*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Johnny Darter	*Etheostoma nigrum*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Logperch	*Percina caprodes*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Sauger	*Sander canadense*	Native	spring	✓	✓	n/a	n/a	n/a	S4
	Walleye[f]	*Sander vitreus*	Native	spring	✓	✓	n/a	n/a	n/a	S5
	Yellow Perch	*Perca flavescens*	Native	spring	✓	✓	n/a	n/a	n/a	S5

Table 13-6: Fish Species Documented in the Fish and Fish Habitat Local Study Area and Their Conservation Concern

Family	Common Name[a]	Scientific Name	Native/ Exotic	Spawning Season	Documented Presence		Federal		Provincial	
					Lake Superior	Tributaries in the LSA	COSEWIC[b]	SARA[c]	SAR[d]	S Rank[e]
Percopsidae	Trout-perch	*Percopsis omiscomaycus*	Native	spring/ summer	✓	✓	n/a	n/a	n/a	S5
Petromyzontidae	American Brook Lamprey	*Lampetra appendix*	Native	spring	✓	✓	n/a	n/a	n/a	S3
	Northern Brook Lamprey	*Ichthyomyzon fossor*	Native	spring	✓	✓	special concern	special concern	special concern	S3
	Sea Lamprey	*Petromyzon marinus*	Exotic	spring	✓	✓	n/a	n/a	n/a	SNA
	Silver Lamprey	*Ichthyomyzon unicuspis*	Native	spring	✓	✓	special concern	n/a	special concern	S3
Salmonidae	Bloater	*Coregonus hoyi*	Native	fall/ winter	✓	✓	n/a	n/a	n/a	S4
	Brook Trout[f]	*Salvelinus fontinalis*	Native	fall	✓	✓	n/a	n/a	n/a	S5
	Brook Trout "Coaster" Population[f]	*Salvelinus fontinalis*	Native	fall	✓	✓	n/a	n/a	n/a	-
	Brown Trout	*Salmo trutta*	Exotic	fall	✓	✓	n/a	n/a	n/a	SNA
	Chinook Salmon	*Oncorhynchus tshawytscha*	Exotic	fall	✓	✓	n/a	n/a	n/a	SNA
	Cisco (Lake Herring)	*Coregonus artedi*	Native	fall	✓	✓	n/a	n/a	n/a	S5
	Coho Salmon	*Oncorhynchus kisutch*	Exotic	fall	✓	✓	n/a	n/a	n/a	SNA
	Kiyi	*Coregonus kiyi*	Native	fall	✓	n/a	n/a	n/a	n/a	-
	Kiyi Upper Great Lakes Kiyi	spp. Kiyi (*Coregonus kiyi kiyi*)	Native	fall	✓	n/a	special concern	special concern	special concern	S3
	Lake Trout	*Salvelinus namaycush*	Native	fall	✓	✓	n/a	n/a	n/a	S5
	Lake Whitefish	*Coregonus clupeaformis*	Native	fall	✓	✓	n/a	n/a	n/a	S5
	Pink Salmon	*Oncorhynchus gorbuscha*	Exotic	fall	✓	✓	n/a	n/a	n/a	SNA

Table 13-6: Fish Species Documented in the Fish and Fish Habitat Local Study Area and Their Conservation Concern

Family	Common Name[(a)]	Scientific Name	Native/ Exotic	Spawning Season	Documented Presence		Federal		Provincial	
					Lake Superior	Tributaries in the LSA	COSEWIC[(b)]	SARA[(c)]	SAR[(d)]	S Rank[(e)]
Salmonidae (cont'd)	Pygmy Whitefish	*Prosopium coulteri*	Native	fall	✓	n/a	n/a	n/a	n/a	SU
	Rainbow Trout (Steelhead)	*Oncorhynchus mykiss*	Exotic	spring	✓	✓	n/a	n/a	n/a	SNA
	Round Whitefish	*Prosopium cylindraceum*	Native	fall	✓	✓	n/a	n/a	n/a	S4
	Shortjaw Cisco	*Coregonus zenithicus*	Native	fall	✓	✓	threatened	n/a	threatened	S2
	Splake	hybrid (lake trout and brook trout)	Hybrid of Native	fall	✓	n/a	n/a	n/a	n/a	SNA
Umbridae	Central Mudminnow	*Umbra limi*	Native	spring	✓	✓	n/a	-n/a	n/a	S5

a) Species list collated from 686860 Ontario Ltd. (2006); AbiBow Canada Inc. (2010); Bobrowicz (2014); Clergue Forest Management Inc. (2009); Dillon (2015); Domtar Inc. (2008); Eakins (2016); Government of Ontario (2004a, b, 2014, 2015, 2016a,b,c); Great West Timber Ltd. (2005); GreenForest Management Inc. (2010); Greenmantle Forest Inc. (2006); Hawkins (2016); MNRF (2016a, 2016c); Mucha and Mackereth (2008); Nature Conservancy (2015), Terrace Bay Pulp (2010).

b) COSEWIC (2016).

c) Government of Canada (2016).

d) Government of Ontario (2016d).

e) Government of Ontario (2016b); S1 = critically imperilled; S2 = imperilled; S3 = vulnerable; S4 = apparently secure; S5 = secure; SNA = not applicable; SU = unrankable.

f) Criteria species.

COSEWIC = Committee on the Status of Endangered Wildlife in Canada; SARA = *Species at Risk Act*; SAR = Species at Risk, n/a = not applicable (not documented or not listed)

Specific watercourses were identified as important spawning tributaries for Coaster Brook Trout through consultation with the MNRF and as referenced in Dillon (2015, 2016). Coaster Brook Trout are the same fish species as watercourse resident Brook Trout (i.e., *Salvelinus fontinalis*), but live primarily in Lake Superior, feeding in the lake for most of the year and then migrating into watercourses to spawn in the late summer and fall (Mucha and Mackereth 2008). Watercourses draining into Nipigon Bay of Lake Superior are considered to be one of two primary locations remaining in Lake Superior known to contain spawning populations of Coaster Brook Trout, and are of particular conservation concern (Bobrowicz 2014). Nipigon Bay tributaries in the fish and fish habitat LSA with potential to sustain migratory Coaster Brook Trout include the Nipigon River, Fire Hill Creek, Ozone Creek, the Jackpine River, Dublin Creek, Cypress River, Little Cypress River, Little Gravel River, Gravel River and McLean's Creek. Other watercourses in the fish and fish habitat LSA that were identified to potentially provide spawning habitat for Coaster Brook Trout include Wild Goose Creek, the Mackenzie River, Coldwater Creek, the Black Sturgeon River, the Steel River, the Pukaskwa River, the Prairie River, the Little Pic River, the Dog River, the Makwa River, the Dore River and the Michipicoten River (Mucha and Mackereth 2008; Bobrowicz 2014).

13.5.2.2.1 Species of Conservation Concern

Eight federally and/or provincially protected species of conservation concern were identified to have potential to occur in the fish and fish habitat LSA (Table 13-6). Based on known habitat requirements (e.g., Scott and Crossman 1973) and geographic distributions, Northern Brook Lamprey (*Ichthyomyzon fossor*), Lake Sturgeon and Shortjaw Cisco (*Coregonus zenithicus*) have reasonable potential to occur in the fish and fish habitat LSA water bodies.

Northern Brook Lamprey likely occur in the Nipigon, Jackpine, Little Pic, Pic and Michipicoten-Magpie tertiary watersheds. There is potential for this species to occur at 39 water body crossings along the preferred route ROW and 35 water body crossings along the access roads (Appendix 13-II, Table 13-II-1 and 13-II-2). Northern Brook Lamprey is listed as a species of "Special Concern" under the COSEWIC (2016), *Endangered Species Act, 2007* under the Species at Risk in Ontario list (Government of Ontario 2016d) and the SARA under Schedule 1 (Government of Canada 2016). They are listed as "Vulnerable" by the NHIC (Government of Ontario 2016b).

Lake Sturgeon are known to occur in Lake Superior and the Black Sturgeon, Nipigon, Gravel, Prairie, Pic and Black rivers. However, migration barriers on the Black Sturgeon and Black rivers likely limit access to the crossing locations. There are no known migration barriers in the remaining rivers that would prevent Lake Sturgeon from using these rivers in the fish and fish habitat LSA. They are listed as a "Threatened" species under the COSEWIC (2016) and the *Endangered Species Act, 2007* under the Species At Risk in Ontario list (Government of Ontario 2016d), but are not listed under SARA (Government of Canada 2016). They are listed as "Imperiled/Vulnerable" by the NHIC (Government of Ontario 2016b).

Shortjaw Cisco are known to occur in the open waters of Lake Superior and are likely to only be present in Lake Superior at crossings 2080.00-WC and 2290.00-WC. They are listed as a "Threatened" species under the COSEWIC (2016) and *Endangered Species Act, 2007* under the Species At Risk in Ontario list (Government of Ontario 2016d), but are not listed under SARA (Government of Canada 2002). They are listed as "Imperiled" by the NHIC (Government of Ontario 2016b).

13.5.2.2.2 Introduced Species

There are 13 exotic fish species documented in Lake Superior with potential to occur in the fish and fish habitat LSA (Table 13-6). Exotic fish species are fish that do not naturally occur in the region and have been introduced. Notably, four Pacific salmonid species (Oncorhynchus spp.) were introduced as sport fish but have since become naturalized in the area: Rainbow Trout (*O. mykiss*), Coho Salmon (*O. kisutch*), Pink Salmon (*O. gorbuscha*), and Chinook Salmon (*O. tshawytscha*) (Dillon 2015). Sea Lamprey (*Petromyzon marinus*) is considered to be invasive as it parasitizes other fish. It is known to occur in Lake Superior, the Gravel River and the Black Sturgeon River, and likely occurs in other water bodies in the fish and fish habitat LSA due to direct connectivity with the lake (Dillon 2015).

13.5.2.2.3 Brook Trout

Brook Trout were widely distributed across the fish and fish habitat LSA. Based on the desktop review, they were the most common fish species and have been documented in 40 of the water bodies in the fish and fish habitat LSA. They have also been documented in the majority of the major water bodies in the fish and fish habitat RSA. Brook Trout inhabit water bodies with cold water and spawn in the fall in watercourses with gravel substrates. This type of spawning habitat was prevalent in the majority of the water bodies in the fish and fish habitat LSA and given the distribution of Brook Trout, it is likely that all life stages (i.e., fry, juvenile and adult) are present in the fish and fish habitat RSA. Given the fish habitat quality and quantity in the fish and fish habitat LSA and the known distribution of Brook Trout in the fish and fish habitat RSA, 181 water bodies crossed by the preferred route ROW and 179 water bodies crossed by the access roads may support Brook Trout and may provide spawning habitat within the water body.

13.5.2.2.4 Northern Pike

Northern Pike were widely distributed across the fish and fish habitat LSA. Based on the desktop review, they were the second most common fish species and have been documented in 19 of the water bodies in the fish and fish habitat LSA. They have also been documented in the majority of the major water bodies in the fish and fish habitat RSA. Northern Pike inhabit water bodies with cool water and spawn in early spring in the water bodies with instream vegetation. This type of spawning habitat was prevalent in the majority of the water bodies in the fish and fish habitat LSA and given the distribution of Northern Pike, it is likely that all life stages (i.e., fry, juvenile and adult) are present in the fish and fish habitat LSA. Given the fish habitat quality and quantity in the fish and fish habitat LSA and the known distribution of Northern Pike in the fish and fish habitat RSA, 84 water bodies crossed by the preferred route ROW and 109 water bodies crossed by the access roads may support Northern Pike and may provide spawning habitat within the water body.

13.5.2.2.5 Walleye

Walleye were more common along the eastern portion of the fish and fish habitat LSA compared to the western portion. Walleye have been documented in 13 of the water bodies in the fish and fish habitat LSA and they have been documented in the majority of the lakes in the fish and fish habitat RSA. Walleye are likely to inhabit the lakes and large rivers in the fish and fish habitat LSA and spawn in the spring on inshore areas of lakes, or nearby tributaries in the fish and fish habitat LSA. Given the fish habitat quality and quantity in the fish and fish habitat LSA and the known distribution of Walleye in the fish and fish habitat RSA, 51 water bodies crossed by the preferred route and 75 water bodies crossed by the access roads ROW may support Walleye and may provide spawning habitat in the water body.

13.5.2.2.6 Lake Sturgeon

The distribution and abundance of Lake Sturgeon in the fish and fish habitat LSA is limited compared to the species above. The quantity of fish habitat available is limited in the fish and fish habitat LSA but includes Lake Superior and a few of the larger watercourses, as this species typically does not inhabit smaller tributaries. Lake Sturgeon are known to occur in Lake Superior and the Black Sturgeon, Nipigon, Gravel, Prairie, Pic and Black rivers. However, migration barriers on the Black Sturgeon and Black rivers likely limit access to the crossing locations. There are no known migration barriers in the remaining larger rivers that would prevent Lake Sturgeon from using these rivers in the fish and fish habitat LSA. It is unlikely that Lake Sturgeon inhabit these rivers year round, but they may use the rivers for migration and spawning, especially closer to the confluence with Lake Superior. Lake Sturgeon spawn in late spring/early summer in relatively shallow, fast-flowing water (usually below waterfalls, rapids, or dams) with gravel and boulders at the bottom, or on shoals in large rivers with strong currents.

13.5.2.3 Aquatic Ecosystems

Lower trophic organisms (i.e., bacteria, fungi, benthic invertebrates, phytoplankton, and zooplankton) are plentiful in the fish and fish habitat LSA and are often the primary food source for fish communities. Lower trophic organisms can act as early warning indicators of the health of the aquatic ecosystem due to their abundance, and wide distribution. Lower trophic organisms are the primary producers and decomposers of an aquatic ecosystem, transferring nutrients and energy from the sediment-water interface into the food chain (Smith and Smith 2001).

Benthic invertebrate (i.e., organisms that live in or on the sediment in water bodies) communities generally vary by sediment types (e.g., silt, organic, cobble, boulder). In lake and pond environments in northern Ontario. The benthic invertebrate community in soft fine sediments (i.e., silt and organic matter) usually consists of a high abundance of non-biting midges (family Chironomidae) and biting midges (family Ceratopogonidae) as well as various true flies (members of the Diptera order). Round worms (phylum Nematodes), worms (family Naididae), amphipods (*Hyalella Azteca*), and bivalve clams (family Sphaeriidae) are also common (Reynoldson et al. 2005). In watercourse environments in northern Ontario, the benthic invertebrate community in the coarse substrates (e.g., cobble, boulder) usually consists of the following major taxa: non-biting midges, biting midges, mayflies (families Ephemerellidae, Leptophlebiidae, and Heptageniidae), dragonflies (family Gophidae), amphipods (family Hyalellidae), bivalve clams, caddisflies (family Hydropsychidae), and beetles (family Elmidae) (Reynoldson et al 2005).

Phytoplankton communities consist of microscopic plant-like single cellular and multicellular organisms that live suspended in the water column of lakes and grow in colonies (i.e., periphyton) on coarse substrates of watercourse environments (Kalff 2002). Phytoplankton are often the primary producers in these systems. The phytoplankton community in northern Ontario aquatic ecosystems often is dominated by cyanobacteria (organisms that obtain energy through photosynthesis), although diatoms (i.e., unicellular algae) often play a key role in the phytoplankton community (Kalff 2002). Cryptophytes (i.e., a type of algae) often are secondary contributors in terms of abundance and often represent the greatest proportional biomass in oligotrophic (i.e., nutrient poor) lakes (Kalff 2002).

Zooplankton communities consist of microscopic free-floating animals suspended in the water column. They are abundant, diverse, and highly variable in their seasonality and distribution within water bodies (Wetzel 2001). Zooplankton act both as filter feeders and carnivores, providing a primary food source to young of the year (i.e., less than one year old) fish and cyprinids (Scott and Crossman 1973). Zooplankton of oligotrophic systems are often dominated by crustaceans (subclass Copepoda) in both abundance and biomass (Carney 1990), including water fleas (order Cladocera) and calanoid copepods (order Calanoida) as well as few rotifers (phylum Rotifera).

The plant communities in aquatic environments in northern Ontario generally consist of pondweed (*Potamogeton* species), common cattail (*Typha latifolia*), spikerush (*Eleocharis* spp.), floating arrowhead (*Sagittaria cuneata*), floating bur-reed (*Sparganium fluctuans*), star duckweed (*Lemna trisulca*), milfoil (*Achiliead* sp.), yellow water-lily (*Nuphar lutea*), Coontail (*Ceratophyllum* sp.), and watershield (*Brasenia* sp.).

Fish communities in northern Ontario are often dominated by Brook Trout, Northern Pike, and Walleye, although these species' importance as harvested species increases the probability of occurrence records existing, as they are more readily documented (Marshall and Jones 2011). Other sport fish species such as Lake Trout, Northern Pike, White Sucker, Lake Whitefish, and Yellow Perch are also common in northern Ontario systems. Forage fish species occupy almost all aquatic environments and consist of a variety of species including: chubs, shiners, minnows, and dace (family Cyprindae); darters (family Percidae); and sticklebacks (family Gasterosteidae). Sculpins (family Cottidae) occupy the benthic niches of both lakes and rivers (Scott and Crossman 1973).

13.5.2.4 Summary of Existing Conditions (Base Case)

The following section summarizes the key findings of the baseline assessment of fish and fish habitat.

The majority of the water bodies in the fish and fish habitat LSA have potential fish habitat, and as a result, may support a variety of fish species. Lake Superior supports 79 fish species, including the four criteria species (Brook Trout, Northern Pike, Walleye, and Lake Sturgeon); 67 of these fish species have potential to occur in the tributaries to Lake Superior in the fish and fish habitat LSA. The fish community is diverse, consisting of many species important for commercial, recreational, and Aboriginal fishing, and also includes forage fish, sport fish, and species of conservation concern. The water bodies in the fish and fish habitat LSA are known to be productive from a fisheries perspective, and it is likely that the majority of the water bodies have fish present. Brook Trout are documented throughout the fish and fish habitat LSA, while Northern Pike and Walleye are more common along the eastern portion of the fish and fish habitat LSA. Lake Sturgeon are less common in the fish and fish habitat LSA due to their habitat requirements for lakes or larger watercourses. Spawning habitat was prevalent for Brook Trout and Northern Pike. The lakes in the fish and fish habitat LSA may provide spawning habitat for Walleye. Spawning habitat for Lake Sturgeon in the fish and fish habitat LSA was limited, as these fish typically spawn in larger water bodies in relatively shallow, fast-flowing water (usually below waterfalls, rapids, or dams) with gravel and boulders at the bottom, or on shoals in large rivers with strong currents.

The aquatic ecosystems in the fish and fish habitat contain lower trophic organisms (i.e., bacteria, fungi, benthic invertebrates, phytoplankton, zooplankton), aquatic plants, and fish. Lower trophic organisms are plentiful in the fish and fish habitat LSA and are often the primary food source for fish communities.

13.6 Project-Environment Interactions and Pathway Analysis

The linkages between Project components and activities and potential effects to fish and fish habitat are identified and assessed through a pathway analysis (Section 5.4). Potential pathways for effects to fish and fish habitat are presented in Table 13-7. Classification of effects pathways to fish and fish habitat are also presented in Table 13-7, and detailed descriptions are provided in the following sections.

This page left intentionally blank

Table 13-7: Potential Effect Pathways for Effects to Fish and Fish Habitat

Project Component or Activity	Effect Pathway	Pathway Duration	Mitigation	Pathway Type
Project activities during the construction phase: ■ site access development, site preparation and soil salvage; ■ surface water management and erosion control; and, ■ reclamation of decommissioned access roads and staging areas. Project activities during the operation phase: ■ maintenance of access roads and preferred route ROW.	Physical alteration of water bodies can change fish habitat availability	Pathway begins during construction and extends through operation	**Construction Phase:** ■ Existing roads and trails will be used where possible ■ Minimize the number of temporary and permanent water body crossings required for the Project ■ Construct or install water body crossings structures in a manner that protects the banks from erosion and maintains the flows in the water body and follows permits or authorizations issued for the Project from the appropriate regulatory agencies and/or conservation authorities, as well as DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat*. ■ Complete instream construction in isolation of flowing water (i.e., use isolation methods for the installation and removal of culverts where surface water exists at the time of construction) (Appendix 4-II – Figure B-5) ■ Apply DFO *Measures to Avoid Causing Harm to Fish and Fish Habitat*. For isolations/diversions, maintain 100% downstream flow. Pump intakes should not disturb the bed. Water diversion hoses will be screened as per the Freshwater Intake End-of-Pipe Fish Screen Guidelines. ■ To minimize the duration and severity of disturbance, complete instream activity in the shortest timeframe practical ■ Use existing bridges to cross water bodies where available ■ Under non-frozen conditions and where regulatory approvals allow, install mats (e.g., rig mats, swamp mats, or access mats) to limit impacts to water bodies, if warranted and surface conditions require ■ Avoid construction during a fish and fish habitat restricted activity timing window. Work may not be conducted during the restricted activity timing window, or within a setback unless approval is obtained from the appropriate regulatory agencies, where required. ■ For the equipment crossing structures, the restricted activity timing windows are applicable if any work is completed below the high water mark ■ For the equipment crossing structures, the restricted activity timing windows are not applicable if all work is completed above the high water mark, if the water body is frozen and a ice bridge/snow fill is constructed, or when using the equipment crossing structures. ■ Remove temporary water body crossing structures (if constructed), restore and stabilize water body banks, and other disturbed areas when the crossing is no longer required ■ Construct water body crossing structures according to the crossing method identified on the Environmental Alignment Sheets and in accordance with regulatory approvals. Alternatives or modifications to the crossing requirements specified in approvals must be approved by the Owner before construction begins. ■ Fording of water bodies is not permitted, unless approved by the regulatory agencies ■ Locate off-ROW workspaces, where feasible, a minimum of 30 m back from the ordinary high water mark of a water body, wherever practical. If a water body is located within the boundary of an off-ROW workspace, Project activities will not occur within a 30 m area from the ordinary high water mark of the water body. **Operation Phase:** ■ For the equipment crossing structures, the restricted activity timing windows are not applicable when using the equipment crossing structures ■ Periodically (e.g., before and/or after spring freshet) inspect and maintain culverts to prevent blockages from forming and causing ponding or backwater effects. Where culverts are installed at fish-bearing water bodies, debris removal activities will follow DFO's guidance (i.e., gradual removal such that flooding downstream, extreme flows downstream, release of suspended sediment, and fish stranding can be avoided).	Secondary
	Instream construction can cause injury or mortality of fish	Pathway anticipated to be limited to approximately one to two days for each water body with instream works during construction	■ Construct or install water body crossings structures in a manner that protects the banks from erosion and maintains the flows in the water body and follows permits or authorizations issued for the Project from the appropriate regulatory agencies and/or conservation authorities, as well as DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat*. ■ Install culverts or temporary bridges using best management practices (Appendix 4-II - Figures B-6, B-7 and B-8) and following all environmental approval conditions ■ Complete instream construction in isolation of flowing water (i.e., use isolation methods for the installation and removal of culverts where surface water exists at the time of construction) (Appendix 4-II - Figure B-5) ■ Apply DFO *Measures to Avoid Causing Harm to Fish and Fish Habitat*. For isolations/diversions, maintain 100% downstream flow. Pump intakes should not disturb the bed. Water diversion hoses will be screened as per the Freshwater Intake End-of-Pipe Fish Screen Guidelines (Appendix 4-II). ■ Obtain regulatory approval from the appropriate regulator, as applicable, and salvage any fish behind isolation structures and relocate under the guidance of a qualified fisheries expert prior to instream construction. ■ Fording of water bodies is not permitted, unless approved by the regulatory agencies ■ Locate off-ROW workspaces, where feasible, a minimum of 30 m back from the ordinary high water mark of a water body, wherever practical. If a water body is located within the boundary of an off-ROW workspace, Project activities will not occur within a 30 m buffer from the ordinary high water mark of the water body. Locate off-ROW workspaces a minimum of 30 m back from the ordinary high water mark of a water body, where possible. Where a water body is located within the boundary of an off-ROW workspace, Project activities will not occur within a 30 m buffer from the ordinary high water mark of the water body.	No pathway

Table 13-7: Potential Effect Pathways for Effects to Fish and Fish Habitat

Project Component or Activity	Effect Pathway	Pathway Duration	Mitigation	Pathway Type
Project activities during the construction phase: ■ site access development, site preparation and soil salvage; ■ surface water management and erosion control; and, ■ reclamation of decommissioned access roads and staging areas. Project activities during the operation phase: ■ maintenance of access roads and preferred route ROW.	Release of sediment during road construction at water body crossings and from land disturbance may cause a change in habitat quality, affecting fish and lower trophic organisms downstream from crossings	Pathway begins during construction and extends through operation	**Construction Phase:** ■ Postpone instream construction, where necessary, if excessive flows or flood conditions are present or anticipated. Resume activities when water levels have subsided or equipment/techniques suitable for conditions are deployed ■ Complete instream construction in isolation of flowing water (i.e., use isolation methods for the installation and removal of culverts where surface water exists at the time of construction) (Appendix 4-II – Figure B-5) ■ Apply DFO *Measures to Avoid Causing Harm to Fish and Fish Habitat*. For isolations/diversions, maintain 100% downstream flow. Pump intakes should not disturb the bed. ■ Install culverts or temporary bridges using best management practices (Appendix 4-II – Figures B-6, B-7 and B-8) and following all environmental approval conditions ■ Avoid construction during a fish and fish habitat restricted activity timing window. Work may not be conducted during the restricted activity timing window, or within a setback unless approval is obtained from the appropriate regulatory agencies, where required. ■ Construct water body crossing structures according to the crossing method identified on the Environmental Alignment Sheets and in accordance with regulatory approvals. Alternatives or modifications to the crossing requirements specified in approvals must be approved by the Owner before construction begins. ■ Avoid bank grading to accommodate temporary bridges where possible. Restrictions on grading may be required as part of water body crossing permits. ■ Re-contour disturbed areas to restore drainage patterns and the approximate preconstruction profile ■ Install, monitor and manage appropriate erosion and sedimentation control measures to minimize or avoid sediment mobilization from the disturbed area to drainages, or water bodies. Adequate and appropriate erosion and sedimentation control materials shall be on site and available prior to commencement of construction. ■ Install temporary sediment barriers (e.g., berms, silt fences) on approach slopes to water bodies. Erect silt fences or other sediment control structures near the base of approach slopes to water bodies prior to grading (Appendix 4-II – Figures B-3 and B-4). Inspect the temporary sediment control structures on a regular basis and repair, if warranted, as soon as practical after noticing repairs are necessary. ■ Temporary erosion control measures must be: ▪ properly installed; ▪ installed before or immediately after initial disturbance; and ▪ inspected and properly maintained (e.g., repaired, replaced or supplemented with functional materials) throughout construction until permanent erosion control is established or reclamation is complete ■ To minimize the duration and severity of disturbance, complete instream activity in the shortest timeframe practical ■ Reclaim temporary access roads, the travel lane, water body crossings, laydown yards, staging areas and construction camps, following mitigation measures for reclamation in Appendix 4-II Section 5.8 ■ Locate off-ROW workspaces, where feasible, a minimum of 30 m back from the ordinary high water mark of a water body, wherever practical. If a water body is located within the boundary of an off-ROW workspace, Project activities will not occur within an approximately 30 m buffer from the ordinary high water mark of the water body. ■ Turbidity and total suspended solids monitoring will be conducted according to permit requirements **Operation Phase:** ■ Apply DFO *Measures to Avoid Causing Harm to Fish and Fish Habitat*	Secondary

Table 13-7: Potential Effect Pathways for Effects to Fish and Fish Habitat

Project Component or Activity	Effect Pathway	Pathway Duration	Mitigation	Pathway Type
Project activities during the construction phase: ■ site access development, site preparation and soil salvage; ■ surface water management and erosion control; and, ■ reclamation of decommissioned access roads and staging areas. Project activities during the operation phase: ■ maintenance of access roads and preferred route ROW.	Placement of crossing structures may change channel morphology, affecting fish habitat	Pathway begins during construction and extends through construction for temporary crossings or through operation for permanent crossings	**Construction Phase:** ■ Existing roads and trails will be used where possible ■ Minimize the number of temporary and permanent water body crossings required for the Project ■ Obtain regulatory approvals as required from applicable regulatory agencies (MNRF, DFO, and/or conservation authority) prior to installation of water body crossing structures. Any alternatives or modifications to the crossing requirements specified in approvals must be approved by the appropriate regulatory agency before construction begins. ■ Reclaim temporary access roads, the travel lane, water body crossings, laydown yards, staging areas and construction camps, following mitigation measures for reclamation in Appendix 4-II Section 5.8 ■ Construct water body crossing structures according to the crossing method identified on the Environmental Alignment Sheets and in accordance with regulatory approvals. Alternatives or modifications to the crossing requirements specified in approvals must be approved by the Owner before construction begins. ■ Construct or install water body crossings structures in a manner that protects the banks from erosion and maintains the flows in the water body and follows permits or authorizations issued for the Project from the appropriate regulatory agencies and/or conservation authorities, as well as DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat* ■ Regularly inspect and maintain culverts to prevent blockages from forming and causing ponding or backwater effects. Where culverts are installed at fish-bearing water bodies, debris removal activities will follow DFO's guidance (i.e., gradual removal such that flooding downstream, extreme flows downstream, release of suspended sediment, and fish stranding can be avoided). **Operation Phase:** ■ Apply DFO *Measures to Avoid Causing Harm to Fish and Fish Habitat* ■ Periodically (e.g., before and/or after spring freshet) inspect and maintain culverts to prevent blockages from forming and causing ponding or backwater effects. Where culverts are installed at fish-bearing water bodies, debris removal activities will follow DFO's guidance (i.e., gradual removal such that flooding downstream, extreme flows downstream, release of suspended sediment, and fish stranding can be avoided).	Secondary
	Placement of crossing structures may cause changes in fish access to habitats, affecting fish distribution and abundance	Pathway begins during construction and extends through construction for temporary crossings and off-ROW workspaces or through operation for permanent crossings	**Construction Phase:** ■ Existing roads and trails will be used where possible ■ Minimize the number of temporary and permanent water body crossings required for the Project ■ Construct water body crossing structures according to the crossing method identified on the Environmental Alignment Sheets and in accordance with regulatory approvals. Alternatives or modifications to the crossing requirements specified in approvals must be approved by the Owner before construction begins. ■ Construct or install water body crossings structures in a manner that protects the banks from erosion and maintains the flows in the water body and follows permits or authorizations issued for the Project from the appropriate regulatory agencies and/or conservation authorities, as well as DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat* ■ Reclaim temporary access roads, the travel lane, water body crossings, laydown yards, staging areas, and construction camps, following mitigation measures for reclamation in Appendix 4-II Section 5.8 ■ Locate off-ROW workspaces, where feasible, a minimum of 30 m back from the ordinary high water mark of a water body, wherever practical. If a water body is located within the boundary of an off-ROW workspace, Project activities will not occur within a 30 m buffer from the ordinary high water mark of the water body. ■ Regularly inspect and maintain culverts to prevent blockages from forming and causing ponding or backwater effects. Where culverts are installed at fish-bearing water bodies, debris removal activities will follow DFO's guidance (i.e., gradual removal such that flooding downstream, extreme flows downstream, release of suspended sediment, and fish stranding can be avoided). **Operation Phase:** ■ Periodically (e.g., before and/or after spring freshet) inspect and maintain culverts to prevent blockages from forming and causing ponding or backwater effects. Where culverts are installed at fish-bearing water bodies, debris removal activities will follow DFO's guidance (i.e., gradual removal such that flooding downstream, extreme flows downstream, release of suspended sediment, and fish stranding can be avoided). ■ Apply DFO *Measures to Avoid Causing Harm to Fish and Fish Habitat*	Secondary

Table 13-7: Potential Effect Pathways for Effects to Fish and Fish Habitat

Project Component or Activity	Effect Pathway	Pathway Duration	Mitigation	Pathway Type
Project activities during the construction phase: ■ site access development, site preparation and soil salvage; ■ surface water management and erosion control; and, ■ reclamation of decommissioned access roads and staging areas. Project activities during the operation phase: ■ maintenance of access roads and preferred route ROW.	Changes to hydrology or groundwater may alter drainage patterns and increase or decrease drainage flows and surface water levels, which could affect fish habitat availability	Pathway begins during construction and extends through operation	**Construction Phase:** ■ Implement the surface water mitigation presented in Section 7.6 ■ Implement the groundwater mitigation presented in Section 8.6 ■ Install, monitor and manage appropriate erosion and sedimentation control measures to minimize or avoid sediment mobilization from the disturbed area to drainages, or water bodies. Adequate and appropriate erosion and sedimentation control materials shall be on site and available prior to commencement of construction. ■ Temporary erosion control measures must be: ▪ properly installed; ▪ installed before or immediately after initial disturbance; and ▪ inspected and properly maintained (e.g., repaired, replaced or supplemented with functional materials) throughout construction until permanent erosion control is established or reclamation is complete ■ Re-contour disturbed areas to restore drainage patterns and the approximate preconstruction profile ■ Postpone instream construction, where necessary, if excessive flows or flood conditions are present or anticipated. Resume activities when water levels have subsided or equipment/techniques suitable for conditions are deployed. ■ To minimize the duration and severity of disturbance, complete instream activity in the shortest timeframe practical ■ Existing roads and trails will be used where possible ■ Reclaim temporary access roads, the travel lane, water body crossings, laydown yards, staging areas and construction camps, following mitigation measures for reclamation in Appendix 4-II Section 5.8 ■ Locate off-ROW workspaces, where feasible, a minimum of 30 m back from the ordinary high water mark of a water body, wherever practical. If a water body is located within the boundary of an off-ROW workspace, Project activities will not occur within a 30 m buffer from the ordinary high water mark of the water body. **Operation Phase:** ■ Apply DFO *Measures to Avoid Causing Harm to Fish and Fish Habitat* ■ Implement the surface water mitigation presented in Section 7.6 ■ Implement the groundwater mitigation presented in Section 8.6	Secondary
Project activities during the construction phase: ■ use of explosives to create level areas for transmission structures, for foundation excavations, and access road installation	Blasting can cause injury or mortality of fish or lower trophic communities in nearby water bodies	Pathway anticipated to be limited to approximately one to two days for nearby crossings during construction	■ Use of explosives for transmission structures, foundation excavations and access road installation will be limited to conditions that do not allow for typical or standard drilling methods ■ Ripping is preferred over blasting where rock is encountered ■ The Contractor will develop a Blasting Management Plan that describes specific measures that would be implemented if blasting is required. The plan must follow applicable regulations and guidelines for transportation, handling, storage and use of explosives. The Blasting Management Plan will be submitted to the Owner for review and approval. ■ Blasting operations will follow DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat* (DFO 2016a) and Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998) for setback distances from fish-bearing water bodies ■ Blast on land where no water or fish are present. Blasting in a water body is not permitted unless otherwise approved by the appropriate regulatory agency	No pathway
Project activities that generate air emissions and dust (Section 9.6) including: ■ site access development, site preparation and soil salvage; ■ hauling of materials; ■ surface water management and erosion control; ■ maintenance of site services; and, ■ reclamation of decommissioned access roads and staging areas	Changes to dust and air emissions resulting from the Project could lead to changes to constituent concentrations in water in the receiving environment, which could affect fish habitat quantity and quality	Pathway begins during construction and extends through operation	**Construction Phase:** ■ Implementation of the air quality and dust control mitigation measures presented in Section 9.6 ■ Tackify, cover, seed, apply water or pack the topsoil stockpiles and windrows with approved equipment, if soils prone to wind erosion **Operation Phase:** ■ Implementation of the air quality and dust control mitigation measures presented in Section 9.6	No pathway

Table 13-7: Potential Effect Pathways for Effects to Fish and Fish Habitat

Project Component or Activity	Effect Pathway	Pathway Duration	Mitigation	Pathway Type
■ Site access development ■ Maintenance of access road and preferred route ROW	Changes to public access to recreational angling areas could affect fish abundance	Pathway begins during construction and extends through operation	**Construction Phase and Operation Phase:** ■ Existing roads and trails will be used where possible ■ Limit public access by installing gates and fencing on roads where permissible or required by MNRF. Specifically, install gates and fences on access roads and the ROW leading to and within the proposed Moose Lake Highlands Enhanced Management Area (EMA), also known as the Proposed Brook Trout Triangle (Hawkins 2016) ■ Re-contour disturbed areas to restore drainage patterns and the approximate preconstruction profile ■ Regrade areas with vehicle ruts and erosion gullies to conform to the local topography to maintain drainage patterns ■ Hunting and fishing in the Project footprint by Project personnel is prohibited	Secondary
■ Hauling of materials ■ Solid and liquid waste management ■ Fuel storage and hazardous materials handling	Changes to surface water and sediment quality from spills of fuel or other materials can affect fish and lower trophic level organisms reproduction and survival, and as a result, abundance	Pathway begins during construction and extends through operation	**Construction Phase:** ■ The Contractor will develop an Environmental Emergency Response Plan for review and approval by the Owner that describes response procedures to potential environmental incidents or emergencies (e.g., spills, fire, erosion or sedimentation), clearly indicates responsibilities for communication and reporting, and provides contact names and details for individuals to be contacted in case of emergency. ■ The Environmental Emergency Response Plan should include the measures listed in Spill Prevention and Response Contingency Plan (Appendix 4-II Section 6.1) ■ Provide adequate supply of spill prevention and emergency response equipment on site at all times. The Spill Prevention and Response Plan (Appendix 4-II Section 6.1) will be adhered to if any spills occur. ■ Re-fuelling or equipment maintenance activities are not to occur within 100 m of a water body. If re-fuelling within 100 m of a water body cannot be avoided, the Contractor is to provide and implement a spill prevention plan ■ Fuel storage tanks shall be in accordance with the *Technical Standards and Safety Act* and should be visually inspected on a regular basis. Maintain inspection record in accordance with applicable regulations and local requirements. Identified problems or deficiencies shall be corrected in a timely manner. ■ Transport, storage and handling of fuel will be in compliance with the *Technical Standards and Safety Act* ■ Fuel and hazardous materials will be transported in approved containers in licensed vehicles ■ Machinery and equipment will be inspected for leaks routinely throughout the duration of construction ■ Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks ■ The Owner will develop the environmental and safety orientation program, to be implemented by the Contractor **Operation Phase:** ■ Fuel storage tanks shall be in accordance with the *Technical Standards and Safety Act* and should be visually inspected on a regular basis. Maintain inspection record in accordance with applicable regulations and local requirements. Identified problems or deficiencies shall be corrected in a timely manner. ■ Transport, storage and handling of fuel will be in compliance with the *Technical Standards and Safety Act* ■ Fuel and hazardous materials will be transported in approved containers in licensed vehicles ■ Machinery and equipment will be inspected for leaks routinely throughout the duration of construction ■ Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks	No pathway
Vegetation maintenance using herbicides along the preferred route ROW and access roads.	Herbicide use during vegetation maintenance can affect fish habitat quality	Pathway begins during construction and extends through operation	**Construction Phase:** ■ Clearing may be accomplished by harvesting machinery, mulchers, and hand cutting ■ Prohibit the use of herbicides within 30 m of an open body of water, unless the herbicide application is conducted by ground application equipment and approved by the relevant regulatory agency ■ Storage, handling and application of herbicide will comply with the Ontario *Clean Water Act* ■ Apply approved herbicides under the direction of a provincially-licensed applicator ■ The Contractor will develop an Herbicide Management Plan that describes the storing, mixing, handling and disposing of the unused herbicides prior to construction. The Plan will also include relevant Material Safety Datasheet (MSDS). The Herbicide Management Plan will be submitted to the Owner. **Operation Phase:** ■ Clearing may be accomplished by harvesting machinery, mulchers, and hand cutting ■ Prohibit the use of herbicides within 30 m of an open body of water, unless the herbicide application is conducted by ground application equipment and approved by the relevant regulatory agency ■ Storage, handling and application of herbicide will comply with the Ontario *Clean Water Act* ■ Apply approved herbicides under the direction of a provincially-licensed applicator	No pathway

ROW = right of way; DFO = Fisheries and Oceans Canada; m = metre

This page left intentionally blank

13.6.1 Pathway Screening

13.6.1.1 No Pathway

A pathway was assessed as having “no pathway” if the activity would not occur (e.g., no work below the high water mark), or if the pathway would be removed by mitigation such that the Project would result in no measurable environmental change in, and no expected net effect to fish and fish habitat. The pathways described in the following bullets were assessed as having no pathway to fish and fish habitat. No further assessment or characterization of net effects, including determination of significance, is required for these pathways.

- **Instream construction can cause injury or mortality of fish**

During instream construction of the travel lane and access road crossings, there is the potential for physical injury or mortality of fish to occur. This can occur from the operation of heavy machinery in the water or the placement of fill or other materials in the water body where fish are present (i.e., placement of a culvert below the high water mark of a channel). The use of intakes or pumps can also cause entrainment or impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself.

No measurable changes to fish abundance or distribution are expected from construction activities with the effective implementation of mitigation measures described in Table 13-7 and in the EPP (Appendix 4-II). There is no anticipated effect from instream construction on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye, and Lake Sturgeon), and to aquatic ecosystems.

- **Blasting can cause injury or mortality of fish or lower trophic communities in nearby water bodies**

Pressure changes and vibrations caused by blasting during Project construction has potential to cause injury or mortality of fish and lower trophic communities in nearby water bodies. Post-detonation compression shock waves caused by detonations of explosives in or near water can cause internal damage to the swim bladder and other soft organs of fish, and cause changes to fish behavior (Wright 1982; Wright and Hopky 1998; Godard et al. 2008). The severity of effects is related to the type of explosive, method of detonation, distance away from fish, water depth, and the weight and pattern of the charge(s). The species, size and life stage of fish also plays a role in the severity of effects of blasting. Fish eggs incubating in spawning beds near blasting zones can also be damaged by movement of the substrate in which eggs are embedded, causing mortality or disrupting development (Wright 1982; Faulkner et al. 2008). Peak particle velocities (i.e., vibrations) can increase mortality of incubating eggs close to blasting zones (Wright 1982).

Blasting is expected to result in no measurable changes to fish habitat quantity and quality, fish abundance and distribution, or in the community composition of the aquatic ecosystems with the effective implementation of mitigation measures described in Table 13-7 and the EPP (Appendix 4-II). There is no anticipated effect from blasting on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye, and Lake Sturgeon) or the aquatic ecosystems.

- **Changes to dust and air emissions resulting from the Project could lead to changes to constituent concentrations in water in the receiving environment, which could affect fish habitat quantity and quality**

Construction and operation of the Project is expected to generate air and dust emissions (refer to Section 9). The use of fossil fuels in vehicles, construction equipment and generators, and travel along access roads would be the main sources of emissions (Farmer 1993; Harrison et al. 2003; Peachey et al. 2009; Liu et al. 2011). The dominant contributor to dust emissions (suspended particulate matter [SPM]) is from vehicles travelling on roads (Farmer 1993; Harrison et al. 2003; Peachey et al. 2009; Liu et al. 2011).

Air and dust emissions and subsequent deposition can change water quality, which can influence fish habitat availability and distribution. Rates of dust deposition and accumulation are dependent on the rate of supply from the source, wind speed, precipitation events, topography, and vegetation cover.

The water quality assessment (Section 7) used the results from the air quality assessment (Section 9) to predict effects from air and dust emissions to water quality criteria. Briefly, under Base Case conditions, concentrations of NO_x, SPM (which includes fugitive dust) and particulate matter (e.g., $PM_{2.5}$) were observed to be below the relevant ambient air quality criteria. Sulphur dioxide is not measured at Thunder Bay or at monitoring stations within approximately 100 km of the Project. However, ambient (baseline) SO_2 concentrations were predicted to be small and below air quality criteria based on the concentrations of the other compounds, and there are no large industrial sources of SO_2 in the immediate vicinity of the Project (Section 9).

For the Project Case, air and fugitive dust emissions were modelled during the construction phase only as this is predicted to be the period of maximum emissions from vehicles, equipment, and land clearing activities (Section 9). A screening level assessment was completed for an approximately 5 km segment of the preferred route ROW, which provided conservative estimates for annual concentrations of compounds (Section 9). Maximum predicted concentrations of compounds assessed were highest closest to the Project footprint, decreased markedly with distance from the Project, and were below air quality criteria. For example, annual SPM concentrations are predicted to be 21.6 $\mu g/m^3$ at approximately 100 m and 14.1 $\mu g/m^3$ at approximately 200 m from the Project.

Air and dust emissions and subsequent deposition are expected to result in negligible changes to water quality relative to Base Case conditions with the effective implementation of mitigation measures described in Table 13-7 and the EPP (Appendix 4-II). Therefore, this pathway would result in no measurable changes to fish habitat quantity and quality, fish distribution and abundance, or the aquatic ecosystems. There is no anticipated effect from Project-related changes in dust and air emissions on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye and Lake Sturgeon) or the aquatic ecosystems.

- **Changes to surface water and sediment quality from spills of fuel or other materials can affect fish and lower trophic level organisms reproduction and survival**

Spills during construction and operation that occur in high enough concentrations could contaminate water and cause direct toxicity to fish and aquatic life. Spills are generally preventable and local in nature.

Spills on the Project footprint or along access roads are expected to result in no measurable changes to fish habitat quantity and quality, fish abundance and distribution, or the aquatic ecosystems with the effective implementation of the mitigation described in Table 13-7 and the EPP (Appendix 4-II). There is no anticipated effect from spills on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye and Lake Sturgeon) or the aquatic ecosystems.

- **Herbicide use during vegetation maintenance can affect fish habitat quality**

Initial clearing of the preferred route ROW is planned to be completed through manual and mechanical means. Once cleared, vegetation height will be maintained using mechanical, manual and/or chemical (herbicide) means for ensuring that vegetation remains at an appropriate height to protect the facility and improve public and worker safety. Determination of the method to be used (i.e., mechanical, manual or chemical) will be based on season (time of year), the type of vegetation, site specific features (i.e., topography, terrain, sensitivity), cost, aesthetics and environmental and socio-economic features. Herbicides could contaminate the water and cause direct toxicity to fish and aquatic life.

Herbicide use on the Project footprint or along the preferred route ROW and access roads is expected to result in no measurable changes to fish habitat quantity and quality, fish abundance and distribution, or the aquatic ecosystems with effective implementation of the mitigation described in Table 13-7 and the EPP (Appendix 4-II). There is no anticipated effect from herbicide use on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye and Lake Sturgeon) or the aquatic ecosystems.

13.6.1.2 Secondary Pathways

In some cases both a Project component or activity (i.e., source) and an effect pathway may exist, but the Project is assessed as resulting in a minor environmental change with a negligible net effect on fish and fish habitat relative to baseline values, resulting in a predicted secondary pathway. The pathways described in the following bullets were assessed as secondary and were not carried through to the net effects assessment.

- **Physical alteration of water bodies can change fish habitat availability**

Water body crossings will be required for new and upgraded access roads and along the travel lane on the preferred route ROW. Roads are expected to be approximately 8 m wide with a 20 m ROW. Equipment crossing structures (e.g., bridges, culverts) may be installed at each water body crossing. Along the access roads, 394 temporary equipment crossing structures will be installed and 32 permanent equipment crossing structures will be installed. The travel lane will be approximately 8 m wide and will be used during construction and reclaimed during operation. There are 459 water body crossings in the preferred route ROW.

The Project also includes temporary laydown yards, staging areas and construction camps. Laydown yards, staging areas and construction camps are anticipated to be approximately 300 m by 300 m in size, but may vary with site conditions, environmental constraints, and contractor requirements. It is expected that staging areas (approximately 400 m by 400 m in size) will be located at previously cleared/disturbed sites.

Disturbances that may affect fish habitat directly from construction of water body crossings include:

- operation of heavy machinery in the water body;
- installation of isolation structures during construction;
- bank treatments, site preparation, and restoration/reclamation; and,
- placement of structures, fill, or other materials in the water body.

Direct effects to fish habitat can occur from construction in a water body, which can result from changes in the water body bed from disturbance, change in the composition and size of bed material, change in the bank configuration, and/or removal of bank vegetation (i.e., riparian vegetation). Direct habitat effects can include alteration or loss of specific habitat features, such as pools, aquatic vegetation and bed materials that ultimately lead to loss or impairment of habitat functions (e.g., changes to overwintering, spawning, and rearing habitat for fish, or habitat for benthic invertebrates or aquatic plants). This may include a loss of gravel which acts as spawning habitat for Brook Trout, Walleye, and Lake Sturgeon or a loss of aquatic vegetation that provides spawning habitat for Northern Pike. Alterations of physical habitat in aquatic ecosystems can affect the resident lower trophic communities, which may be reflected in altered fish community structure and productivity.

The effects depend on the types of habitat at the crossing site, the type of crossing structure used, and the timing of the construction.

The type of crossing structure used is an important mitigation measure; therefore, water body crossing structures were identified for each water body (Appendix 13-II, Tables 13-II-1 and 13-II-2). Clear-span and multi-span bridges, culverts, ice bridges/snow fills (for winter construction) and/or rig mats are the proposed water body crossing structures (Appendix 13-II, Tables 13-II-1 and 13-II-2). A number of factors (i.e., potential adverse effects to fish habitat quantity and quality and fish abundance and distribution, constructability, seasonality, planned use and cost) were considered when determining temporary and permanent equipment crossing methods for a water body. For each water body, the proposed water body crossing structure was initially determined using the guidelines below.

Generally, if a water body:

- has a bank-full width (measured in the field or from aerial imagery) less than or equal to 2.0 m or the channel is ephemeral, then rig mats were determined to be appropriate and will not adversely impact fish and fish habitat;
- has a bank-full width between approximately 2.1 and 5.0 m and:
  - there is low to moderate fish habitat potential, then a culvert or ice bridge/snow fill was determined to be appropriate and will not adversely impact fish and fish habitat;
  - there is high fish habitat potential, then a clear-span bridge was determined to be appropriate and will not adversely impact fish and fish habitat; or
  - if the physical properties of a water body (e.g., bank stability, bank-full width) are deemed suitable to support a rig mat functioning as a clear-span bridge, then a rig mat will be determined to be appropriate as an alternative to a clear-span bridge, culvert, or snow/ice bridge (this will be determined after site specific surveys at each water body).
- has a bank-full width more than 5.1 m and:
  - there is low fish habitat potential, then a clear-span, multi-span, or ice bridge/snow fill was determined to be appropriate and will not adversely impact fish and fish habitat; or
  - there is moderate to high fish habitat potential, then a clear-span bridge was determined to be appropriate and will not adversely impact fish and fish habitat.

Clear-span bridges and rig mats are preferred over culverts as they do not involve work below the high water mark. A rig mat is a portable platform used to support equipment used in construction and other resource-based activities. It may also function as a clear-span bridge over small water bodies (i.e., bank-full width less than 2 m). The installation of culverts or multi-span bridges would require the placement of a structure below the high water mark, and therefore, would temporarily or permanently impact the section of fish habitat where the structure is located. The extent of the footprint is expected to be limited to a reasonably small area in each water body.

Fish communities can be adversely affected by in-water work that occurs during certain periods in their life history or at certain life stages; for example, this can include movements to spawning areas, spawning and egg incubation, or eggs and newly hatched fry. In Ontario, restricted activity timing windows are applied to each water body to protect fish from effects of works or undertakings in and around water during spawning migrations and other critical life history stages (DFO 2016b; Government of Ontario 2013). Periods when in-water work should be avoided were identified for each water body (Appendix 13-II, Tables 13-II-1 and 13-II-2) to reduce or avoid potential effects on fish and fish habitat. The restricted activity timing window in the spring covers migration and spawning for spring spawning species, and the completion of egg incubation and fry emergence. The restricted activity timing window in the fall begins with migration to fall spawning areas and continues through egg incubation and emergence the following spring.

The following guidelines were used to determine a restricted activity timing window (Figure 13-1):

- If there is no fish habitat potential based on site-specific information, then there is no restricted activity timing window;
- If there is fish habitat potential and;
  - there is documented fish presence and:
    - it is likely that the documented fish species will be present based on the habitat conditions, barriers, and flow status; then the MNRF species specific restricted activity timing windows (Government of Ontario 2013) for the appropriate region were applied (Table 13-8). If more than one species is present, then the timing windows were combined for all species present;
    - due to a lack of site-specific data at this time, it is unknown if the documented fish species will be present; then a conservative approach was used and the MNRF species specific restricted activity timing windows (Government of Ontario 2013) for the appropriate region were applied for all species documented in the water body (Table 13-8). If more than one species is present, then the timing windows were combined for all species present; or
    - it is unlikely that the documented fish species will be present based on the habitat conditions, barriers, and flow status; then there is no restricted activity timing window for that species;
  - there is no known documented fish presence but there is documented fish presence in upstream or downstream water bodies and:
    - it is likely that the documented fish species will be present based on the habitat conditions, barriers, and flow status; then the MNRF species specific restricted activity timing windows (Government of Ontario 2013) for the appropriate region were applied (Table 13-8). If more than one species is present, then the timing windows were combined for all species present;
    - due to a lack of site specific data at this time, it is unknown if the documented fish species will be present; then a conservative approach was used and the MNRF species specific restricted activity timing windows (Government of Ontario 2013) for the appropriate region were applied for all species documented upstream and downstream (Table 13-8). If more than one species is present, then the timing windows were combined for all species present; or
    - it is unlikely that the documented fish species will be present based on the habitat conditions, barriers, and flow status; then there is no restricted activity timing window for that species;

- there is no known documented fish presence in the water body or in upstream or downstream water bodies, but there is a designated thermal regime; the species specific restricted activity timing windows (Government of Ontario 2013) for species that may be present in each thermal regime were used (Table 13-8). Based on the habitat conditions, barriers, and flow status, the restricted activity timing windows were adjusted to exclude species that would not be present. If more than one species is present, then the timing windows were combined for all species present;
- there was no known documented fish presence in the water body or in upstream or downstream water bodies and there is no designated thermal regime, then a conservative September 1 to July 15 restricted activity timing window was applied. However, based on habitat conditions, barriers, and flow status, the restricted activity timing windows were adjusted to exclude species (e.g., fall spawners) that would not be present.

If the habitat conditions, barriers, and flow status were unknown, a conservative approach was used when assigning restricted activity timing windows, as described above.

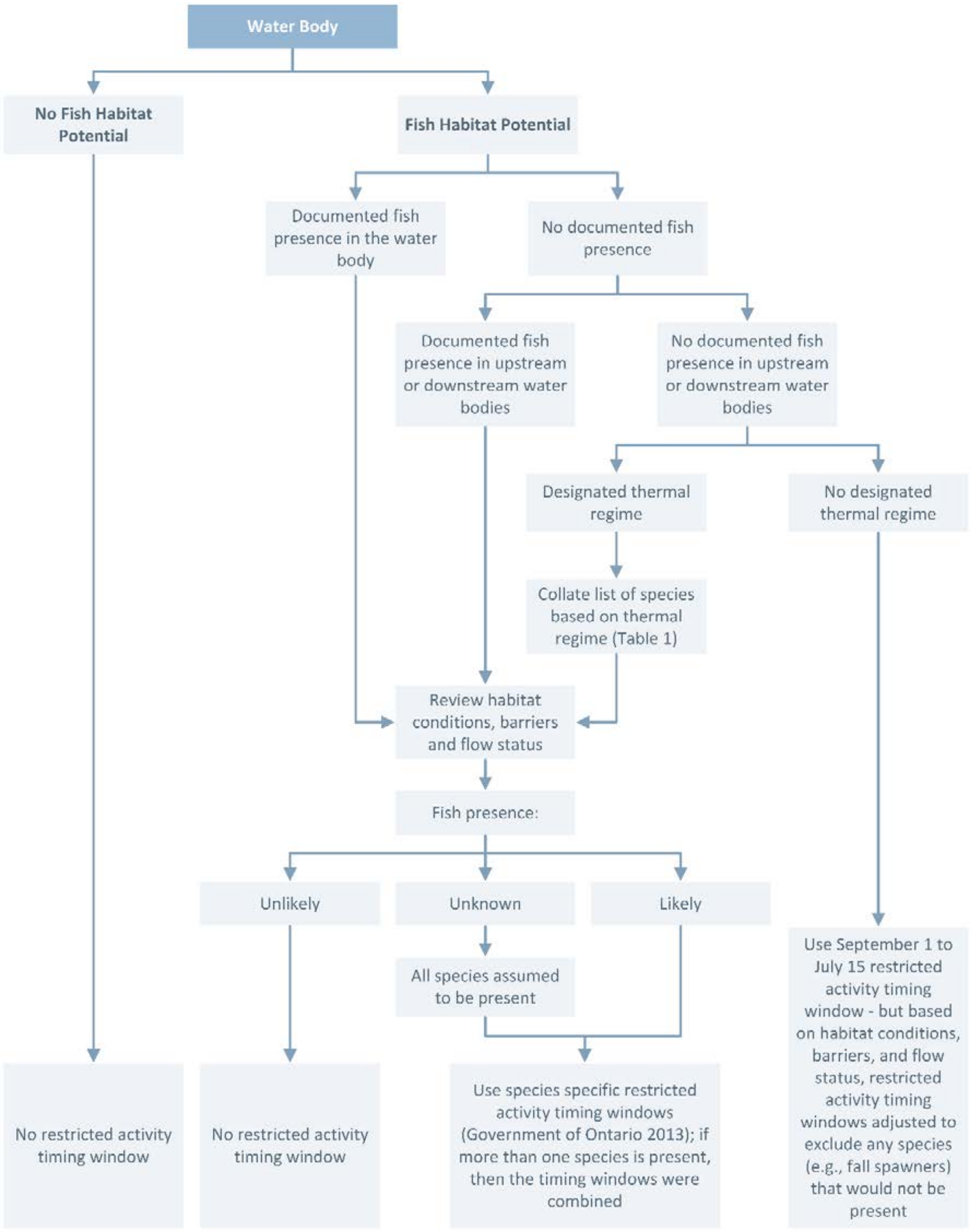

Figure 13-1: Guidelines to Determine a Restricted Activity Timing Window

The Project is in the northwest and northeast regions for designation of the restricted activity timing windows (Government of Ontario 2013).

Table 13-8: Species Specific Restricted Activity Timing Windows and Thermal Regimes Applicable to the Project

Thermal Regime	Species[a]	Scientific Name	Spawning Season	Restricted Activity Timing Window[b]	
				Northwest Region	Northeast Region
Cold	Lake Sturgeon	*Acipenser fulvescens*	Spring	May 1 to June 30	May 1 to July 15
	Rainbow Trout	*Oncorhynchus mykiss*	Spring	April 1 to June 15	April 1 to June 15
	Brook Trout	*Salvelinus fontinalis*	Fall	September 1 to June 15	September 1 to June 15
	Cisco (Lake Herring)	*Coregonus artedi*	Fall	October 1 to May 31	October 1 to May 31
	Lake Trout	*Salvelinus namaycush*	Fall	September 1 to May 31	September 1 to May 31
	Lake Whitefish	*Coregonus clupeaformis*	Fall	September 15 to May 31	September 15 to May 31
	Pacific Salmon[c]	n/a	Fall	September 1 to June 15	September 1 to June 15
Cool[d]	Muskellunge	*Esox masquinongy*	Spring	May 1 to July 15	May 15 to July 15
	Northern Pike	*Esox lucius*	Spring	April 1 to June 15	April 1 to June 15
	Walleye	*Sander vitreus*	Spring	April 1 to June 20	April 1 to June 20
Warm[d]	Largemouth Bass	*Micropterus salmoides*	Spring	May 15 to July 15	May 15 to July 15
	Smallmouth Bass	*Micropterus dolomieu*	Spring	May 15 to July 15	May 15 to July 15
n/a	Other/Unknown Spring Spawning Species	n/a	Spring	April 1 to June 15	April 1 to June 15
n/a	Other/Unknown Fall Spawning Species	n/a	Fall	September 1 to June 15	September 1 to June 15

a) Species listed collated from MNRF (2016d).
b) Government of Ontario (2013).
c) Pacific Salmon includes Chinook Salmon (*Oncorhynchus tshawytscha*), Coho Salmon (*O. kisutch*), and Pink Salmon (*O. gorbuscha*).
d) Fall spawners are not included in the cool or warm water thermal regime timing windows.
n/a = not applicable.

Temporary access roads and water body crossings will be decommissioned and reclaimed during and after completion of the construction phase. As a result, much (i.e., 395 water body crossings) of the disturbance to fish habitat and the aquatic ecosystems is anticipated to be reversible within two years following construction.

In contrast, changes to fish habitat from permanent Project features (i.e., crossings associated with permanent access roads) are irreversible during the life of the operation. However, the mitigation measures implemented during the construction of these features are anticipated to result in minor and localized changes to fish habitat availability relative to Base Case conditions. Physical alteration of the water bodies crossed by the preferred route ROW and access roads is expected to result in no measurable changes to fish habitat availability, fish abundance and distribution, or the community composition in the aquatic ecosystems with effective implementation of the mitigation described in Table 13-7 and the EPP (Appendix 4-II). There is no anticipated effect from physical alteration of the water bodies on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye and Lake Sturgeon) or the aquatic ecosystems.

- **Release of sediment during road construction at water body crossings and from land disturbance may cause a change in habitat quality, affecting fish and lower trophic organisms downstream from crossings**

Increases in the concentration of suspended sediment can result directly from disturbance and re-suspension of bed materials during construction of water body crossings or indirectly from site runoff. This could increase total suspended solids and turbidity in the downstream aquatic ecosystems and result in an adverse effect on surface water quality. Exposure to suspended sediment can affect the health of fish and lower trophic organisms with effects ranging from minor physiological stress to mortality. The magnitude of the effect depends on a combination of the suspended sediment concentration and the duration of exposure.

Fine sediment can also result in downstream sediment deposition that alters substrate composition and modifies the suitability of habitat for spawning, overwintering and rearing. Deposited sediments can modify the availability and suitability of fish habitat by (CCME 1999):

- smothering aquatic plants;
- changing the bed conditions, which can reduce habitat suitability for benthic invertebrates or the incubation of developing fish eggs;
- in-filling pools and reducing the size of riffle areas, consequently reducing the habitat available for juvenile and adult fish;
- changing habitat conditions, reducing benthic invertebrate and forage fish populations and shifting fish species composition; and,
- in-filling interstitial spaces between gravel particles, which can prevent the emergence of fry.

Effects of suspended sediments on benthic invertebrates include physical habitat changes, smothering, clogging of interstices, and abrasion of respiratory surfaces (Bilotta and Brazier 2008; CCME 1999). Benthic invertebrate drift has been observed to increase with the concentration of total suspended solids (TSS) and may occur within hours of a relatively small increase in TSS. In comparison, changes in benthic invertebrate structure and abundance may be observed at higher TSS exposure generally over a longer period of time (e.g., more than 50 days; Bilotta and Brazier 2008).

Clear-span and multi-span bridges, culverts, ice bridge/snow fill (for winter construction) and/or rig mats are the proposed equipment crossing methods (Appendix 13-II, Tables 13-II-1 and 13-II-2). During construction of the equipment crossings, the installation of clear-span bridges and rig mats is unlikely to cause sediment input, whereas the installation of a culvert or multi-span bridge may cause sediment input.

The release of sediment into water bodies crossed by the preferred route ROW and access roads is expected to be minimal with effective implementation of the mitigation described in Table 13-7 and the EPP (Appendix 4-II), including the use of isolation techniques for in-water construction, and as a result, is expected to result in no measurable changes to fish habitat availability, fish abundance and distribution, or the community composition in the aquatic ecosystem Small, localized increases in TSS during the construction period may result in increased benthic invertebrate drift but would not be expected to result in a change to benthic invertebrate community structure. In the event of potential disturbance to the benthic invertebrate community in water bodies, the resilience, or capacity of a benthic community to recover after a disturbance event, is typically high (Lake 2000). The potential effects on the benthic invertebrate community during the construction period are expected to be short term and not expected to affect the maintenance of self-sustaining and ecologically effective populations of fish in the water bodies. There is no anticipated effect from sediment release into water bodies on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye and Lake Sturgeon) or the aquatic ecosystems.

- **Placement of crossing structures may change channel morphology affecting fish habitat**

Channel features, such as pools, riffles, and runs, provide a variety of habitat uses for fish and lower trophic communities. During construction of access roads and the travel lane on the ROW, changes in channel morphology and habitat use could potentially occur through alterations in the shape, stability and bank composition. Increased sediment inputs from erosion and bed and bank instabilities could upset the dynamic equilibrium in the channel's ability to transport water and sediment. The installation of culverts could also result in a constriction of the channel, which could affect flow velocities that could in turn affect channel geomorphology (e.g., bank-full width and depth, bed material composition, ratio of pools to riffles, composition of riparian vegetation). Changes in channel morphology can, therefore, affect fish habitat quantity and quality, and potentially fish abundance and distribution and the community composition in the aquatic ecosystems.

Access road and travel lane water body crossing construction may cause small-scale changes in channel morphology and the changes may occur over longer periods and might not be evident for several years after construction, during the operation phase.

The placement of crossing structures into water bodies in the preferred route ROW and at access roads is expected to result in no measurable changes to fish habitat quantity and quality, fish abundance and distribution, or the community composition of the aquatic ecosystems with effective implementation of the mitigation described in Table 13-7 and the EPP (Appendix 4-II). There is no anticipated effect from the placement of crossing structures into water bodies on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye and Lake Sturgeon) or the aquatic ecosystems.

- **Placement of crossing structures may cause changes in fish access to habitats, affecting fish distribution and abundance**

Placement of crossing structures in water bodies can also cause potential changes in fish accessibility to habitat (e.g., where the culvert forms a barrier to fish passage), which can cause habitat fragmentation. For example, a barrier between rearing and spawning habitat may remove access to habitat, resulting in loss of habitat at the crossing location and a loss of access to habitat upstream from the crossing, which can ultimately, affect the stability of a self-sustaining population. Habitat fragmentation can be a concern especially where there is more than one crossing in the water body, or if there are multiple crossings in a small watershed.

Effects on fish migration and access to habitats are expected to be negligible; as a result, effects to fish abundance and distribution are also expected to be negligible with effective implementation of the mitigation described in Table 13-7 and the EPP (Appendix 4-II). There is no anticipated effect from the placement of crossing structures into water bodies on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye and Lake Sturgeon) or the aquatic ecosystems.

- **Changes to hydrology or groundwater may alter drainage patterns and increase or decrease drainage flows and surface water levels, which could affect fish habitat availability**

Changes in drainage patterns and increases or decreases in drainage flows and surface water levels beyond the natural range of variation could lead to changes in fish habitat availability. Changes in water body flow can affect spawning, rearing, feeding, migration and overwintering habitat of fish-bearing water bodies, and can also affect the water body productivity and availability of food for fish (e.g., plankton or benthic invertebrates). Changes in water body flow can also alter the presence of macrophytes, which provide cover, spawning material or food for fish, including spawning habitat for Northern Pike.

Groundwater baseflow is seasonally important to local water bodies and natural environment features (e.g., vegetation, fish and fish habitat, and wetlands). Construction activities have the potential to locally influence groundwater discharge as baseflow to these features. Specifically, Project construction may lead to changes in the local hydrogeological environment by increasing, decreasing or redirecting groundwater flows. These changes in local groundwater flow can result in local groundwater table lowering or raising and alteration of flow pathways. These potential changes in groundwater flow pathways are linked to surface water quantity (i.e., water levels) and subsequently fish habitat quantity and quality.

Overall, minor and local changes in the fish habitat quantity and quality and fish abundance and distribution are predicted relative to Base Case conditions, and therefore, this pathway was determined to have a negligible net effect on fish habitat quantity and quality, fish abundance and distribution and the community composition of the aquatic ecosystems during construction and operations with effective implementation of the mitigation described in Table 13-7 and the EPP (Appendix 4-II). There is no anticipated effect from Project-related changes in drainage patterns or increase or decrease of drainage flows and surface water levels on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye and Lake Sturgeon) or the aquatic ecosystems.

- **Change in public access to recreational angling areas could affect fish abundance**

The development of existing and new access roads for the Project could adversely affect the abundance of harvested criteria species (i.e., Brook Trout, Northern Pike, and Walleye) through increased access for harvesting or sport fishing activities.

Potential changes in angler pressure and fish harvest will continue to be managed by MNRF, the government resource agency mandated to manage provincial fisheries resources. Fishing is managed as a public resource through provincial licensing requirements, and by establishing rules in terms of season length, catch limits and catch-and-release rules for water bodies near the Project.

Minor changes to harvest of fish in individual water bodies are anticipated, with a negligible net effect on fish abundance with effective implementation of the mitigation described in Table 13-7 and the EPP (Appendix 4-II). There is no anticipated effect from Project-related changes in public access on the maintenance of self-sustaining and ecologically effective populations of the criteria fish species (Brook Trout, Northern Pike, Walleye and Lake Sturgeon).

13.6.1.3 Primary Pathways

No primary effect pathways were identified for fish and fish habitat. Subsequently, there is no further assessment or characterization of net effects, including determination of significance (Section 5.4.3).

13.7 Project Effects Assessment (Project Case)

No primary effect pathways were identified for fish and fish habitat as a result of the Project (refer to Section 13.6.1). No further assessment or characterization of net effects, including determination of significance, is required.

13.8 Cumulative Effects Assessment (Cumulative Effects Case)

No primary effect pathways were identified for fish and fish habitat as a result of the Project (refer to Section 13.6.1). Consequently, the fish and fish habitat criteria are not carried forward for assessment of cumulative effects.

13.9 Prediction Confidence in the Assessment

There is a high degree of certainty that Project construction activities are expected to result in minor and localized changes to fish and fish habitat. Decommissioning and reclamation of temporary Project components is anticipated to occur during construction and into the operation phase.

The confidence in the effects assessment for fish and fish habitat is moderate, considering that the mitigation described in the EPP (Appendix 4-II) is based on accepted and proven best management practices that are well-understood and have been applied to transmission line projects throughout North America. A comprehensive desktop review was conducted to review existing information; however, there are limitations with respect to detailed site-specific baseline data, and there are potential changes that may occur in Project locations and/or methods (e.g., equipment crossing structure) during the design phase. Uncertainty in the assessment has been reduced by making conservative assumptions, planning implementation of known effective mitigation and monitoring measures, including DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat* (DFO 2016a), and using available adaptive management measures to address unforeseen circumstances should they arise.

The Project will undergo a regulatory review and permitting process with the Lakehead Region Conservation Authority, MNRF, and DFO following the EA approval process. During this process, additional site-specific information will be collected at applicable crossings to support permit applications, as required. A key component of the confidence in the assessment, is that NextBridge will follow regulatory requirements with respect to fish and fish habitat

13.10 Follow-up, Inspection and Monitoring Programs

Monitoring will be conducted during instream construction (e.g., installation and removal of culverts) by a qualified Environmental Inspector to observe implementation and report on the effectiveness of the construction procedures and mitigation measures for minimizing potential effects to fish and fish habitat. Turbidity and total suspended solids monitoring will be conducted according to permit requirements.

The implementation of post-construction monitoring programs will be used to provide feedback on the effectiveness of design features and mitigation. Post-construction monitoring will be conducted at water body crossings to verify that erosion and sediment control measures have been successful (e.g., bank restoration and re-vegetation). The integrity of the crossing structures will be inspected regularly and during periods of high run-off, such as the spring freshet. Any changes to the morphology of the water body channel will be identified and addressed, as needed. At culverts, regular monitoring will be conducted to identify and remove blockages (e.g., ice, woody debris), as needed, that would otherwise lead to scouring and effects to channel morphology and fish habitat, and potentially interfere with fish passage.

Using monitoring and adaptive management, mitigation may be modified or additional mitigation may be implemented to reduce unexpected impacts to fish and fish habitat.

13.11 Information Passed on to Other Components

Results of the fish and fish habitat assessment were reviewed and incorporated into the following components of the EA:

- Traditional Land and Resource Use (Section 17);
- Non-Traditional Land and Resource Use (Section 19); and,
- Human Health (Section 21).

This page left intentionally blank