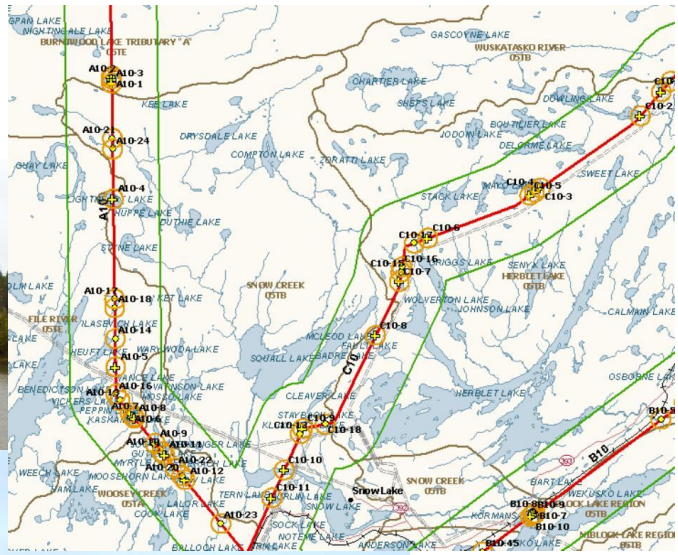
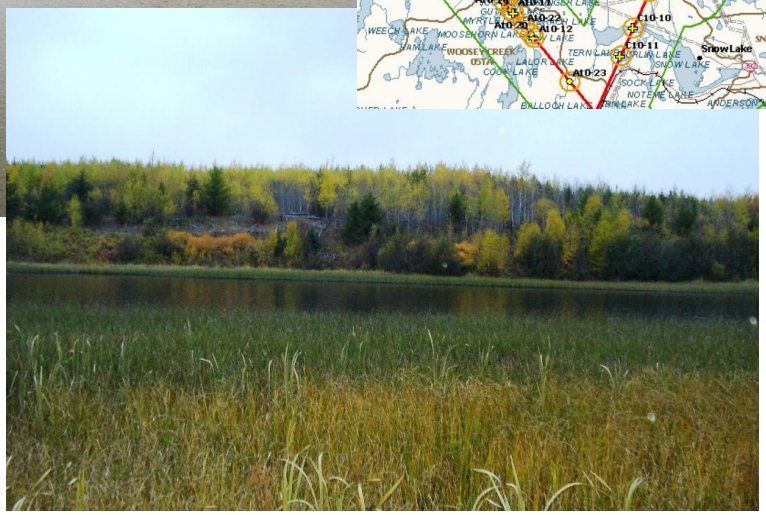
BIPOLE III TRANSMISSION PROJECT:

EXISTING AQUATIC ENVIRONMENT





North/South Consultants Inc.

Aquatic Environment Specialists

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Existing Aquatic Environment

Prepared for:

Manitoba Hydro

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North/South Consultants Inc.

In Association with:

MMM GROUP

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1.0 INTRODUCTION

Manitoba Hydro has proposed the development of a new high voltage direct current (HVDC) transmission line, known as Bipole III (the Project), on the west side of the province. This report provides a description of existing aquatic environment in the Project's potential corridor area (Study Area) as defined in Map 1. The objective of this report was to provide regional-level characterization of water bodies in the Study Area, which would support Manitoba Hydro's environmental and social feasibility assessment of the transmission line. Included in this report are a description of aquatic biophysical habitats, surface water quality, biotic components, and resource use.

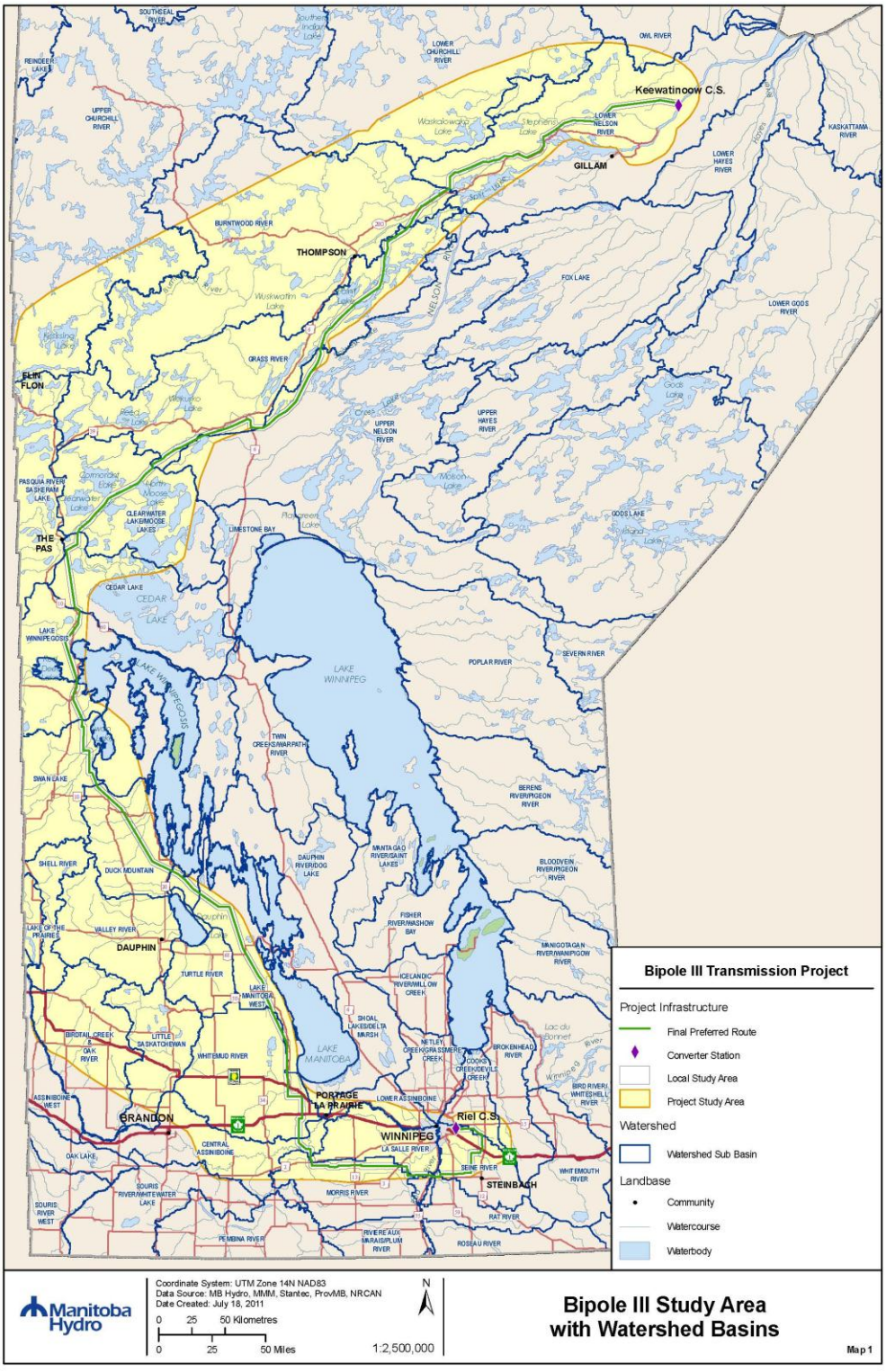
The intent of the Existing Environment Description is to provide a high level description of the aquatic environment within the Bipole III study area. Further details will be provided for water bodies that fall within the preferred route corridor; this will include both existing information and information gathered during field studies. At this point, these water bodies and detailed information are not included as the preferred route has not been selected.

1.1 Study Area

The Study Area is illustrated in Map 1. The Project study area begins near Gillam at Manitoba Hydro's proposed Conawapa Generating Station, angles southwest towards The Pas and curves around the west side of lakes Winnipegosis and Manitoba and south of Lake Manitoba to Winnipeg. It is bound by the Manitoba and Saskatchewan border in the west, by the Lake Manitoba, Lake Winnipegosis, and Cedar Lake in the southeast, and follows the north side of the Nelson River in the northeast.

The majority of land in the northern half of the Study Area is undeveloped Crown Land with the exception of linear developments such as roadways, railways and transmission lines. Major land use activities within this area include: commercial forestry; mining; transmission, sub-transmission, and distribution lines; all weather roads; commercial fishing; trapping; traditional resource use; and recreation and tourism. Incorporated communities within the northern half of the Study Area include the City of Flin Flon and Thompson, and the towns of Gillam, Snow Lake, and The Pas. Northern Affairs communities include Cormorant, Herb Lake Landing, Nelson House, Split Lake, and Wabowden. There are also several First Nation Reserves in the northern Study Area, namely Fox Lake First Nation, Nisichawayasihk Cree Nation, Opaskwayak Cree Nation, and Tataskweyak Cree Nation.

Most of the lands in the southern half of the Study Area are developed agricultural land with the exception of urban areas, parks, and linear developments. Cities include Dauphin, Portage La Prairie, Steinbach, and Winnipeg. There are numerous First Nation Reserves in the vicinity, including: Dakota Plains, Dakota Tipi, Ebb and Flow, Gamblers, Keeseekoowenin, Long Plain, Mosakahiken



Map 1. Bipole III Study Area with watersheds identified.

Cree Nation, Pine Creek, Rolling River, Sandy Bay, Tootinaowaziibeeng Treaty Reserve, Waywayseecappo First Nation Treaty Four – 1874, and Wuskwi Sipihk First Nations.

2.0 METHODS

A literature and existing data review were conducted to provide information on existing conditions in the Study Area and to identify potential issues of interest to the Project (e.g., historic high concentrations of certain surface water quality parameters, seasonal variation in parameters, sensitive fish habitats). Additionally, the literature review was intended to identify existing data gaps that could be addressed in the field program. Data on aquatic components were obtained from published literature, grey literature, Water Survey of Canada, and the Manitoba Fisheries Inventory and Habitat Classification System (FIHCS).

Information on the habitat requirements of fish species listed as "endangered", "threatened" or "species of concern" by the federal or Manitoba governments that are known to occur in the Study Area was reviewed.

2.1 Hydrology Network

The National Hydro Network (NHN) (Geobase 2009) was identified as the best available geographic information system (GIS) vector water features data set for the entire Bipole III study area. The NHN is a federal standard, adopted in 2004 by the Canadian Council on Geomatics (CCOG), and provides geospatial vector data describing hydrographic features such as lakes, reservoirs, rivers, and streams among others. An important feature of the data set is the inclusion of a linear drainage network, in addition to the basic cartographic features. The network features are intended for water flow analysis, water and watershed management, environmental and hydrographical applications. The data set is constructed primarily from National Topographic System (NTS) 1:50,000 digital vector topographic data. NHN work units were acquired for the entire Bipole III study area and placed into a GIS database.

2.2 Watersheds

Watershed boundaries were obtained from Manitoba Conservation's Manitoba Land Initiative (MLI) web site. The data set, "Watersheds (Gross Polygons)", is derived from the Prairie Farm Rehabilitation Administration's (PFRA) Watershed Project, gross drainage area polygon data set. The original gross drainage areas were delineated by hand on 1:50,000 and 1:250,000 NTS map sheets, and later transferred to digital GIS format. In 2004, it was decided to include watershed boundaries within Manitoba (primarily northern Manitoba) as described by Fedoruk (1970) and based on 1:250,000 topography (PFRA 2009). The MLI watershed data set was identified as the most complete coverage for the Bipole III study area.

3.0 EXISTING AQUATIC ENVIRONMENT

3.1 Biophysical Description

The Study Area crosses portions of eight Manitoba drainage basins, including 34 sub-basins (Table 1; Fedoruk 1970). In order from north to south, the drainage basins encountered include the Hudson Bay, Churchill River, Nelson River (then the Churchill River basin again), Saskatchewan River, Lake Manitoba, Assiniboine River, Red River, and Lake Winnipeg basins. An inventory of the main (i.e., larger) water bodies within the Study Area is provided in Appendix A as listed in FIHCS.

Table 1 Drainage basins within the Project Study Area.

Drainage Basin	Drainage Sub-basin	Area (km^2)	% Study Area
Hudson Bay	Owl River	3,024	1.4
	Total	**3,024**	**1.4**
Churchill River	Lower Churchill River	11,498	5.5
	Upper Churchill River	10,576	5.0
	Total	**22,074**	**10.5**
Nelson River	Lower Nelson River	16,039	7.6
	Upper Nelson River	7,269	3.5
	Burntwood River	25,229	12.0
	Grass River	16,220	7.7
	Total	**64,757**	**30.9**
Saskatchewan River	Cedar Lake	7,586	3.6
	Clearwater Lake/Moose Lakes	9,179	4.4
	Pasquia River/Saskeram Lake	14,883	7.1
	Total	**31,648**	**15.1**
Lake Manitoba	Duck Mountain	4,543	2.2
	Lake Manitoba West	3,969	1.9
	Lake Winnipegosis	16,774	8.0
	Shoal Lakes/Delta Marsh	641	0.3
	Swan Lake	7,232	3.4
	Turtle River	2,455	1.2
	Valley River	6,278	3.0
	Whitemud River	12,108	5.8
	Total	**54,000**	**25.8**

Table 1. Continued.

Drainage Basin	Drainage Sub-basin	Area (km^2)	% Study Area
Assiniboine River	Assiniboine West	2,155	1.0
	Birdtail Creek & Oak River	5,791	2.8
	Central Assiniboine	4,039	1.9
	Lake Of The Prairies	2,192	1.0
	Little Saskatchewan	4,386	2.1
	Lower Assiniboine	1,768	0.8
	Shell River	2,632	1.3
	Souris River/Whitewater Lake	883	0.4
	Total	**23,846**	**11.4**
Red River	Red River South	266	0.1
	Cooks Creek/Devils Creek	1,215	0.6
	La Salle River	2,677	1.3
	Morris River	2,218	1.1
	Rat River	194	0.1
	Netley Creek/Grassmere Creek	529	0.3
	Seine River	2,057	1.0
	Total	**9,156**	**4.4**
Lake Winnipeg	Brokenhead River	1,200	0.6
	Total	**1,200**	**0.6**
TOTAL STUDY AREA DRAINAGE		**209,705**	**100**

The Churchill and Nelson river drainage basins lie on the Canadian Shield west-centrally in Manitoba, but eventually descend easterly onto the Hudson Bay coastal plain. The Study Area portion of the Saskatchewan River basin transitions from Canadian Shield in the north to Prairie in the south. The Lake Manitoba, Assiniboine River, Red River, and Lake Winnipeg drainage basins are wholly within the Prairie and/or Aspen Parkland area of Manitoba. General characteristics of water bodies are described in Table 2 by physiographic region.

Table 2 Water body characteristics by physiographic region of Manitoba.

Physiographic Region	Lake Characteristics	Watercourse Characteristics
Prairie Region	• Generally shallower and warmer than Canadian Shield and Hudson Bay coastal plain lakes • Substrates composed of fines • Gently contoured basins • Fewer lakes than Canadian Shield and Hudson Bay coastal plain regions	• Low gradients • Moderate water velocities • Meandering channel pattern • Warm and turbid • Underlain by clay sediments deposited by Glacial Lake Agassiz

	• Notable exceptions:
	  • Water bodies on the Manitoba Escarpment:
	  • Spring-fed, clear, cool
	  • Higher gradient streams and higher water velocities
	  • Incised valleys through relatively soft Mesozoic sediments
	  • Waters in the northwestern sections of Lake Manitoba and Lake Winnipeg water basins:
	  • Clear and relatively cool waters
	  • Underlain by Paleozoic limestone	

Canadian Shield	• Vary from clay sediments to plant debris to boulders and bedrock • Vary from shallow and gently contoured to irregular with steep drop-offs and reefs • Cooler than prairie lakes • More aquatic macrophytes than prairie lakes	• Short, relatively steep-gradient sections or meandering bog sections • Clear to stained brown water • Cooler than prairie streams • More aquatic macrophytes than prairie streams • Convoluted valleys • Surficial deposits underlain by Proterozoic rock
Hudson Bay Coastal Plain	• Shallow, gently contoured basins • Fine sediment substrates • Underlain by Paleozoic sedimentary rock covered by glacial till, with clay overlay • Lakes are less common than in Canadian Shield • Clear to stained brown water • Turbid water in areas with bank erosion • Extensive aquatic macrophyte beds in quiet water	• Low gradients • Meandering or braided channel pattern • Generally flow over glacial till, but may be cut down to underlying limestone • Straight, relatively shallow valleys

Source: Smith et al. (1999); Stewart and Watkinson (2004)

3.1.1 Hudson Bay Basin

The northeastern-most part of the Study Area begins in the Hudson Bay basin, where it is limited to a small headwater portion of the Owl River sub-basin. Approximately 1% of the Study Area is within this drainage basin (Table 1). This basin is outside the extent of the Canadian Shield on the Hudson Bay coastal plain. Watercourses in this area of the Study Area are generally low gradient bog/fen with limited surface drainage. Streamside vegetation is generally alders, birch, poplar, spruce or willow (Mills et al. 1976). The lakes are generally small, shallow, with stained brown water, and soft fine sediment substrates. Shoreline vegetation for these water bodies is generally birch, larch, peat

(lichen/moss), sedge, and spruce (Mills et al. 1976). Drainage flows northeast into the Owl River and eventually into Hudson Bay.

3.1.2 Churchill River Basin

The Study Area includes two separate portions of the Churchill River drainage basin. In the northwest it encounters the Upper Churchill River sub-basin and in the northeast it encounters the Lower Churchill River sub-basin (separated by the Nelson River basin). Approximately 10% of the total Study Area is within this basin (Table 1). Both sub-basins lie entirely in the Canadian Shield and their respective water bodies would be broadly characterized as in Table 2. Riparian vegetation would be similar to the Hudson Bay basin, consisting of a combination of alders, birch, larch, peat, poplar, sedge, spruce or willow (Mills et al. 1976). The Upper Churchill River sub-basin drains northeast and includes Kississing and Highrock lakes and the Kississing River. The Lower Churchill sub-basin also drains northeast and includes large lakes such as Waskaiowaka and Baldock.

3.1.3 Nelson River Basin

The Nelson River basin comprises the largest proportion of the Study Area (31%; Table 1). The Nelson River basin's extent in the Study Area begins in the west near Cranberry Portage and flows northeast ending near Gillam. Most of this basin is on the Canadian Shield; however, the easternmost extent is on the Hudson Bay coastal plain (Mills et al. 1976). Marsh and bog areas are common throughout and the landscape is generally hummocky and predominated by small to medium oval and rounded lakes with smooth shorelines. Many larger lakes exist; often shallow with irregular rocky shorelines (Cleugh 1974, Schlick 1972, Veldhuis 1979). Riparian vegetation would be similar to the Hudson Bay and Churchill River basins, consisting of a combination of alders, birch, larch, peat, poplar, sedge, spruce or willow (Mills et al. 1976).

Within the Study Area, the Lower Nelson River sub-basin begins at Split Lake and flows north-eastward ending at the proposed Conawapa G.S. This sub-basin includes the Nelson River mainstem and Split Lake as well as numerous headwater lakes and tributaries of these water bodies. The eastern portion of this sub-basin lies within the Hudson Bay coastal plain and is notable for a number of small to medium sized tributaries of the Nelson River mainstem that, with their coarse substrate and groundwater flows, support fall spawning runs and resident populations of brook trout (*Salvelinus fontinalis*). These include the Weir and Limestone rivers. Further west, this sub-basin consists of more typical boreal lakes and rivers such as the Crying and Assean rivers.

The Burntwood River sub-basin is the largest sub-basin within the Study Area and contributes the greatest drainage area to the Nelson River basin (Table 1). Within the Study Area, the sub-basin generally begins at Rat Lake, flows southeast to Wuskwatim Lake, and then flows northeast joining the Nelson River at Split Lake. The predominant watercourse in the Burntwood River sub-basin is the Churchill River Diversion (CRD), which enters the Study Area from the north via the Rat River. The

diversion was constructed during the early 1970s to divert water from the Churchill River system into the Nelson River system for hydroelectric generation. Flows in the Rat River are augmented with flows from the Churchill River through a diversion channel that was excavated from South Bay on Southern Indian Lake to Issett Lake in the upper reaches of the Rat River system. Flows in the diversion channel are controlled by the Notigi Control Structure located at the outflow of Notigi Lake adjacent to Provincial Road (PR) 391. Water released through Notigi flows through Wapisu Lake and into Threepoint Lake where it converges with the Burntwood River. Diversion flows continue down the Burntwood River through Wuskwatim, Opegano, Birch Tree, and Apussigamasi lakes before converging with the Nelson River at Split Lake. Shorelines along the diversion route within the Study Area have been flooded to varying degrees and are rapidly eroding. High clay banks that are treed to the shoreline characterize river shorelines from Notigi Control Structure to Threepoint Lake. Flooded standing dead trees occur in low areas, near tributary confluences and in backwater bays. Bedrock banks occur in constricted areas, where current is higher.

The Grass River sub-basin lies south of the Burntwood River sub-basin and is similar in size to the Lower Nelson sub-basin (Table 1). This system begins in the west near Cranberry Portage and, similarly to the Burntwood River basin, flows northeast converging with the Nelson River at Split Lake. Water bodies is this sub-basin include numerous lakes and rivers; notably, the Grass, Missipisew and Wuskatasko rivers and Wekusko, Herblet, Snow and Tramping lakes.

3.1.4 Saskatchewan River Basin

The Saskatchewan River basin has the third largest drainage area in the Study Area (approximately 15%; Table 1). This basin begins near Flin Flon along the Saskatchewan border and flows southeast to Cedar Lake. Water bodies in this area are typically characterized by shallow depth, soft substrate, higher turbidity and marsh or bog shorelines. The northern portion of this basin is underlain by limestone and includes Clearwater and Cormorant lakes. The Saskatchewan River delta, Summerberry Marsh, and the Pasqaui and Carrot river valleys dominate the central and southern portion of this basin and include Mawdesley, Atikimeg, and Tremaudian lakes. Flows in the Saskatchewan River are controlled by the E.B. Campbell Generating Station at Iskwao Rapids in Saskatchewan and by the Grand Rapids Generating Station in Manitoba. A typical watercourse in the southern portion of the Study Area drains low boggy areas, is highly convoluted, and has relatively low water velocities. Shoreline vegetation is generally a combination of birch, dogwood, grass/sedge, peat, poplar, or willow (Benke and Cushing 2010).

3.1.5 Lake Manitoba Basin

The Lake Manitoba basin is the second largest drainage basin in the Study Area comprising 26% of its area (Table 1). This basin extends from the Lake Winnipegosis sub-basin in the north, south through the escarpment region of Manitoba to the Whitemud River sub-basin and watercourses generally flow from west to east. The varied topography in this basin, ranging from the steep

elevation change of the escarpment to the lowland region adjacent to lakes Winnipegosis and Manitoba result in a diverse range of fish habitat features. The northern portion of the Lake Winnipegosis sub-basin is characterized by the Overflowing River, Red Deer Lake, and Red Deer River. Further south, the small lakes and streams on top of the Porcupine Mountains flow northeast to Lake Winnipegosis through the Bell and Steeprock rivers. The Swan Lake sub-basin captures water from the southern portion of the Porcupine Mountain through the Woody River. The Valley River, Turtle River, and Duck Mountain sub-basins collect water from the eastern sides of the Duck and Riding mountains and enter Lake Winnipegosis either directly or via Dauphin Lake and the Mossy River. The Lake Manitoba West sub-basin captures water from the southeastern slopes of Riding Mountain before flowing through the low gradient landscape adjacent to the lake. Characteristic of the escarpment streams are elevated water velocity and coarse stream substrate. Once on the lowland areas adjacent to lakes Winnipegosis, Swan or Manitoba, water velocity slows and substrates shift to fine silts and organics. Shoreline vegetation is generally a combination of birch, dogwood, grass/sedge, poplar, or willow.

3.1.6 Assiniboine River Basin

The Assiniboine River basin comprises 11% of the Study Area (Table 1). Its catchment begins with the Shell River and Lake of the Prairies sub-basins in the northwest, flows southwest including the southwestern drainages of the Duck and Riding mountains in the Little Saskatchewan River and Birdtail Creek sub-basins, and then flows west through the sand hills region of Spruce Woods before joining the Red River at Winnipeg. The majority of lands adjacent to water bodies in this basin are utilized for agriculture and many riparian areas have been encroached by such activities. Shoreline vegetation is generally a combination of Manitoba maple, ash, basswood, cattail, cottonwood, dogwood, elm, grass/sedge, or poplar (Benke and Cushing 2010). Major features of this basin include Lake of the Prairies, created on the Assiniboine River by the Shellmouth Dam, three impoundment lakes on the Little Saskatchewan River system, and numerous small pothole lakes and streams in the area south of Riding Mountain. Flows in the Assiniboine River are controlled by the dam at Lake of the Prairies and through the Assiniboine River Diversion at Portage la Prairie. Similar to the Lake Manitoba basin, in the Assiniboine River basin higher elevation streams of the escarpment area have higher water velocity and coarse stream substrates compared to more southern lowland areas that have slower water velocity and substrates composed of fine silts and organics.

3.1.7 Red River Basin

The Red River basin comprises approximately 4% of the Study Area and generally surrounds Winnipeg (Table 1). It is characterized by a low gradient landscape dominated by row-crop agriculture where many of the smaller watercourses have been severely altered or eliminated. Major watercourses still persist, but have undergone shoreline modifications and flow management. Examples include the Red, La Salle and Seine rivers. Even so, watercourses in this basin, with fine substrates of silt and clay, are highly productive supporting a high diversity of fish. Shoreline

vegetation is generally a combination of Manitoba maple, ash, basswood, cottonwood, elm, oak or willow (Benke and Cushing 2010). Drainage is generally north to Lake Winnipeg.

3.1.8 Lake Winnipeg Basin

The Lake Winnipeg basin is the smallest basin in the Study Area, comprising less than 1% (Table 1). The Study Area portion of this basin is situated east of Winnipeg and contains the small headwater streams of the Brokenhead River sub-basin. This area has similar characteristics to the Red River basin: low gradient area; dominated by agriculture with watercourses altered for field drainage; watercourses have fine substrates of silt and clay. Shoreline vegetation in this small area is generally a combination of ash, basswood, cottonwood, elm, oak, spruce or willow. Drainage is northward to Lake Winnipeg.

3.2 Surface Water Quality

Surface water quality throughout the Study Area is influenced by overall drainage patterns, bedrock and surficial geology, soils, topography, climate, precipitation, and land use practices. Given the expanse of the Study Area, a large range of natural and impacted surface water conditions are experienced throughout the region.

The majority of the northern half of the Study Area is comprised of the Churchill and Nelson river basins, which lies within the Canadian Shield physiographic region of Manitoba. The quality of surface water within this area is influenced by glacio-lacustrine deposits which overly the Precambrian bedrock (Hecky and Ayles 1974). Although lakes in this region may be considered Precambrian in nature, the water is somewhat harder, more nutrient rich, and turbid than typical Shield lakes, primarily due to the presence of the glacio-lacustrine deposits (Hecky and Ayles 1974).

The Burntwood River sub-basin covers the majority of the north-central region of the Study Area. Water bodies within this sub-basin (includes the Rat River watershed) have well documented water quality information in anticipation for and resulting from the CRD project. The primary effects of CRD development on this system were: increased turbidity, higher concentrations of sodium, potassium, chloride, fluoride, and total phosphorous, as well as decreased conductivity, alkalinity, and concentrations of calcium and magnesium (Ramsey 1991, Williamson 1993). These differences primarily resulted from the addition of softer Churchill River water to the system and shoreline erosion caused by elevated water levels and increased discharge through the system.

The majority of the northeast part of the Study Area lies within the Nelson River basin, which has also been dramatically altered by hydroelectric development, i.e., CRD and Lake Winnipeg regulation. Similar to the Burntwood River sub-basin, the major water bodies within this area have well documented water quality information. Generally, notable increases in turbidity, dissolved minerals, and phosphorous have been observed since hydroelectric development (Baker 1991, Williamson 1993).

Lakes within the northern region are generally similar in chemical composition and are predominantly isothermal throughout the summer (Hecky and Ayles 1974, Cleugh 1974, Bezte and Kroeker 2000). The isothermal nature of the lakes throughout most of the open-water season can generally be attributed to relatively shallow average depths and turbulent flows throughout the riverine sections of the system. These characteristics, combined with the presence of glacio-lacustrine clays, and the potential for wind-induced mixing, result in relatively high water turbidity (Cleugh 1974). The Burntwood River upstream of Threepoint Lake is generally the most turbid region of this system, with somewhat less turbid water in Footprint Lake (on the Footprint River). Notigi and Wapisu lakes tend to be less turbid than lakes downstream of the Burntwood River influence, such as Threepoint and Wuskwatim lakes (Bezte and Kroeker 2000).

The Grass River sub-basin lies within an area of mainly grey wooded podzol soils, which is low in available nutrients and generally poorly drained (CEC 1982). Lakes within this area are typical shield lakes: hard (high $CaCO_3$), shallow (average depth of 3-6 m), with rocky shorelines and numerous islands. Because of the exceptional water quality within the upper Grass and upper Burntwood River systems, the CEC (1981) proposed that these waters come under a "non-degradation" objective for water quality control. Water bodies under this designation include the Grass River, Reed Lake, Simonhouse Lake, Cranberry Lakes, Tramping Lakes, and others (CEC 1982).

The central portion of the Study Area includes the eastern tip of the Saskatchewan River basin. This area consists mainly of carbonate rock overlain by glacial tills and proglacial lacustrine sediments (Betcher 1995). Lake water in this area is typically well aerated and rich in dissolved minerals (Williamson 1988). Both Clearwater and Cormorant Lakes have received much attention due to their excellent clarity (Secchi disc depths of up to 10 m) and pristine conditions. Clearwater Lake received the "High Quality Surface Water" designation from the CEC in 1989 which implies very strict regulations on discharges into and development involving Clearwater Lake.

The south-central section of the Study Area lies within the Lake Manitoba basin. This is an area of gentle relief bounded to the west by the higher relief areas of the Manitoba Escarpment. Mainly carbonate bedrock is overlain by highly calcareous glacial till and proglacial lacustrine sediments (Betcher 1995 and Weir 1983). This area includes a number of small streams and rivers and in particular, includes Dauphin Lake. Dauphin Lake is a large, shallow (mean depth 2.1 m) water body with mostly silty-clay substrates (Schaap 1987). Complete mixing caused by wind action results in elevated turbidity and water temperatures, which in turn create favourable conditions for algal blooms.

The southern extent of the Study Area encompasses the eastern edge of the Assiniboine River basin and a portion of the northern tip of the Red River basin to the south. Areas within the Assiniboine drainage lie within the Manitoba Upland physiographic region of Manitoba and are characterized by shale, sandstone, and limestone bedrock overlain with moderately calcareous glacial tills (Betcher 1995, Weir 1983). Areas within the Assiniboine river floodplain are typically flat with sandy/silty

soils. Surface water quality within the Assiniboine River and its tributaries is directly impacted by discharges from industrial, municipal, and agricultural sources. Bourne et al. (2002) reported 52 wastewater treatment facilities and five major industrial operations were licensed to discharge directly into the Assiniboine River. These activities, along with other natural processes, have resulted in excessive nutrient loading (nitrogen and phosphorous) within this system. By 1994, total Nitrogen load within the Assiniboine River (at Headingly, MB) had increased by 863 tonnes from 1973 levels (Bourne 2002). Higher concentrations of both nitrogen and phosphorous can result in algal blooms which reduce water quality and can limit the productive capacity for local biota.

The Red River watershed is underlain with Ordovician limestone and dolomite bedrock covered by mostly clay and silt surface deposits (CEC 1981). This area is predominated by the Red River and its tributaries, including the Assiniboine River to the west. Historically, this basin had a diversity of streams and wetlands. However, agricultural development have eliminated the majority of wetlands and created an artificial drainage network that diverts most surface waters into the Red River and its larger tributaries. Water quality within the Red River is subject to inflows from wastewater treatment facilities, industrial, and agricultural activities originating in the United States and southern Manitoba. The resulting river conditions include high turbidity, varying levels of dissolved oxygen, periodic algal blooms, and in some areas a noticeable odour (CEC 1981). Downstream of Winnipeg, detectable levels of pesticide and fertilizer residues have occurred, along with certain non-degradable chemical compounds from wastewater treatment effluents. Accidental spills of organic and untreated effluent into the Red River have occurred and remain a serious threat to the integrity of these waters. Concerns have been raised on several occasions regarding the potential health risks associated with microbial and pathenogenic organisms existing in the Red River water.

Both the Assiniboine and Red River basin areas are strewn with small, generally stagnant prairie pothole lakes and man-made dugouts. Given their nature and proximity to agriculture and livestock operations, these water bodies are typically high in nutrient concentrations and host rich algal communities. These small water bodies in particular are prone to outbreaks of blue-green algae (cyanobacteria), which can produce deadly toxins for wildlife, livestock, and humans (Jones 1998).

3.3 Lower Trophic Levels

Lower trophic levels form the basis of the food web and, therefore, are important to higher trophic levels such as fish. Aquatic lower trophic level organisms include bacteria, algae (large filamentous algae and microscopic phytoplankton), large rooted plants (aquatic macrophytes), and invertebrates (zooplankton, aquatic insects, shellfish). In particular, aquatic invertebrates are noted for their ecological significance as a dietary item for fish.

3.3.1 Aquatic Invertebrates

Aquatic invertebrates, as discussed in this document, are defined as those living organisms that lack a spinal chord and associate one or more of their life stages with the aquatic environment. Aquatic invertebrates can be divided into two main categories; microinvertebrates (those individuals indistinguishable by the naked eye) and macroinvertebrates (individuals that can be distinguished without the aid of magnification). Microinvertebrates are widespread throughout the Study Area and are broadly classified as zooplankton. Macroinvertebrates include a wide range of organisms such as water mites, insects, worms, mollusks, and crayfish. Table 3 provides a summary of preferred habitats, aquatic life stages, and feeding habits for ten classes of macroinvertebrates likely occurring within the extent of the Study Area.

Aquatic invertebrates within the Study Area inhabit a variety of riverine and lacustrine environments. Species distribution, diversity, and relative abundance throughout the area are influenced by differences in water depth, water current, substrate type, vegetation, water chemistry, and climate. Although parameters can be broadly characterized, it is the compounding effects of these parameters that directly influence the suitability of water bodies for invertebrate communities. Within individual water bodies, invertebrates utilize various habitat types based on physiological constraints (e.g., temperature), feeding habits (e.g., filter feeders versus carnivores), trophic interactions (e.g., predator and prey relationships), and physical constraints (e.g. flow regimes). Some types of invertebrates spend their entire life cycle within the aquatic environment while others utilize this medium only during particular life stages (e.g., egg or larval stages with larvae eventually emerging from the water as a terrestrial adult).

Aquatic invertebrates occupy valuable ecological roles; serving as food sources for higher trophic levels (including fish species), recycling organic materials and nutrients, and removing toxic substances from the water column. Aquatic invertebrates can also serve as valuable bio-indicators of environmental change. Invertebrate responses at the individual, species, or community level can be observed and linked to short and long-term environmental stresses (Hodkinson and Jackson 2005, Rosenberg et al. 2005).

The southern reach of the Study Area encompasses the geographic range of the endangered Saskatchewan-Nelson population of the mapleleaf mussel (*Quadrula quadrula*) as designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The mapleleaf mussel inhabits medium to large rivers with low to moderate flows and shallow lakes with soft to coarse substrate (COSEWIC 2006, Metcalfe-Smith et al. 2005). Historic distribution of this species within the Study Area includes the lower reaches of the Assiniboine River as well as the Red River and its tributaries (COSEWIC 2006).

Table 3. Aquatic macroinvertebrates occurring within the Bipole III Study Area.

Taxonomic Class	Taxonomic Order	Common Name	Common Aquatic Habitat	Aquatic Life Stage	General Feeding Method
Arachnida	Araneae	Spiders	General	Adult	Carnivores
	Acarina	Mites	General	Egg/Larva/Nymph/Adult	Parasite, carnivore
Crustacea		Crayfish and amphipods	General	Egg/Juvenile/Adult	Detritivores and carnivores
Gastropoda		Snails and slugs	General	Egg/Juvenile/Adult	Grazers and filterers
Hirudinea		Leeches	General	Egg/Juvenile/Adult	Carnovores and parsites
Hydrozoa		Hydras	General	Egg/Larva/Adult	Carnivores
Insecta	Ephemeroptera	Mayflies	General	Egg/Larva	Primarily scapers and grazers, some carnivores
	Odonata	Dragonflies and damselflies	Most abundant in streams and ponds	Egg/Larva	Carnivores
	Plecoptera	Stoneflies	Primarily associated with clean, cool, running water	Egg/Larva	Detritivores and carnivores
	Hemiptera	True Bugs/Water Bugs	General	Egg/Larva/Adult	Generally Carnivores
	Megaloptera/Neuroptera	Alderflies, dobsonflies, fishflies, hellgrammites, and spongillaflies	General	Egg/Larva	Carnivores
	Trichoptera	Caddisflies	General	Egg/Larva	Detritivores, filterers, and carnivores
	Coleoptera	Beetles	General	Egg/Larva/Adult	Detritivores, carnivores, and scavengers
	Lepidoptera	Moths	General	Egg/Larva	Generally herbivores
	Diptera	True Flies (including osquitoes and bl	General	Egg/Larva	Collectors, scrapers, and carnivores
Nematoda		Round Worms	General	Egg/Juvenile/Adult	Carnivores, herbivores, and parasites
Oligochaeta		Segmented worms	General	Egg/Juvenile/Adult	Carnivores, grazers, and detritivores
Plecypoda		Bivalves	General	Egg/Larva/Juvenile/Adult	Filterers
Porifera		Freshwater sponges	General	Egg/Juvenile/Adult	Filterers
Tubellaria		Flatworms	General	Larva/Adult	Carnivores

Source: Clifford (1987) and Merritt and Cummins (1996)

3.4 Fish

At least 82 species of fish representing 19 families are found within, or are likely to be found within, the Study Area. A list of these species by their scientific names, common names, and abbreviations can be found in Appendix B: Table B-1. The Study Area covers a large expanse, with variations in the fish community from northern to southern Manitoba. An attempt to describe this variation has been made by organizing the fish communities by the eight drainage basins occurring in the Study Area. A list of fish distributions by drainage basin can be found in Appendix B: Table B-2. A summary of life history characteristics for all fish species can be found in Appendix B: Table B-3. Fish utilization and an assessment of habitat conditions of selected water bodies within the Study Area are in Appendix B: Table B-4.

3.4.1 Fish Distribution

Some fish species are distributed throughout the Study Area, including brook stickleback, northern pike, and white sucker. Fish species distributed throughout the Study Area, except the most northern basin (i.e., Hudson Bay basin), include burbot, walleye, troutperch, yellow perch, emerald shiner, longnose dace, and johnny darter.

3.4.1.1 Hudson Bay Basin

Larger-bodied fish species widely distributed throughout the Hudson Bay basin include lake sturgeon, longnose sucker, cisco, lake whitefish, brook trout, and lake trout. Smaller species generally found in the basin include lake chub, ninespine stickleback, and slimy sculpin.

3.4.1.2 Churchill River Basin

Within the Churchill River basin, lake sturgeon, goldeye, longnose sucker, cisco, lake whitefish, and lake trout are fish species that are broadly distributed. Smaller species generally distributed throughout this basin include lake chub, spottail shiner, ninespine stickleback, logperch, spoonhead sculpin and slimy sculpin. Brook trout are found in some water bodies within this basin.

3.4.1.3 Nelson River Basin

Large-bodied fish species broadly distributed in the Nelson River basin include carp, goldeye, mooneye, cisco, lake whitefish, and lake trout. Smaller species include lake chub, blacknose shiner, spottail shiner, fathead minnow, ninespine stickleback, and slimy sculpin. Other fish species that occur primarily in the Nelson River mainstem include lake sturgeon, silver lamprey, shorthead redhorse, rainbow smelt, and freshwater drum. Brook trout occur in the northern portion of the drainage basin and are stocked in more southern locations. Rainbow trout are stocked in some lakes within the southern part of the basin.

3.4.1.4 Saskatchewan River Basin

Larger fish species generally distributed throughout the Saskatchewan River basin include carp, goldeye, mooneye, longnose sucker, silver redhorse, cisco, lake whitefish, smallmouth bass, and lake trout. Smaller species include lake chub, river shiner, blacknose shiner, fathead minnow, central mudminnow, ninespine stickleback, spoonhead sculpin, and logperch. Lake sturgeon occur in the Saskatchewan River mainstem. Within this basin, shortjaw cisco and deepwater sculpin are only known to occur in Lake Athapapuskow. Rainbow trout, brown trout, and brook trout have been stocked in some areas.

3.4.1.5 Lake Manitoba Basin

Within the Lake Manitoba basin, larger species that are broadly distributed include goldeye, mooneye, carp, silver redhorse, shorthead redhorse, quillback, smallmouth bass, and freshwater drum. Smaller species broadly distributed include spottail shiner, fathead minnow, ninespine stickleback, Iowa darter, river darter, logperch, common shiner, blacknose shiner, and creek chub. Arctic char and rainbow, brown, brook, and lake trout have been stocked in some Lake Manitoba basin water bodies.

3.4.1.6 Assiniboine River Basin

Broadly distributed large-bodied fish species in the Assiniboine River basin include chestnut lamprey, goldeye, mooneye, carp, silver redhorse, shorthead redhorse, black bullhead, brown bullhead, and rock bass. Smaller species include common shiner, sand shiner, golden shiner, northern redbelly dace, fathead minnow, creek chub, tadpole madtom, central mudminnow, ninespine stickleback, and Iowa darter. Fish species primarily found in the Assiniboine River mainstem include silver lamprey, quillback, spotfin shiner, silver chub, flathead chub, bigmouth buffalo, golden redhorse, channel catfish, and freshwater drum. Lake sturgeon have been re-introduced into the Assiniboine River mainstem. Rainbow, brown, brook, and lake trout have been stocked in some water bodies within this basin.

3.4.1.7 Red River Drainage

Broadly distributed larger fish species include chestnut lamprey, goldeye, mooneye, carp, silver redhorse, shorthead redhorse, black bullhead, brown bullhead, rock bass, and black crappie. Smaller species include common shiner, golden shiner, sand shiner, fathead minnow, creek chub, stonecat, central mudminnow, Iowa darter, and logperch. Fish species primarily in the Red River mainstem include silver lamprey, quillback, bigmouth buffalo, spotfin shiner, river shiner, silver chub, flathead chub, channel catfish, lake whitefish, and freshwater drum. Rainbow trout have been stocked within this basin.

3.4.1.8 Lake Winnipeg Basin

Within the Lake Winnipeg basin, larger species that are broadly distributed include chestnut lamprey, carp, silver redhorse, shorthead redhorse, black bullhead, burbot, rock bass, and logperch. Smaller species include common shiner, pearl dace, hornyhead chub, tadpole madtom, central mudminnow, troutperch, blackside darter, and river darter. The stonecat is found primarily in the Brokenhead River mainstem. Rainbow, brown, and brook trout have been stocked in some water bodies.

3.5 Fish Habitat

Fresh water fish habitat is found in a wide variety of water bodies, such as lakes, reservoirs, rivers, streams, creeks, marshes, ponds and swamps. Any place that fish depend on for food, shelter, reproduction (i.e., spawning and larval rearing), growth or migration is considered fish habitat (see Section 34(1) of the *Fisheries Act*). Habitat requirements particular to a fish species can change depending on the stage of its life cycle. For example, reproductive habitat requirements (i.e., spawning habitat) will often be different than those required for adult fish feeding and shelter (e.g., overwintering habitat). Thus, one species of fish may require a wide variety of habitats to successfully complete its life cycle.

3.5.1 Watercourses

3.5.1.1 Intermittent Streams

There are numerous intermittent streams in the study area, many of which are unnamed. Intermittent streams have well-defined banks and scoured channels, but typically have flowing water for only a portion of the year. Intermittent streams in the study area generally drain local, low-lying areas (e.g., bogs, fens, wetlands) into larger watercourses. Water levels and discharge are reliant on runoff from precipitation events. Discharge can range from a number of cubic metres per second during the spring freshet to zero during subsequent dry periods. Maximum water depths are usually less than 1 m. Water temperatures in these streams can rise rapidly from 0˚C at break-up in April or May to the mid-twenties by late May.

Fish habitat is generally only provided for a brief period of time during spring when these streams have water. During this time, pike and suckers might utilize these streams as spawning and nursery areas. Smaller forage species such as minnows and stickleback might utilize these streams whenever water is available. In winter, low water flow and low dissolved oxygen levels generally preclude fish overwintering in these types of streams. An example of this type of stream is Canada Creek, a tributary to Snow Lake. Stewart-Hay (1951) noted that Canada Creek became only a trickle by August, but was used by pike and suckers for spawning during the spring. Fifty-five Mile Creek, a tributary to Wapisu Lake that crosses PR 391, is an important walleye spawning location during spring, but has little flow throughout the rest of the year.

3.5.1.2 Perennial Streams

Perennial streams have well-defined channels and continuously flowing water most years. There are numerous perennial small streams in the study area that provide year-round fish habitat. These streams generally have larger watersheds than intermittent streams and are characterized by discrete water flow habitat types (i.e., riffle/pool/run sequences), diversified substrates (generally coarser with less organic material than intermittent streams), and beaver activity. Discharges can reach 3 to 8 m^3/sec during spring, but may decrease to less than 0.1 m^3/sec during dry periods in summer/fall and during winter. Generally, mean annual flows are 0.1 to 1 m^3/sec and maximum water depths are 1 to 3 m. Water temperatures approach 0˚C during winter and increase to the mid-twenties during summer.

In the study area, these streams potentially supply spawning (spring) and nursery habitat (spring to fall) for larger fish species such as pike and suckers. Various species of darters, minnows, sculpin, and stickleback potentially utilize these streams for all life cycle stages. Fish overwintering potential is generally limited by low winter stream discharge and shallow winter water depths; however, overwintering of smaller fish may occur where deeper pools are available. These types of stream within the study area generally include ones named as a 'creek', e.g., Bell, Brannigan, Cooks, Fetterly, Goose, Kiski, McMillan, and Moose creeks. Wachistoon Creek, a tributary to Wapisu Lake, is known to be an important spawning location for walleye.

Other noteworthy perennial streams include the creeks throughout the Manitoba escarpment. These are higher gradient and higher water velocity streams that are spring-fed, clear, and cool with coarse, clean substrates. These streams potentially supply spawning and nursery habitat for brook, rainbow, and brown trout that have been introduced into the area.

3.5.1.3 Small to Moderate Sized Rivers

In general, small to moderate sized rivers in the study area are characterized by mean annual discharges of 1 to 10 m^3/sec, more diverse water flow habitat types (e.g., riffle, pool, run, falls, rapids, etc.), abundant fish cover (e.g., undercut banks, woody debris, boulders, vegetation, pools), larger sized substrate than perennial streams (i.e., cobbles and boulders), and more distinctive banks and floodplains. During spring or after heavy precipitation, flows may reach into the 100 m^3/sec range, but can also be as low as 1 m^3/sec during dry periods or during the winter. Maximum depths are generally in excess of 3 m.

Small and medium sized rivers are common within the study area and provide migratory routes and habitat for a variety of large and small fish. Generally, these watercourses offer spawning, nursery, foraging, and overwintering areas; however, low flows during summer, fall, and winter can limit the abundance of larger fish. Rapids and riffle habitat in these rivers can provide important spawning habitat for suckers and walleye during spring and lake whitefish during fall. Examples of this type of

stream within the study area include: File, Hunting, Grass, La Salle, Morris, Sinclair, Taylor, Winnapedi, and Valley rivers.

Manitoba escarpment small rivers potentially supply spawning and nursery habitat for brook, rainbow, and brown trout that have been introduced into the area. Examples of these small rivers include the Steeprock, Garland, North Duck, and Pine rivers.

3.5.1.4 Large Rivers

Large rivers generally do not show differentiation of water flow habitat types (e.g., distinct pool, riffles, and runs). While differences in depth may occur across the river channel, habitat features (e.g., water flow, substrate, cover) are generally associated with shoreline, island, and tributary confluence areas. In general, large sized rivers are characterized by mean annual discharges over 10 m^3/sec and maximum depths in excess of 5 m.

Large rivers in the study area provide migratory routes and habitat for a variety of large and small fish. Similarly to smaller rivers, rapids and riffle habitat in large rivers can provide important spawning habitat for sucker and walleye during spring and lake whitefish during fall. The main channel and tributary confluences of large rivers are also important lake sturgeon habitat, where populations occur. Large rivers are important overwintering habitat of large fish.

Examples of large rivers in the study area include Assiniboine, Burntwood, Nelson, Red and Saskatchewan rivers.

3.5.2 Lakes and Reservoirs

There are numerous small lakes within the study area with surface areas of 1 to 2 km^2. Lakes of this size are generally unnamed, have detritus substrates, are shallow (<2 m), and often freeze to the bottom or become anoxic during winter. This generally precludes fish overwintering in these small water bodies and may lead to winter fish die-offs for fish that remain (known as winterkills). Fish species such as brook stickleback and pearl dace are tolerant to low oxygen conditions and are common in small study area lakes. Depending on connectivity to adjacent fish bearing water bodies, these small lakes may provide rearing and feeding habitat to other fish species during the open water season. In general, however, these lakes provide very little fish habitat except for a few minnow species and stickleback.

Moderate sized lakes that can provide life history requirements for some larger fish species year-round are generally deeper than 2 m or have inflows that prevent ice from forming to the bottom and replenish oxygen levels. Substrates are organic, but have less detritus than smaller lakes. In the study area, these types of lakes are usually 2 to 5 km^2 in area and greater. Minnow species, perch, pike, stickleback, and sucker frequently inhabit these types of lakes; all of which have to be somewhat tolerant to moderately low dissolved oxygen levels and higher water temperatures.

Many small to moderate sized lakes are highly productive (i.e., nutrient rich that in turn promotes algae, plant, and invertebrate growth) compared to larger lakes and can offer superior fish foraging habitat throughout the year. Higher productivity can be a result of extended warmer water temperatures and less dilution of nutrient inputs compared to bigger, colder lakes.

Lakes larger than 5 km^2 in the study area generally provide a diversity of habitats that support all life history requirements for lake dwelling fish species. In the study area, substrates are generally clays with occasional rocky shorelines and reefs, and maximum water depths commonly exceed 20 m. Fish species such as burbot, goldeye, lake whitefish, pike, tullibee, and walleye are common in these type of lakes. Some larger lakes in the study area are sufficiently deep and cold to provide habitat for cold-water fish species such as lake trout.

3.6 Aquatic Species at Risk

There are six fish species and one mollusk species within the Study Area that are listed under the federal *Species at Risk Act* (SARA) or have designation via COSEWIC (SARPR 2010, COSEWIC 2010). These species, their distributions, and their status can be found in Table 4. Most of these species are found within the southern portion of the Study Area (i.e., Red River and Assiniboine River basins), such as the chestnut lamprey, silver chub, bigmouth shiner, and mapleleaf mussel. The shortjaw cisco is only found in Lake Athapapuskow, which is situated in the Saskatchewan River basin. Lake sturgeon have a broad distribution across the Study Area; however, they have a limited distribution within the Red and Assiniboine River basins (Stewart and Watkinson 2004).

3.7 Invasive Species

The introduction of non-native species (i.e., invasive species) continues to be a worldwide phenomenon due largely to anthropogenic effects (DFO 2003). Introductions of invasive species to non-native habitats can be deliberate (e.g., sport fishermen introducing bait fish) or unintentional (e.g., zebra mussel larvae in boat ballast water) and the effects can be devastating on an ecosystem scale (Ricciardi 2003, Ricciardi and Rasmussen 1998).

Several aquatic invasive species potentially exist in the Manitoba. Invasive species within the Study Area include two fish species (rainbow smelt and carp) and two plants (purple loosestrife and Eurasian watermilfoil). Table 5 lists the distribution of invasive species existing in Manitoba and also lists species on the Invasive Species Council of Manitoba's watch list. In general, invasive species are known to be particularly resilient and tough to remove once they have become established in an ecosystem.

Table 4. Distribution within the Study Area of aquatic species with status under SARA and COSEWIC.

Species	Study Area Basin	Status	
		SARA	COSEWIC
Chestnut lamprey (*Ichthyomyzon castaneus*)	Lake Winnipeg, Red River, Assiniboine River	Special Concern (Sched 3)	Special Concern
Silver chub (*Macrhybopsis storeiana*)	Assiniboine River, Red River	Special Concern (Sched 1)	Special Concern
Bigmouth shiner (*Notropis dorsalis*)	Lake Manitoba, Assiniboine River, Red River	Special Concern (Sched 3)	Not at risk
Shortjaw cisco (*Coregonus zenithicus*)	Saskatchewan River	Threatened (Sched 2)	Threatened
Bigmouth buffalo (*Ictiobus cyprinellus*)	Lake Manitoba, Assiniboine River, Red River	Special Concern (Sched 3)	Non-active
Lake sturgeon (*Acipenser fulvescens*)	Hudson Bay, Churchill River, Nelson River, Saskatchewan River, Assiniboine River, Red River	No status	Endangered
Mapleleaf mussel (*Quadrula quadrula*)	Assiniboine River, Red River	No status	Endangered

Note: Refer to COSEWIC (2010) for criteria of their classifications.

Table 5. Distribution of invasive aquatic species potentially in Manitoba.

Common Name	Species Name	Area of Known Occurrence	Reference
Fish			
Rainbow smelt	*Osmerus mordax*	Lake Winnipeg, Nelson River	Gov. Man 2010; Remnant et al.
Carp	*Cyprinus carpio*	Mississippi/Missouri drainage	ISCM 2010
Mosquito fish	*Gambusia affinis/holbrooki*	ISCM watch list	ISCM 2010
Invertebrates			
Zebra mussel	*Dreissena polymorpha*	Winnipeg River (N. Dakota, USA)	ISCM 2010
Rusty crayfish	*Orconectes rusticus*	Falcon Lake	ISCM 2010
Spiny water flea	*Bythotrephes longimanus*	Dept. of Fisheries and Oceans watch list	North/South 2006
Riparian/Aquatic Macrophytes			
Purple loosestrife	*Lythrum salicaria*	Southern Manitoba	ISCM 2010
Eurasian watermilfoil	*Myriophyllum spicatum*	Red River watershed	ISCM 2010

3.8 Aquatic Resource Use

Aquatic resource use within the Study Area is diverse with multiple stake holders and/or interest groups. Factors that dictate resource use include: water body type (e.g., riverine versus lacustrine), accessibility, desirability of fish species, water abundance, and water quality. Aquatic resource use of water bodies within the Study Area generally includes the following:

- domestic fishing
- commercial fishing
- sport fishing
- bait fisheries
- wild rice production
- municipal water use
- industrial water use
- agricultural water use
- recreational water use

Aquatic resource and surrounding land use of water bodies within the Study Area that had available information from FIHCS is provided in Appendix C: Tables C-1 and C-2, respectively.

3.8.1 Domestic Fishing

First Nation communities within the Study Area have historically utilized aquatic resources within their Resource Management Area (RMA) to meet individual and community requirements. The Study Area covers a large portion of the province and intersects 20 different RMAs. Water bodies within the Study Area are in 14 of these RMAs: Split Lake, Fox Lake, York Factory, Pikwitonei, Nelson House, Thicket Portage, Wabowden, Snow Lake, Cranberry Portage, Cormorant, Moose Lake, Porcupine, Red Deer/Shoal River, and Easterville. Major species targeted by domestic fisheries include lake whitefish, walleye, and pike. Lake sturgeon have also been harvested traditionally where they occur.

3.8.2 Commercial Fishing

Commercial fishing is an important industry in Manitoba and is a major source of income for northern Manitoba and the Interlake communities. The industry is controlled by federal and provincial jurisdictions that govern the allocation of licenses, determine fishing periods, establish quotas, and sanction type of fishing gear. Within the Study Area, water bodies of Nelson and Saskatchewan river basin, and lakes Manitoba and Winnipegosis represent a significant part of the Manitoba commercial fishing industry.

In the Nelson River basin, water bodies in the Study Area that support round weight commercial fishing quotas $\geq$ 20,000 kg are: Split Lake, Setting Lake, Wekusko Lake, and Pakwa Lake (Appendix C: Table C-3). In the Saskatchewan River basin, water bodies meeting these criteria include: North and South Moose Lake, Cormorant Lake, Cedar Lake, and the Saskatchewan River (Appendix C: Table C-3). Lake Manitoba and Lake Winnipegosis both support substantial Manitoba commercial fisheries. In the 2006/2007 season these lakes produced 6.3 and 9.7% of the summer seasons production and 28.7 and 27.2% of the winters production, respectively. These lakes also employed, on average, 817 and 324 individuals (26 and 10% of all commercial fishing employees), respectively, in the 2006/2007 season (Manitoba Water Stewardship 2010a).

Commercially fished lakes are governed by restrictions on seasons, mesh size extensions, and quotas per fish species harvested (Manitoba Water Stewardship 2010c). The primary fish species subjected to commercial quota restrictions in the Study Area include lake whitefish, walleye, sauger, northern pike, lake trout, and goldeye. Species such as lake cisco (classified as tullibee), longnose sucker, and white sucker (both classified as mullet), and carp are not subject to quotas, but contribute significantly to the total commercial harvest of some lakes (Manitoba Water Stewardship 2010a).

Water bodies within the Study Area that historically or presently support commercial fisheries are outlined in Appendix C: Table C-1. Study Area water bodies in the 2009/2010 commercial harvest schedule, along with restrictions and quotas, are listed in Appendix C: Table C-3.

3.8.3 Sport Fishing

Sport fishing generally occurs throughout the Study Area. Fish species in the Study Area targeted by sport fishers include walleye, sauger, northern pike, yellow perch, lake trout, brook trout, rainbow trout, goldeye, cisco, lake whitefish, brown bullhead, channel catfish, burbot, and freshwater drum.

Stocked lakes, in particular, attract sport fishers targeting rainbow trout, walleye, sauger, and brook trout. Fish stocking information for lakes in the Study Area is presented in Appendix C: Table C-4. Lakes with naturally occurring lake trout populations, such as Clearwater, Paint and Cormorant Lake, also attract fishers for unique angling experiences.

Much of the sport fishing in the northern portion of the Study Area is limited by road access. However, water bodies in this area are accessed for sport fishing via fly-in lodges and outfitters.

3.8.4 Bait Fishing

Bait fish include a number of smaller fish species such as ciscoes (sub-family Coregoninae), minnows (family Cyprinidae), and suckers (family Catostomidae). Licensed commercial bait fishermen may collect, buy, and sell bait fish from assigned bait-fish blocks. In 2009, active bait-fish blocks in the Study Area included Reed Lake, Wekusko Lake, Cormorant Lake, Lake Winnipegosis, Cooks Creek, the Red River, and the Saskatchewan River (FIHCS; Barb Scaife, Manitoba Water Stewardship Fisheries Branch, Winnipeg, pers. comm.)

3.8.5 Wild Rice Harvest

Lakes that are suitable for the production of wild rice are generally shallow, sheltered, have good water flow, provide minimal competition from other species of aquatic macrophytes, and have relatively good water clarity (Sain et al. 1987). The highest concentration of wild rice leases found in Manitoba are between the 53rd and 56th parallels, north of Cranberry Portage, and adjacent to Sherridon Lake road (Derksen 2000). Dyce, Cormorant, Dolomite, Hargrave, North Moose, South

Moose, Reed, and Wekusko are lakes within the Study Area licensed for commercial wild rice harvests (Appendix C: Table C-2).

3.8.6 Municipal Water Use

Communities extract water from many lakes and rivers within the Study Area, e.g., Cedar Lake, South Moose Lake, Boyne River, Saskatchewan River, Assiniboine River and Whitemud River. Groundwater use within the northern section of the Study Area is minimal due to the availability of abundant, clean surface water and the high cost of drilling wells to bedrock aquifers. In the southern portion of the Study Area, aquifers are another major source of water municipal use (Betcher et al. 1995).

3.8.7 Industrial Water Use

Various water bodies within the Study Area experience water withdrawal for industrial purposes. Tolko Manitoba Inc. at The Pas utilizes water from the Saskatchewan River for processing paper. The Selkirk thermal power generation plant requires water withdrawal from the Red River for cooling purposes. Sawmills also utilize water from the Saskachewan River, Swan River, and Cedar Lake.

3.8.8 Agricultural Water Use

Many Study Area water bodies adjacent to agricultural land experience water withdrawal for agricultural practices, i.e., crop irrigation and livestock watering (Appendix C: Table C-2). Specifically, water bodies such as the Seine, Assiniboine, Red, and Whitemud rivers are major sources of water withdrawal for feedlots and large-scale crop irrigation.

3.8.9 Recreational/Aesthetic Use

Other aquatic resource use in the Study Area includes commercial lodges, cottage development, and provincial, municipal, and federal parks/campgrounds. These recreational and aesthetic uses are listed in Appendix C: Table C-, as provided in FIHCS. Lodges, campgrounds, and cottages notably utilize lakes and rivers for domestic uses.

4.0 VALUED ECOSYSTEM COMPONENTS (VECS)

Two Valued Ecosystem Components (VECs) have been chosen for the aquatics component of the Project assessment: surface water quality and fish habitat.

Surface water quality is considered a VEC in all water bodies that are considered fish habitat and/or are utilized by people. Provincial guidelines for surface water quality as it relates to humans and aquatic life are in place (Williamson 2002). As water quality is tied to fish habitat, it will be discussed within the fish habitat VEC.

Fish habitat is considered a VEC and is generally used as a surrogate for measuring productive capacity. Section 35.1 of the *Fisheries Act* prohibits the 'Harmful Alteration, Disruption or Destruction (HADD)' of fish habitat. Maintaining fish habitats is best assured by minimizing short-term and avoiding long-term degradation of instream and riparian habitats.

Fish habitat is defined by a variety of biophysical parameters, including hydrology, channel and flow characteristics, substrate, cover, water and sediment quality, aquatic macrophytes and periphyton, and benthic invertebrate communities. Benthic invertebrate communities represent a large and diverse food base for higher trophic levels such as fish populations. They are also of indirect importance to fish populations through ecological importance to the overall structure and function of aquatic environments. Water quality parameters key to defining fish habitat characteristics include temperature, dissolved oxygen (DO), total suspended solids (TSS), turbidity and pH.

The Key Indicator Resources (KIRs) associated with fish habitat, and the measurable parameters (in parentheses) that may facilitate quantitative or qualitative measurement of potential Project and cumulative effects, include:

- physical fish habitat (substrate composition, channel characteristics, cover composition and habitat units);
- water quality (DO, TSS and turbidity);
- hydrology (velocity and water depth); and
- riparian vegetation (riparian health and riparian vegetation composition).

Overhead transmission line presence, construction and maintenance potentially have little effect on water quality and fish habitat if appropriate mitigation is implemented. However, the avoidance of sensitive and critical areas is recommended. Potential overhead line construction issues related to water quality and fish habitat include:

- Improper construction practices causing negative impacts to riparian zones, instream areas, and fish migration (e.g., insufficient riparian buffers, improper temporary stream crossings that may cause infilling, sedimentation, or impede fish passage).
- Accidental spills and leaks of substances harmful to fish and the aquatic environment (e.g., fuels and lubricants).
- Workforce presence and improved access to sensitive habitat.
- Improper use of herbicides during right-of-way maintenance resulting in herbicides entering waterways.
- Contamination and/or habitat loss from structure foundations and installations.

5.0 RELEVANT LEGISLATION

Federal, provincial, and in some cases municipal regulations and guidelines apply to most activities regarding water use and the protection of fish and fish habitat. The federal *Fisheries Act* applies to all Canadian waters and supercedes provincial and all other legislation when they are in conflict.

5.1 Fisheries Act

The following sections of the Department of Fisheries and Oceans (DFO) *Fisheries Act* are those most relevant to overhead transmission line construction in regard to watercourse crossings and construction of near a watercourse:

Subsection 20(1): Requirement for safe fish passsage;
Subsection 35(1): Prohibition of harmful alteration, disruption or destruction of fish habitat (HADD);
Subsection 36(3): Prohibition of deleterious substance release; and
Subsection 38(5): Due diligence – every effort to protect fish and fish habitat to a point deemed reasonable will be made.

Definition of deleterious substance from **Section 34(1)**:

a) "Any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water, or"

b) "Any water that contains a substance in such quantity or concentration, or that has been so treated, processed or changed, by heat or other means, from a natural state that it would, if added to any other water, degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the use by man of fish that frequent that water"

DFO will assess the risk of HADD for a Project and are the only regulatory body that can issue an *Authorization* under Subsection 35 (2) and/or a *Letter of Advice* for approving works that might affect fish or fish habitat.

Routine construction activities near, within, or over fish bearing water may be covered within the framework of existing guidelines released by DFO called Operational Statements. Provided the construction activities follow all the guidelines in the Operational Statements, there would be limited effects to fisheries and only a notification of the intended work needs to be provided to DFO (prior to commencing work activities).

5.2 Navigable Waters Protection Act

The *Navigable Waters Protection Act* (*NWPA*) is enforced by Transport Canada and is administered via their Navigable Waters Protection Program (NWPP). Under the *Act* any work that interferes with a navigable water is prohibited (Section 5.1[1]) unless the work site plans have been approved by NWPP (i.e., prior to commencement of work; Section 9) and all work proceeds according to those plans submitted to the NWPP. During the approval process the NWPP will determine which sections of the *NWPA* apply to the Project. The NWPP will then advise the proponent of their obligations pending approval accordingly (Transport Canada 2010).

Definition of *Navigable Water*: "Any body of water capable of being navigated by floating vessels of any description for the purpose of transportation, commerce or recreation. This includes both inland and coastal waters. The final authority to determine the navigability of a waterway rests with the Minister of Transport or his/her designated representative."(Transport Canada 2010)

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APPENDIX A. WATER BODIES WITHIN THE PREFERRED ROUTE CORRIDOR AND SELECT WATER BODIES WITHIN THE BIPOLE III STUDY AREA

Table A-1. Water bodies within the preferred route corridor and select water bodies within the Bipole III Study Area as listed in FIHCS.

Water body	1:50 000 Map Number	Watershed Unit	Latitude	Longitude
Apussigamasi Lake	63P13	5TG-A	55 50 46	97 36 47
Assean Lake	64A01	5UF-H	56 13 21	96 30 1
Assiniboine River	62H14	5MJ-A	49 53 9	97 7 41
Bell River	63C10	5LF-E	52 44 42	100 52 1
Birch Tree Lake	63O09	5TF-A	55 42 48	98 0 56
Bowden Lake	63J15	5TC-B	54 55 39	98 37 9
Boyne River	62H12	5OF-D	49 34 30	97 34 30
Burntwood River	64A02	5TG-A	56 8 21	96 34 28
Cedar Lake	63F08	5KJ-A	53 19 45	100 10 8
Clarke Lake	63J15	5UD-G	54 45 2	98 42 17
Clearwater Lake	63K03	5KJ-G	54 5 0	101 0 0
Cooks Creek	62I02	5OJ-E	50 17 44	96 48 34
Cormorant Lake	63K02	5KJ-D	54 15 0	100 49 59
Dauphin Lake	62O05	5LJ-A	51 17 0	99 47 4
Dolomite Lake	63K07	5KJ-E	54 27 21	100 32 49
Dyce Lake	63K08	5TB-G	54 22 46	100 5 14
Fifteen Creek	54C12	5UH-D	-	-
File Lake	63K16	5TE-G	54 53 20	100 20 12
Garland River	62N16	5LG-C	51 55 16	100 14 2
Goose Creek	54C12	5UH-D	56 39 41	93 49 29
Grass River	64A02	5TD-A	56 2 52	96 32 59
Halfway Lake	63O01	5TC-B	55 4 16	98 23 58
Hargrave Lake	63J05	5UC-D	54 28 59	99 39 59
Kiski Lake	63J15	5TC-A	54 45 0	98 55 0
Lake Manitoba	62J15	5LL-A	51 5 7	98 46 58
Lake Winnipegosis	63B05	5LD-A	53 57 20	101 14 13
Limestone River	54D09	5UG-A	56 30 54	94 7 11
Manasan River	63P12	5TG-M	55 42 41	97 56 35
McMillan Creek	54D09	5UG-C	56 37 15	94 26 13
Morris River	62H06	5OF-A	49 21 35	97 21 33
Mossy River	62O12	5LJ-A	51 39 10	99 55 2
Mystery Lake	63P13	5TG-A	55 50 50	97 43 40
North Duck River	63C01	5LG-E	52 11 5	100 10 42
North Moose Lake	63K01	5KJ-A	54 4 30	100 12 0
Odei River	64A02	5TG-I	56 0 34	98 14 6
Orr Lake	64A03	5TG-D	56 5 57	97 11 49
Ospwagan Lake	63O09	5TG-M	55 35 28	98 2 21
Overflowing River	63F03	5LD-B	53 7 50	101 4 57
Paint Lake	63P05	5TD-G	55 30 28	98 0 7
Pakwa Lake	63J15	5TC-A	54 51 42	98 52 42
Phillips Lake	63O08	5TC-A	55 15 1	98 17 0
Rat Creek	62J02	5LL-C	50 12 21	98 34 20
Rat River	62H11	5OE-B	49 35 16	97 8 16
Red Deer Lake	63C14	5LC-A	52 56 45	101 21 39
Red River	62I07	5OJ-D	50 17 11	96 51 28
Reed Lake	63K09	5TA-A	54 38 0	100 29 59

Table A-1 (cont)

Water body	1:50 000 Map Number	Watershed Unit	Latitude	Longitude
Rock Island Lake	63J15	5TC-B	54 54 29	98 35 2
Saskachewan River	63G03	5KJ-A	53 9 59	99 15 51
Sclater River	63C01	5LG-D	52 7 59	100 12 9
Seine River	62H14	5OH-A	49 54 1	97 6 34
Seine River Diversion	62H11	5OE-A	49 41 52	97 5 59
Setting Lake	63J15	5TC-A	54 59 58	98 37 18
Sinclair River	63C02	5LE-E	52 12 47	100 59 57
South Moose Lake	63F16	5KJ-A	53 49 0	100 1 0
Split Lake	64A01	5UF-G	56 7 56	96 15 16
Squirrel Creek	62J02	5LL-D	50 8 0	98 40 4
Steeprock River	63C11	5LF-F	52 43 55	101 6 54
Stephens Lake	54D06	5UF-F	56 25 58	95 7 1
Swan River	63C07	5LE-D	52 29 40	100 45 15
Talbot Lake	63G13	5KJ-C	54 5 29	99 53 0
Threepoint Lake	63O10	5TF-A	55 41 2	98 55 14
Waskaiowaka Lake	64A09	6FC-J	56 33 20	96 22 38
Weir River	54C14	5UH-F	56 54 32	93 21 27
Wekusko Lake	63J13	5TB-A	54 46 3	99 52 17
Whitemud River	62J02	5LL-B	50 15 0	98 35 0
Woody River	63C10	5LE-C	52 30 37	100 50 47
Wuskwatim Lake	63O10	5TF-A	55 33 31	98 32 34

APPENDIX B. FISH AND FISH HABITAT

Table B-1. Family, species, common name, and abbreviated name for fish species that may occur in the Bipole III Transmission Project Study Area.

Family	*Scientific Name*	Common Name	Abbreviation
Petromyzontidae	*Ichthyomyzon castaneus*	Chestnut Lamprey	CHLM
	Ichthyomyzon unicuspis	Silver Lamprey	SLLM
Acipenseridae	*Acipenser fulvescens*	Lake Sturgeon	LKST
Hiodontidae	*Hiodon alosoides*	Goldeye	GOLD
	Hiodon tergisus	Mooneye	MOON
Cyprinidae	*Carassius auratus*	Goldfish	GLFS
	Couesius plumbeus	Lake Chub	LKCH
	Cyprinella spiloptera	Spotfin Shiner	SFSH
	Cyprinus carpio	Common Carp	CARP
	Hybognathus hankinsoni	Brassy Minnow	BRMN
	Luxilus cornutus	Common Shiner	CMSH
	Macrhybopsis storeriana	Silver Chub	SLCH
	Margariscus margarita	Pearl Dace	PRDC
	Nocomis biguttatus	Hornyhead Chub	HRCH
	Notemigonus crysoleucas	Golden Shiner	GLSH
	Notropis atherinoides	Emerald Shiner	EMSH
	Notropis blennius	River Shiner	RVSH
	Notorpis dorsalis	Bigmouth Shiner	BGSH
	Notropis heterodon	Blackchin Shiner	BCSH
	Notropis heterolepis	Blacknose Shiner	BLSH
	Notropis hudsonius	Spottail Shiner	SPSH
	Notropis stramineus	Sand Shiner	SNSH
	Notropis texanus	Weed Shiner	WDSH
	Phoxinus eos	Northern Redbelly Dace	NRDC
	Phoxinus neogaeus	Finescale Dace	FNDC
	Pimphales notatus	Bluntnose Minnow	BLMN
	Pimephales promelas	Fathead Minnow	FTMN
	Platygobio gracilis	Flathead Chub	FLCH
	Rhinichthys cataractae	Longnose Dace	LNDC
	Rhinichthys obtusus	Western Blacknose Dace	BLDC
	Semotilus atromaculatus	Creek Chub	CRCH
Catostomidae	*Carpiodes cyprinus*	Quillback	QUILL
	Catostomus catostomus	Longnose Sucker	LNSC
	Catostomus commersoni	White Sucker	WHSC
	Ictiobus cyprinellus	Bigmouth Buffalo	BGBF
	Moxostoma anisurum	Silver Redhorse	SLRD
	Moxostoma erythrurum	Golden Redhorse	GLRD
	Moxostoma macrolepidotum	Shorthead Redhorse	SHRD
Ictaluridae	*Ameiurus melas*	Black Bullhead	BLBL
	Ameiurus nebulosus	Brown Bullhead	BRBL
	Ictalurus punctatus	Channel Catfish	CHCT
	Noturus flavus	Stonecat	STON
	Noturus gyrinus	Tadpole Madtom	TDMD

Table B-1. (cont)

Family	*Scientific Name*	Common Name	Abbreviation
Esocidae	*Esox lucius*	Northern Pike	NRPK
	Esox masquinongy	Muskellunge	MUSK
Umbridae	*Umbra limi*	Central Mudminnow	CNMD
Osmeridae	*Osmerus mordax*	Rainbow Smelt	RNSM
Salmonidae	*Coregonus artedi*	Cisco	CISC
	Coregonus clupeaformis	Lake Whitefish	LKWH
	Coregonus zenithicus	Shortjaw Cisco	SHCS
	Oncorhynchus mykiss	Rainbow Trout	RNTR
	Salmo trutta	Brown Trout	BWTR
	Salvelinus alpinus	Arctic Char	ARCH
	Salvelinus fontinalis	Brook Trout	BRTR
	Salvelinus namaycush	Lake Trout	LKTR
Percopsidae	*Percopsis omiscomaycus*	Troutperch	TRPR
Gadidae	*Lota lota*	Burbot	BURB
Fundulidae	*Fundulus diaphanus*	Banded Killifish	BNKL
Gasterosteidae	*Culaea inconstans*	Brook Stickleback	BRST
	Pungitius pungitius	Ninespine Stickleback	NNST
Cottidae	*Cottus bairdi*	Mottled Sculpin	MTSC
	Cottus cognatus	Slimy Sculpin	SLSC
	Cottus ricei	Spoonhead Sculpin	SPSC
	Myoxocephalus thompsoni	Deepwater Sculpin	DPSC
Moronidae	*Morone chrysops*	White Bass	WHBS
Centrarchidae	*Ambloplites rupestris*	Rock Bass	RCBS
	Lepomis gibbosus	Pumpkinseed	PUMP
	Lepomis macrochirus	Bluegill	BLUE
	Micropterus dolomieu	Smallmouth Bass	SMBS
	Micropterus salmoides	Largemouth Bass	LRBS
	Pomoxis annularis	White Crappie	WHCR
	Pomoxis nigromaculatus	Black Crappie	BLCR
Percidae	*Etheostoma exile*	Iowa Darter	IWDR
	Etheostoma nigrum	Johnny Darter	JHDR
	Perca flavescens	Yellow Perch	YLPR
	Percina caprodes	Logperch	LOGP
	Percina maculata	Blackside Darter	BLDR
	Percina shumardi	River Darter	RVDR
	Sander canadensis	Sauger	SAUG
	Sander vitreus	Walleye	WALL
Sciaenidae	*Aplodinotus grunniens*	Freshwater Drum	FRDR

Table B-2. Distribution of fish species found in the Bipole III Transmission Project Study Area by drainage basin (Note: √ denotes species found in basin and I denotes species introduced or stocked in basin).

Common Name	Lake Winnipeg	Red R.	Ass. R.	SK	L. MB.	Nelson	Churchill	Hudson Bay
Chestnut Lamprey	√	√	√					
Silver Lamprey		√	√			√		
Lake Sturgeon		√	√	√		√	√	√
Goldeye		√	√	√	√	√	√	
Mooneye		√	√	√	√	√		
Goldfish		I	I	I				
Lake Chub		√		√		√	√	√
Spotfin Shiner		√	√					
Common Carp	I	I	I	I	I	I		
Brassy Minnow			√		√			
Common Shiner	√	√	√		√			
Silver Chub		√	√					
Pearl Dace	√		√	√	√			
Hornyhead Chub	√	√						
Golden Shiner		√	√		√			
Emerald Shiner	√	√	√	√	√	√	√	
River Shiner		√	√	√				
Bigmouth Shiner		√	√		√			
Blackchin Shiner			√		√			
Blacknose Shiner			√	√	√	√		
Spottail Shiner		√	√	√	√	√	√	
Sand Shiner		√	√		√			
Weed Shiner			√		√			
Northern Redbelly Dace	√	√	√		√			
Finescale Dace	√		√		√			
Bluntnose Minnow		√						

Table B-2. (cont)

Common Name	Lake Winnipeg	Red R.	Ass. R.	SK	L. MB.	Nelson	Churchill	Hudson Bay
Fathead Minnow	√	√	√	√	√	√		
Flathead Chub		√	√	√	√			
Longnose Dace	√	√	√	√	√	√	√	
Western Blacknose Dace		√	√		√			
Creek Chub		√	√		√			
Quillback		√	√	√	√			
Longnose Sucker				√	√	√	√	√
White Sucker	√	√	√	√	√	√	√	√
Bigmouth Buffalo		√	√		√			
Silver Redhorse	√	√	√	√	√			
Golden Redhorse		√	√					
Shorthead Redhorse	√	√	√	√	√	√		
Black Bullhead	√	√	√		√			
Brown Bullhead		√	√		√			
Channel Catfish		√	√		√			
Stonecat	√	√	√					
Tadpole Madtom	√	√	√		√			
Norther Pike	√	√	√	√	√	√	√	√
Muskellunge			I	I				
Central Mudminnow	√	√	√	√	√			
Rainbow Smelt						I		
Cisco			√	√	√	√	√	√
Lake Whitefish		√	√	√	√	√	√	√
Shortjaw Cisco				√				
Rainbow Trout	I	I	I	I	I	I		
Brown Trout	I		I	I	I			
Arctic Char		I	I		I			

Table B-2. (cont)

Common Name	Lake Winnipeg	Red R.	Ass. R.	SK	L. MB.	Nelson	Churchill	Hudson Bay
Brook Trout	I	I	I	I	I	√	I	√
Lake Trout			I	√	I	√	√	√
Troutperch	√	√	√	√	√	√	√	
Burbot	√	√	√	√	√	√	√	
Banded Killifish		√						
Brook Stickleback	√	√	√	√	√	√	√	√
Ninespine Stickleback		√	√	√	√	√	√	√
Mottled Sculpin					√			
Slimy Sculpin			√	√	√	√	√	√
Spoonhead Sculpin				√			√	
Deepwater Sculpin				√				
White Bass		I	I					
Rock Bass	√	√	√		√			
Pumpkinseed		I						
Bluegill		√						
Smallmouth Bass		I	I	I	I			
Largemouth Bass		I	I		I			
White Crappie		√						
Black Crappie		√	I		I			
Iowa Darter	√	√	√	√	√			
Johnny Darter	√	√	√		√	√	√	
Yellow Perch	√	√	√	√	√	√	√	
Logperch	√	√		√	√		√	
Blackside Darter	√	√	√	√	√			
River Darter	√	√	√		√			
Sauger		√	√	√	√	√	√	
Walleye	√	√	√	√	√	√	√	
Freshwater Drum		√	√		√	√		

Table B-3. Life history characteristics and requirements for fish species that may occur within the Bipole III Transmission Project study area.

Literature Cited in Life History Tables

1. SCOTT, W.B., and E.J. CROSSMAN. 1998. Freshwater fishes of Canada. Galt House Publications Ltd. Oakville, Ontario, 966p.

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4. TALLMAN, R.F. and J.H. GEE. 1982. Intraspecific resource partitioning in a headwaters stream fish, the pearl dace *Semotilus margarita* (Cyprinidae). Environmental Biology of Fishes 7: 243-249.

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Chestnut lamprey (*Ichthyomyzon castaneus*).

Life History Stage	Timing		Suitable Habitat		Other Information	
Larvae/Fry	Ammocoetes larva lives for 5-7 yrs, probably 7yrs in MB.	1, 5	Burrow in firm sand-mud substrates in fast-flowing water, presumably near hatching site.	1	Larvae filter-feed on organic detritus, microscopic algae, and protozoa. Ammocoete larvae grow to a length of 105-122mm.	5
Adult (growth)	Transformation to adult likely completed in fall. Adult stage lasts for one year.	5	Move downstream into larger rivers.	5	Adults have been observed attached to a variety of fish Length actually shortens during transformation to the adult stage, with the smallest adults being 100-125mm long	5
Adult (spawning)	Adults ascend streams in mid-late June.	5	Migrate upstream into tributaries to spawn.	5	Construct a communal nest by moving gravel with their oral discs. Adults cease feeding and the digestive tract degenerates when they mature, and they die after spawning.	5

Silver lamprey (*Ichthyomyzon unicuspus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Other Information	
Egg	Hatch in several weeks	1	Gravel riffles	1	Shallow water	1	Eggs are approx. 1 mm in diameter, Average 10 800 per female	1
Larvae/Fry	Ammocoetes leave nest after hatching	1	Burrow into mud and silt at river margins	1	Shallow	1	Remain in river bottom for their ammocoete life (4-7 years) Ammocoetes are filter feeders	1
Juvenile							Transformation of ammocoetes into adults begins in late fall at about 76 mm in length, fully transformed by spring(89-110 mm long, 1-2 g, increased eye size, development of sharp teeth and functional intestine)	1
Adult (growth)	Adults by 8th year of life	1	Migrate downstream to lakes following transformation	1			Adults are parasitic on other fishes, Live for 12-20 months, grow rapidly at this time to 250-300 mm long	1
Adult (over-wintering)							May feed over the winter, length and weight decrease and intestine becomes less functional as eggs develop during winter prior to spawning	1
Adult (spawning)	May and June	1	Gravelly riffles in larger rivers	1			Build shallow nest by moving stones with mouth and sweeping away sand and silt with the tail All adults die after spawning	1

Lake sturgeon (*Acipenser fulvescens*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	Hatch in 16-18 days @ 10^{o}C, 4-5 days @ 20^{o}C	2	Incubate in interstices among rocks and gravel	2			Range of 10 to 18, optimum of 14 to 16	2	9.5	2			Adhesive eggs (2.7 to 3.5 mm diameter) are randomly scattered over the substrate, no nest is constructed	1,2
Larvae/Fry	Larvae remain dormant in substrate until yolk is absorbed (about 10 days)	2	Stay in dark crevices and other cover until yolk is absorbed before moving into backwaters	2					9.5	2			A combination of low oxygen levels and temperatures in excess of 20^{o}C has been known to cause high mortalities in the young of other sturgeon species	2
Juvenile			Fish that are 120-150 mm in length are found over sand and gravel bars in fast water in summer and fall. Fish older than 1 year live in same habitats as adults	1,2					6.5	2			Males mature at 12-20 years, females mature at 14-33 years	1,2
Adult (growth)	Long-lived, ages of 50 yrs for males and 80 yrs for females are known.	1	Bottom feeders, are found most often over fine to medium sand in larger lakes and rivers. Most densely distributed in current	2, 5	4-6	2	less than 24	2	6.5	2	25-80 ppm (TSS)	2	Backwaters and river banks in May and June, move into water deeper than 2 m in July for fall and winter, movements may in part be based on temperature and oxygen requirements Adult fish often move over long distances (>100 km)	1,2
Adult (over-wintering)			Deep pools in main river channels over sand-silt bottoms	2					6.5	2				
Adult (spawning)	May to mid-June	5	In rapids or the base of impassable falls, as well as off wind-swept shores over hard substrate such as boulders or bedrock.	1,2, 5	0.3-4.7	2	>11	5	6.5	2			Males spawn every 2-3 years, females 4-6 years Upstream spawning migrations are usually <100 km and rarely >400 km Spawning success can be affected by low or fluctuating water levels	2

Goldeye (*Hiodon alosoides*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	Incubate for 1-2 weeks	2	Lake shallows, pools and back water areas in turbid water over firm substrate	2					6	2			Semibouyant, nonadhesive, eggs, about 4 mm in diameter > 25 000 per female	1, 2, 3
Larvae/Fry			Float at waters surface, drifting with wind and currents	1,2					6	2			Remain in same area as spawning grounds until migrating to overwintering areas in deeper lakes and rivers	2
Adult (growth)	Highest growth rate is between June and September	2	Open water of large turbid rivers and lakes, preferring quiet pools and backwater areas, but also found in faster waters	2			22-28.5 (27-29) optimal	2	5	2	Prefer very high turbidity	2	Midwater- to surface-feeding fish, which feed mainly on aquatic insect larvae, and emerging and flying insects in low light conditions Age at which sexually mature varies between areas (generally 2-10 years), fish from northern populations mature at a slower rate. In Southern MB grow to about 400m long and weigh up to about 700g	1, 2, 5
Adult (over-wintering)			Deeper areas of lakes and rivers	2					5	2			Probably dormant during period of ice cover	2
Adult (spawning)	Late May and early July following ice breakup	1,2	Midwater in larger turbid rivers. Gravel shoals over firm substrates	1,2, 5	>0.2	2	10-13	1,2	5	2	Prefer very high turbidity		Probably spawn at night in pairs, each year after reaching maturity Spawning migrations from winter habitats up rivers and tributary streams when water temperatures reach 10-12^{o}C	1, 2

Mooneye (*Hiodon tergisus*).

Life History Stage	Timing		Suitable Habitat		Suitable Turbidity		Other Information	
Egg							10 000 to 20 000 eggs per female	1
Larvae/Fry			Large, clear streams	1			Reach 114-165 mm in length by October	1
Juvenile			Large, clear streams	1			Most males reach maturity by 3 years of age, females often do not mature until reaching 5 years of age. Males also die at younger ages than females	1
Adult (growth)			Feeds mostly in large, clear, swiftly flowing waters, lives in shallow waters. More common in less turbid and slower moving water than goldeye.	1, 5	low - not as tolerant of high turbidity as goldeye.	1	Mdiwater to surface water feeder, feeding on same food items as goldeye Grow to about 400mm long	1, 5
Adult (spawning)	April-June	1	Large, clear streams	1			Large upstream spawning migrations in the spring. Spawns in midwater Probably spawn somewhat later than goldeye.	1, 5

Goldfish (Carassius auratus).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable O_2 Conc. (ppm)		Other Information	
Egg	Hatch in ~3 days or more, depending on temp	1									Eggs are adhesive, 1.2-1.5mm in diameter	1
Adult (growth)			Prefer quiet, weedy water and are less tolerant of turbidity than carp.	5					tolerant of hypoxic conditions	5	Omnivorous feeders, taking mostly larval and adult aquatic insects Adult feral goldfish range from 136-160mm total length Move offshore into deeper water beginning in late August.	1,5
Adult (over-wintering)											Tolerant of hypoxic conditions – can survive winterkill conditions that eliminate most native species of minnow.	5
Adult (spawning)	May-June	1	Warm, weedy shallows	1	>0.15	5	>15.6	5			Eggs deposited on aquatic vegetation	5

Lake chub (Couesius plumbeus).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temperature (°C)		Other Information	
Egg			Tributary streams and shallow water	1					Yellowish eggs, about 500 per female	1
Adult (growth)			Cool water in both streams and lakes. Wide range of depths, from shoals 15cm deep in streams, to rocky habitats along lakeshores, to depths of 178m in Lake Superior	1, 5	Wide range of depths	5			Younger fish are planktivores and larger fish feed on benthic aquatic insects Found in deeper waters of lakes during the summer	1,5
Adult (spawning)	Early spring, but known to extend into the summer	1	Tributary streams and shallow water, over rocky bottoms	1	~ 5cm	5	~14-19	1	eggs are scattered, no nest building or egg guarding	1

Spotfin Shiner (*Cyprinella spiloptera*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Other Information	
Egg							Eggs are adhesive	5
Juvenile							Sexual maturity reached when total length of approx. 68mm reached	3
Adult (growth)	Live to 3 yrs old	5	Low-velocity, turbid water in large rivers and the lower reaches of tributaries. Substrates from sand to mud and silt	5	<0.5	5	Feeds at or near surface, on insects and emerging insect larvae, plankton, and even small fish and drifting fish eggs. Range from 40-58mm total length	5
Adult (spawning)	Late May – early September	5	Observed over sandy lake shoals or creek mouths. Place of spawning apparently depends on current strength, depth, and availability of underwater objects to lay eggs on	1,3			Males select crevices among boulders, the bark of fallen trees, etc., as spawning territories	1

Common Carp (*Cyprinus carpio*).

Life History Stage	Timing		Suitable Habitat		Suitable Temp. (°C)		Other Information	
Egg	hatch in 3 to 6 days	1					Adhesive eggs, 1 mm in diameter, 36 000 to 2.2 million per female	1
Larvae/Fry							Scales completely formed by 22-25 mm in length	1
Juvenile							130-190 mm in length by end of first year Males mature at 3-4 years and females mature at 4-5 years	1
Adult (growth)			Slow-moving or still waters ranging from streams and ponds to large rivers and lakes. All substrates – but prefer shallow water with soft substrates for feeding	5			Usually benthic-feeding omnivores, consuming detritus, vegetation, a wide variety of invertebrates, and even small fish and some carrion. Also observed surface-feeding on floating seeds	5
Adult (spawning)	May – early June	5	Weedy or grassy shallows. Move upstream to spawn	1, 5	17-28	1	Spawn in large groups, 1-3 females and 3-15 males	1

Brassy minnow (*Hybognathus hankinsoni*).

Life History Stage	Timing		Suitable Habitat		Suitable Temp. (°C)		Other Information	
Adult (growth)			Small- to medium-sized streams, usually in pools or slower runs. Live over substrates of gravel, sand, or mud, and the water may vary from turbid to clear.	5			Opportunistic feeder, feeding mainly on algae and organic detritus. Range from 77-87mm total length. Max age 3yrs	5
Adult (spawning)	May-June	5	Spawning occurs over vegetation along stream margins or flooded marshes (Becker, 1983)	5	10-12.8	1	Eggs broadcast over vegetation	5

Common Shiner (*Luxilus cornutus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Other Information	
Egg									Eggs about 1.5mm in diameter. Become adhesive after about 2 min of water hardening, and lodge among gravel	1
Larvae/Fry									Larvae grow to a length of 13.2mm	1
Adult (growth)			Pools and slower stretches of medium- and small-sized streams. Occurs over a variety of substrates, from silt and sand to gravel. Appears to prefer open water with beds of aquatic vegetation	5					Opportunistic, omnivorous feeder, consuming filamentous algae, a variety of aquatic invertebrates, and adult insects from the water surface Range from 135-141mm total length. Reportedly lives to 4 yrs old	5
Adult (over-wintering)										
Adult (spawning)	May-late July	5	Apparently spawn in streams exclusively. Flowing or still water, gravel substrate. Often spawn at head of gravelly riffle	1,5			15.6-18.3	5	Often uses nests excavated by other species in gravel in a commensal relationship. Alternatively, the male excavates a nest in gravel in running water	5

Silver chub (Macrhybopsis storeriana).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Other Information	
Larvae/Fry									four larval stages from 5 to 21 mm	1
Adult (growth)			Mainstems of large rivers and lowermost reaches of their tributaries. Slower-moving water, over soft substrates	5	Most common between 0.9-18.3	1			Benthic feeder, taking aquatic insect larvae, mainly caddis flies, mayflies, and amphipods Adults range from 150mm-210mm total length. Max age of 3 yrs	5
Adult (spawning)	June-July	5	Thought to occur in open water	1			>21	1		

Pearl dace (*Margariscus margarita*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Velocity (m/s)		Other Information	
Egg			Clear water on sand or gravel	1							0.9 mm in diameter	1
Juvenile			Shallower water than adults	4								
Adult (growth)			Cool bog ponds, creeks, headwater streams and lakes. Cool, clear, slow-flowing water. Often in stained, tea-coloured water.	1,5			Preferred temperature of 16	4	0-0.15	5	Aquatic insect larvae are the most common food, but terrestrial insects are also taken. Large adult fish range from 123-133mm. Max age is 3yrs. Intraspecific resource partitioning has been observed, with different age classes occupying different depths and consuming different foods.	1, 4, 5
Adult (spawning)	late April - early May	5	Substrates ranging from gravel to silt, in quiet or flowing water. Clear water	1,5	0.45-0.6	5	>16	5			Males maintain territories, but do not build nests	1

Hornyhead chub (*Nocomis biguttatus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Other Information	
Egg									Eggs are adhesive. Egg counts range from 460-725	5
Juvenile			Along shorelines, most commonly in beds of aquatic vegetation, over silty sand or gravel substrates	5	0.3-1	5			Feed on benthic aquatic invertebrates Standard lengths at age 0; 24-36mm, age 1; 44-58mm, age 2; 64-83mm, age 3; 86-100m, and age 4; 131mm	5
Adult (growth)			Benthic, over gravel to boulder substrates, low to moderate water velocities in runs or pools. Clear water More often in tributaries of large rivers	1,5	<2	5			Feed on filamentous algae, along with aquatic invertebrates Adult fish range from 105-160mm total length. Reach an age of 4yrs	5
Adult (spawning)	May – July	1	Flowing water, gravel substrate	5	0.3-1	5	>23.9	1	Males clean a nest area in gravel. Cleaned pebbles are carried onto the nest area by the male. Males spawn with a succession of females, expanding the nest as required	5

Golden Shiner (*Notemigonus crysoleucas*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Other Information	
Egg											Eggs are adhesive, measure 1mm in diameter	1
Juvenile											Lengths of about 76mm reached in second summer, 102mm during the third, 114mm during the fourth, and 140mm during the fifth summer. Maturity reached usually at lengths of 64-89mm	1
Adult (growth)			Quiet, usually clear, water with aquatic vegetation cover, in ponds, oxbow lakes, or streams with extensive shallow areas. Usually found over soft substrates	1,5	<2	5			Tolerant of low O2	5	Midwater to surface feeders. Consume a wide variety of planktonic invertebrates, with cladocerans, entomostracans, and insect larvae being most common. May also consume significant amount of plant material. Range from 98-107mm total length . Max age 5yrs	1,5
Adult (over-wintering)											Tolerant of low O2 – can survive in waters subject to winterkill	5
Adult (spawning)	Begins mid- to late June, and continues for entire summer	5					>20	5			Eggs broadcast over submerged aquatic vegetation. Have been observed laying eggs in nests of largemouth bass	5

Emerald shiner (*Notropis atherinoides*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Turbidity		Other Information	
Egg	Hatch in 24 to 32 hours	1									Eggs not adhesive, sink to bottom	1
Larvae/Fry											4.0 mm long at hatching, 8.9 mm by 11 days old	1
Juvenile											Pelagic, feeding on rotifers, ciliated protozoa, and algae 51 mm long by fall of first year	1
Adult (growth)			Open waters in lakes and large rivers, usually offshore and near the surface in summer, inshore areas in the fall	1, 5					Tolerant of turbid water	5	Schooling, pelagic feeders, often feed heaviest at night. Feed on larval and adult insects and planktonic crustaceans Do not usually live longer than 3 years	1,5
Adult (over-wintering)			Move back into deeper waters of lakes and large rivers	1								
Adult (spawning)	last week in June to early August	5	Thought to be midwater spawners	1			21-24	5			Populations tend to fluctuate greatly in abundance	1

River shiner (*Notropis blennis*).

Life History Stage	Timing		Suitable Habitat		Other Information	
Juvenile					Early YOY are 9-11mm	5
Adult (growth)			Large, turbid rivers and the lowermost reaches of their tributaries. Lives in non-turbulent water at low to moderate water velocities, over substrates ranging from silt to gravel	5	Feeds on aquatic larval and adult terrestrial and aquatic insects, but also takes planktonic crustacea and some algae Range from 62-72mm total length. Max age of 4yrs.	5
Adult (spawning)	Spring - summer. Extended period	5	sand – gravel substrate	5	Early YOY found by early July into early September	5

Bigmouth Shiner (*Notropis dorsalis*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Velocity (m/s)		Other Information	
Adult (growth)			Benthopelagic. Commonly found in riffles and runs, moderately turbid to turbid water, gravel substrates	5	<0.5	5	0-0.15	5	Feed mostly on aquatic insect larvae, but filamentous algae also found in stomach contents Range from 65-74mm total length. Max age 2 yrs.	5
Adult (spawning)	late May to early August	5								

Blackchin Shiner (*Notropis heterodon*).

Life History Stage	Timing		Suitable Habitat		Other Information	
Juvenile					YOY length 18-36mm, around 1 yr 25-51mm in length	1
Adult (growth)			Cool, clear, weedy, protected waters in lakes and marginal waters of rivers in the Canadian Shield in SE MB. May be tolerant of hypoxic conditions		Feed on crustaceans, oligochaetes, and larval and adult insects that are associated with aquatic vegetation Range from 49-53mm total length. Max age 3 yrs	5
Adult (spawning)	June-August	5				

Blacknose Shiner (*Notropis heterolepis*).

Life History Stage	Timing		Suitable Habitat		Suitable Turbidity		Suitable O2 Conc. (ppm)		Other Information	
Adult (growth)			Cool, clear, weedy, protected waters in lakes, marginal waters of rivers, and smaller streams in Canadian Shield	5	Intolerant of high turbidity	1	Tolerant of hypoxic conditions	5	Feed on planktonic crustaceans, larval and adult insects, small mollusks, and other benthic invertebrates. Some algae also occur in stomach contents Range from 46-56mm total length. Max age 1yr	5
Adult (over-wintering)									Tolerant of hypoxia – can survive winterkill conditions	5
Adult (spawning)	June – mid-August	1	Sandy substrate	1					Protracted spawning period	1

Spottail shiner (*Notropis hudsonius*).

Life History Stage	Timing		Suitable Habitat		Suitable Turbidity		Other Information	
Egg							0.8 mm in diameter, 100 to 2600 per female, with older (larger) females containing more eggs than younger females	1
Juvenile							Feed on planktonic crustaceans and some algae	5
Adult (growth)			Lakes, larger streams, and rivers.In streams and rivers, prefers marginal water with little or no current. Most often associated with weedbeds Variety of substrates, but most common over gravel, sand, or sandy silt in weedbeds.	5	Tolerates a wide range of turbidity, although most common in relatively clear water	5	Often more active at night. Feed on insects and are also reported to feed on spottail shiner eggs Females grow faster than males	1
Adult (spawning)	Spring and early summer	1	Over sandy shoals – gravel substrate. Both lakes and streams, sometimes in mouths and lower reaches of tributary streams	1, 5			Some populations may have a prolonged spawning season	1

Sand shiner (*Notropis stramineus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Velocity (m/s)		Suitable Turbidity		Other Information	
Egg											Age 1 females contain about 250 eggs, age 2, 1100 eggs, and age 3, 1800 eggs	1
Adult (growth)			Tails of riffles, moderate velocity runs, and similar habitats along the margins of rivers. Most common over gravel or sand substrates.	5	<0.30	5	0-0.15	5	Usually found in moderately turbid water	5	Feed on organic detritus, diatoms and other algae, and larval and adult insects Range from 55-61mm total length. Max age of 3yrs	5
Adult (spawning)	Mid-June to mid-July	5									Eggs scattered over clean gravel or sand	1

Weed shiner (*Notropis texanus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Other Information	
Adult (growth)			Shorelines of lakes and larger rivers and in streams. Prefers quiet water, in beds of aquatic vegetation, over mud, silt, and sand substrates	5	<1	5	Feed mostly on plant material Range from 47-56mm total length. Max age 2yrs	5
Adult (spawning)	Late June and early July	5						

Northern redbelly dace (*Phoxinus eos*).

Life History Stage	Timing		Suitable Habitat		Other Information	
Egg					Eggs hatch in 8-10 days at water temps of 21.1-26.7C	1
Juvenile					Standard lengths at age 1, 21mm; age 2, 38mm; age 3, 46mm; age 4, 53mm; age 5, 58mm	1
Adult (growth)			Bog habitats in headwater streams and ponds. Quiet, clear, cool, often brown-stained waters Found over fine substrates including silts and peaty debris	5	Feed mainly on filamentous algae, diatoms, unidentified organic detritus, and occasionally insects Range from 55-64mm total length. Max age 3yrs	5
Adult (spawning)	Spring – early summer	1			Spawn in masses of filamentous algae, with a female and one to eight males forming a spawning group. Eggs are deposited in the algal masses, and are non-adhesive	5

Finescale dace (*Phoxinus neogaeus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Velocity (m/s)		Other Information	
Adult (growth)			Bog habitats in small lakes, ponds, and streams. They live in quiet, clear, cool, often brown-stained water. More common over firmer substrates of gravel or sand	5	0.6-1.1	5	0-0.1	5	Feeds mainly on aquatic invertebrates, including small mollusks and a variety of larval insects, also some filamentous algae Range from 65-90mm total length. Max age of 4yrs	5
Adult (spawning)	Spring (late April)	5							Have been observed spawning in depressions covered by submerged logs. One or two males accompanied females, and eggs were deposited on the substrate	5

Bluntnose minnow (*Pimephales notatus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable Turbidity		Other Information	
Egg	Hatch in 7-14 days, depending upon temperature										Eggs are adhesive, large, measure 1.0-1.5mm in diameter One female deposits 200-500 eggs per season	1,5
Larvae/Fry											Larvae are 5mm long at hatching, 6mm at 7 days old, and 12mm at 2 weeks	1
Juvenile											Juveniles reach length of 37mm by December of 1st year Females attain sexual maturity in their 2nd year, but males seem not to mature until their 3rd year	1
Adult (growth)			Protected, marginal waters and tributary mouths. Occurs over mud substrates with submerged wood as cover, and on cobble to boulder substrates.	5	0.5	5			Clear to slightly turbid water	5	Feed on bottom and in midwater on algae, larval and adult insects, and planktonic crustacea Range from 52-57mm total length. Max age 3yrs.	5
Adult (spawning)	May - August	5					>20	1			Male excavates nest in sand or gravel substrate, under logs, bark, or other covering objects. Eggs are laid on the underside of these objects. Male guards nest until all young are hatched Most spawning occurs at night	1,5

Fathead minnow (*Pimephales promelas*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable Velocity (m/s)		Suitable O_2 Conc. (ppm)		Other Information	
Egg	Hatch in 4.5 to 6 days	1			<1	1							Buoyant and adhesive eggs, 1 to 1.3 mm in diameter	1,5
Larvae/Fry													5 mm long at hatching	1
Juvenile													In warm waters rapidly growing fish can reach adult size and spawn by late summer of their first year	1
Adult (growth)			Broad range of habitats and water turbidities, from bog ponds and headwater streams to lakes and large, turbid rivers. Prefers aquatic vegetation as cover. Fine substrates, including sapropel	5	<1	5			0-0.1	5	Tolerates low O2 levels	5	Benthic feeders on detritus, as well as microscopic plants and animals Range from 60-74mm total length. Only 2 age classes Often an invader in newly created human-made habitats such as storm water retention ponds, ponded water in drainage ditches, or farm dugouts	3,5
Adult (over-wintering)													Can withstand winterkill conditions.	5
Adult (spawning)	Spring (mid-May – late June)	5	Underside of rocks, branches and plants in shallow water. Nests built on soft substrates such as sand or mud	1.5		1	>15.6	1					Repeat spawners throughout summer, males build and defend nests. Most adults die after spawning, few fish reach age 3	1

Flathead chub (*Platygobio gracilis*).

Life History Stage	Timing		Suitable Habitat		Other Information	
Juvenile					Sexual maturity at ~85mm standard length	1
Adult (growth)			Mid-channel, in fast-flowing sections of larger rivers. Found on gravel, sand, or, less commonly, rubble. Small schools will gather in scour holes on d/s side of obstructions	5	Predatory, consuming a variety of aquatic invertebrates at all life-history stages, as well as small fish (by adults). Feeding is mostly benthic, but they do occasionally surface-feed. Largest native minnow in MB. Large adults range from 270-323m total length. Max age 5yrs	5
Adult (spawning)	Spring - summer (exact time unknown), not protracted	1,5	Sometimes moves into smaller streams in spawning season	1		

Longnose dace (*Rhinichthys cataractae*).

Life History Stage	Timing		Suitable Habitat		Suitable Temp. (°C)		Suitable Depth		Suitable Velocity (m/s)		Suitable Turbidity		Other Information	
Egg	Hatch in 7-10 days at 15.6°C	1			~15	1							200-1200 transparent, adhesive eggs per female	1,3
Larvae/Fry	Yolk sac is absorbed about 7 days after hatching	1	At the surface of quiet waters near the shore	1										
Juvenile	Move to bottom at about 4 months old	1	Bottom dwelling	1									Relatively slow growing	1
Adult (growth)			Clean, swift flowing streams with a gravel or boulder substrate, often in areas of high turbulence. Also in inshore waters of lakes over gravel or boulder substrate Benthic, in crevices betweeen boulders Some fish move into deeper waters in summer	1	Tolerant of a wide range of temps	5	0.05-0.25	5	Prefer swiftly flowing waters, 0.75-2	1	Tolerates a wide range of turbidites	5	Feed on aquatic insects (mainly caddis fly and black fly larvae) Larger, older fish have a proportionately smaller gas bladder and are less buoyant. These fish are found in areas with high velocities	3
Adult (spawning)	Late spring and into summer	1	Riffles over a gravel to rubble substrate (particle size 5-20cm)	1	4-16	5			0.525-0.6	5			Males guard territories, eggs laid in a single group may be guarded by one of the parent fish. Longnose dace spawn earlier than western blacknose dace, although there is overlap	3,5

Western blacknose dace (*Rhinichthys obtusus*).

Life History Stage	Timing		Suitable Habitat		Sutable Depth (m)		Suitable Temp. (°C)		Suitable Velocity (m/s)		Other Information	
Egg			Shallow water with a gravel substrate	1			~21	1			0.8 mm diameter, transparent, amber-coloured eggs	1
Larvae/Fry	About 5 mm at hatching	1										
Adult (growth)			Clean, swift flowing streams with a gravel substrate Also in inshore waters of lakes over gravel or boulder substrate	1	<1	5			Prefer flowing waters of moderate velocity, 0.15-0.5	1	Benthic feeders, on aquatic insect larvae and some plant material Range from 69-88mm total length. Max age of 3yrs	5
Adult (spawning)	Late spring and into summer	1	Shallow riffles over a coarse sand – gravel substrate (particle sizes <5cm)	1,5			9-18	5	0.07-0.45	5	Males may guard territories, eggs laid in a single group and may be forced into substrate during spawning Spawn later than longnose dace, although there is significant overlap	1,5

Creek chub (*Semotilus atromaculatus*).

Life History Stage	Timing		Suitable Habitat		Suitable depth (m)		Suitable Temp. (^{o}C)		Suitable Velocity (m/s)		Suitable Turbidity		Other Information	
Egg			Clear streams	1									Eggs varied from 1.5-2.0mm in diameter Fecundity of females increased with size, varying from 1146 eggs in a 100mm fork length female to 7539 in a 200mm female	1
Juvenile			Shallow riffles or quiet, shallow water	5									Rapid growth, 51-89 mm by end of first year, 102-178 mm by end of fourth year	1
Adult (growth)			Prefer small clear streams and brooks, but is also found in near-shore waters of lakes. Pools and slick runs, or under cut banks. Substrates from silt in pools to coarse gravel in the runs	1	0.25-0.5, or deeper	5			0-0.1	5	Can tolerate some turbidity, but mostly found in clear water	5	Feed on aquatic invertebrates mostly, although crayfish and fish become important in Age 1 fish and older Males reach larger sizes than females. Large adults range from 214-236mm total length. Max age 6yrs	5
Adult (spawning)	Spring (last 2 weeks of May)	1,5	Shallow channels in small streams over gravel substrate. In smooth water just above or below riffles	1,5			>14	5					Male builds long trench in gravel about 250mm wide, 500-000mm long, 50mm high, with a pit 200-250mm in diameter and 80-200mm deep, parallel to current. Male spawns with several females, eggs in the trench are buried with gravel Spawning begins around noon and increases in intensity through the afternoon, peaking between 1600 and 2000 hrs. Spawning then declines during sunset	1

Quillback (*Carpiodes cyprinus*).

Life History Stage	Timing		Suitable Habitat		Suitable Temp. (^{o}C)		Suitable Turbidity		Suitable Velocities (m/s)		Other Information	
Adult (growth)			Lakes and larger streams, sand to silt substrates	1			Turbid waters	5	low water velocites	5	Benthic, small-particle feeders, feeding mainly on chrionomid larvae, ostracods, cladocerans, and copepods Females mature at 6-8yrs at a min fork length of 345mm, males mature at 4-6yrs at a min fork length of 280mm	5
Adult (spawning)	Mid to late April	5	Coarse to fine gravel in riffles during high discharge periods and move to deeper water with sand substrate as water levels decline	1	>5-6	5					Scatter eggs, no nests are built and no care is given to young Move as far as 32km upstream during years with high discharge and only 2-3km during years in lower discharge. Spent fish migrate downstream between mid-May - early June	1

Longnose sucker (*Catostomus catostomus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Suitable Velocity (m/s)		Other Information	
Egg	Experimentally hatch in 8 days at 15°C and 11 days at 10°C, probably longer in most spawning streams, which are cooler	1	Gravel substrates in cool, flowing streams Often at the tails of riffles	1,2	0.06-0.4	2	7-15.5	2	9.5	2			0.3-1.6	2	White, adhesive eggs, 17 000 to 60 000 per female	1
Larvae/Fry	Remain in gravel for 1-2 weeks after hatching, move into lakes 1-2 months later	1	Spend first summer in stream	2					9.5	2					Drifting fry are found close to surface	2
Juvenile									6.5	2					Mature in 4-6 years, males usually 1 year before females	2
Adult (growth)			Clear cold lakes and in swift rivers with hard substrates. Tend not to be found in smaller streams except when spawning. Primarily nocturnal	1,2,5	1-24	2	<27	1	>5.6	2	25-80 ppm (TSS)	2			Feed on bottom-dwelling invertebrates and some plant material. Growth of 15 to 20 mm per year. Range from 403-488mm total length,and females larger average size than males. Lake-dwelling fish larger than stream fish. Ages up to 19 are reported	1,2,5
Adult (over-wintering)			Areas with adequate O_2 levels, often in streams or offshore areas	2											Migrate upstream following ice breakup	1
Adult (spawning)	Early spring (mid-April to mid-May) Move into spawning areas primarily at night, but spawn in the day	1,5	In flowing waters in streams with a gravel substrate in riffles Also in shallow areas of lakes over gravel substrates	1,2	<1	1	>5	1					0.3-0.45	1,2	Group spawners, 1 female with 2-4 males, no nest is built Only a small percentage of adults die after spawning Spawn in same streams each year Movements affected by fluctuations in discharge. Spawn earlier than white suckers	1,2

White sucker (*Catostomus commersoni*).

Life History Stage	Timing		Suitable Habitat		Suitable depth (m)		Suitable Temp. (^{o}C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Suitable Velocities (m/s)		Other Information	
Egg	Experimentally hatch in 8-11 days at 10 to 15^{o}C	1	Shallow water with a gravel substrate	1			7-15.5	2	6	2					Yellow, adhesive eggs, about 20 000 to 139 000 per female	1
Larvae/Fry	Remain in gravel for 1-2 weeks, then migrate downstream about a month after spawning began	1	Gravel substrate for first two weeks	1					6	2					As little as 3% of eggs laid survive to migration stage of fry Migrate downstream at night	1,2
Juvenile	May remain in spawning stream for 5 months or more	2	Feed at surface until reaching 12 mm, when mouth moves to ventral position and feeding from bottom begins	1					5	2					Females grow faster, larger and live longer than males Males spawn 1 year earlier than females	1
Adult (growth)			Warm shallow lakes and bays, ponds, bogs, streams, and large rivers. Pools below riffles Benthic over a variety of substrates, but mostly over sand, silt and mud substrates	5	0.35-1	5	11.8-20.6	2	5	2	25-80 ppm (TSS)	2	0-0.15	5	Feed on benthic invertebrates, with most feeding at dawn and dusk Lake fish grow larger than river fish. In MB, appears to be slow-growing resident headwater populations in some streams (Brokenhead R., Cypress R., Roseisle Cr.) associated with bogs	1
Adult (over-wintering)			Often overwinter in streams and move upstream after ice breakup	2												
Adult (spawning)	Early spring (mid- to late April). May be protracted until June	1,5	Shallow water with a gravel bottom, although can vary from sand to boulders Usually in streams but occasionally on lake margins or stream mouths	1			>10	5					still water - rapids	5	Group spawners, 1 female with 2-4 males, eggs are scattered, no nest is built Individuals spawn in same stream every year. Most spawning occurs at dawn and dusk	1

Bigmouth buffalo (*Ictiobus cyprinellus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Turbidity		Other Information	
Egg	hatch in ~2 weeks	1									Eggs are adhesive, 1.2-1.8mm in diameter A female 665mm long had ~750,000eggs	1
Juvenile											By late June young are ~ 18mm long and by August have grown as large as 64mm	1
Adult (growth)			Still or slow-moving waters of large rivers or lakes	5	Shallow depths	1			Tolerant of turbid water	1	Feed in midwater on plankton, on bottom on minute organisms Largest sucker in Canada. Range from 358-690mm total length. Max age 20yrs. Females larger than males. Males reach sexual maturity at 381mm fork length, females over 508mm usually mature	5
Adult (spawning)	mid-May to early June	5	Shallow water, in marshes, or flooded riverbanks, or lakeshores	5	shallow water	1	15.5-18.3	1			No nest built. Eggs scattered over vegetation. Move into small tributary streams and into marshes or flooded lake margins. High water events required for spawning.	1,5

Silver redhorse (*Moxostoma anisurum*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Turbidity		Suitable Velocities (m/s)		Other Information	
Egg													Egg number in females 338-490mm in length varied, directly with size, from 14,910 to 36,340	1
Juvenile			Slow-moving waters over variable substrate where overhanging banks provide protection from predators	1										
Adult (growth)			Primarily river fish, although also found in lakes. Typically found in deeper, lower velocity water, over finer grained substrates than shorthead redhorse	5									Feed on aquatic insect larvae and small crustaceans Grows to larger size than our other two redhorse species. Approx 518mm total length. Reach maturity at age 5	5
Adult (spawning)	Late May - early June	5	Gravel to rubble substrates In main channel of streams. Do not ascend tributaries	5	0.3-0.9	5	>13.3	1	turbid water	1	swiftly flowing water	1	Spawn just after spawning peak of shorthead redhorse Small changes in temp affect spawning activity	5

Golden redhorse (*Moxostoma erythrurum*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Other Information	
Egg									Average eggs number for females 292-399mm, 4-6yrs of age, ranged from 6,100-25,350	1
Juvenile			Often inhabit slow-moving streams with soft bottoms	1					YOY 64-114mm in length in October, by age 7 587-625mm in length . Females mature first at age 4	1
Adult (growth)			Mid-channel region of larger stream, over finer grained sediments from fine sand to silt and clay	5	>1	5			Feed mainly on aquatic insect larve, with some filamentous algae and occasional smal bivalve molluscs Of medium size for redhorse spp in MB. Approx 362-413mm total length	5
Adult (spawning)	Late May	5	Usually in main channel of streams, but do ascend tributaries Fast water such as riffles and runs, over coarse gravel	5	0.30-1	5	>15-15.5	1	Spawning lasts for only a short period. Males arrive on spawning grounds first where they establish and defend territories No nest is built. Eggs scattered and abandoned	1

Shorthead redhorse (*Moxostoma macrolepidotum*).

Life History Stage	Timing		Suitable Habitat		Suitable Temp. (°C)		Suitable Velocity (m/s)		Other Information	
Egg									13 500 to 30 000 eggs	1
Juvenile									Fast growing, 51-102 mm by end of first year, growth of fish in northern populations can be slower. Mature at about 4 or 5 years of age	1
Adult (growth)			Shallow, clear waters of lakes occupying nearshore areas at shallow depths, or clear rivers over sand or gravel bottoms without heavy silt, occupying shallow riffles and runs	1,5					Feed on aquatic insect larvae and bivalve molluscs Mature between ages 3-5yrs. Mean fork length of mature females from 353.5-375.6mm, for males 323.0-338.2mm. Max age 14yrs	5
Adult (spawning)	May - June	5	Smaller rivers and streams in riffles over substrate ranging from fine sand to cobble with scattered boulders	1,5	>8-10	5	0.3-0.7	5	Migrate upstream up to 32km. Migration movements positively correlated with stream discharge Males defend spawning territories Spawning mostly at night or early morning, no nest is built, eggs scattered and abandoned	1

Black bullhead (*Ameiurus melas*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Other Information	
Egg	In high temps, eggs hatch in as little as 5 days	1							Eggs covered with a gelatinous coat, somewhat adhesive, pale in colour, and about 3mm in diameter Usually approx 200 eggs laid, but ovaries contain 3000-4000 prior to spawning	1
Larvae/Fry									Parents herd young into a dense school and accompany them for a time after they have absorbed the yolk sac and begun to swim. These schools can be seen in quiet, protected backwaters and tributaries along the Red and Assiniboine rivers and coastal marshes of lakes Winnipeg and Manitoba	5
Juvenile									Underyearlings grown to a length of 40-45mm by late August. Growth extremely variable year to year, and place to place. Max size of 315mm at age 4	5
Adult (growth)			Benthic, over fine substrates such as mud and silt. Lower sections of small-to medium-sized streams of low gradient, ponds, and backwaters of larger rivers, lakes and impoundments Found in most of the same places as the brown bullhead, but is more common in trubutaries and peripheral waters, and less common in current and in deep water in river mainstems	1,5	<2	5	Can withstand high temps, up to 35	1	Opportunistic predators and scavengers feeding mostly on the bottom, taking snails, leeches, crayfish, tadpoles, minnows, and pieces of larger fish (likely taken as carrion) Range from 221-248mm total length. Max age of 4-5yrs Nocturnal	1, 5
Adult (spawning)	mid- to late June	5	Tributaries and marginal waters, soft substrate, moderate to heavy submerged vegetation	5			>21	1	Females excavate a nest in soft substrate under cut banks, in woody debris or other cover, and mating is with a single male, which shares nest guarding and egg fanning	5

Brown bullhead (*Ameiurus nebulosus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable turbidity		Suitable O2 Conc.		Suitable Velocity (m/s)		Other Information	
Egg	eggs take 6-9 days to hatch at 20.6-23.3C	1					20.02-27.0	2			6.0	2			Eggs covered with a gelatinous coat,adhesive, pale in colour, and about 3mm in diameter Females from 203-230mm length may have from 2000-13000 eggs in the ovaries	1
Larvae/Fry											6.0	2			Young are about 6mm in length, yellow, and somewhat transparent Unable to swim until the 7th day. Parents then herd young into a dense school and accompany them until they are about 51mm. These schools can be seen in quiet, protected backwaters and tributaries along the Red and Assiniboine rivers and coastal marshes of lakes Winnipeg and Manitoba	1,5
Juvenile							27.32	2			5.0	2			Growth is moderately rapid and by October the young are 51-122mm Sexually mature by age 3 by females 203-330mm in length , and males slightly smaller	1
Adult (growth)			Benthopelagic, over fine substrates such as mud and silt. Lower sections of small- to medium-sized streams of low gradient, ponds, and backwaters of larger rivers, lakes and impoundments	1,5	<0.5 in tribs and along shorelines to depths of 10m in sections of the Red R	5	20.0-36.0	2	tolerant of turbid water	5	tolerant of variable O2 conc, >7.0	1,2	<0.10	2	Omnivorous, feeding mostly on the bottom, taking snails, leeches, crayfish, tadpoles, minnows, and pieces of larger fish (likely taken as carrion) Larger adult size than black bullhead. Range from 230-295mm total length. Max age 5yrs Nocturnal Resistant to pollution Burrow into bottom mud to avoid adverse conditions	1,5
Adult (over-wintering)							11.9	2			>0.2ppm	1,2				
Adult (spawning)	May-June daytime	1	Tributaries and marginal waters, soft substrate, moderate to heavy submerged vegetation Usually found around shores of lakes, or in coves, bays, or creek mouths Nests more commonly on sand or gravel substrates than black bullhead	5			>21.1	1			5.0	2			Parents excavate a nest in soft substrate under cut banks, in woody debris or other cover. Both parents share nest guarding and egg fanning	1,5

Channel catfish (*Ictalurus punctatus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Suitable Velocity (m/s)		Other Information	
Egg	Hatch in 5-10 days at temps 15.6-27.8C		dark and secluded areas	2					6	2					Eggs 3.5-4mm in diameter before being laid. Females 1-4lbs bear approx 4000eggs. Eggs yellow when laid but become brown as hatching nears	1
Larvae/Fry	remain in nest for 7-8 days	2	Shallow water areas for cover. Slow flowing areas of rocky riffles, debris-covered gravel or sand bars	2	<0.5	2			6	2			<0.15	2	Fry have large yolks and remain on bottom for 2-5 days and then swim to surface to feed Feed mainly on benthic invertebrates	1
Juvenile			Similar to that of fry. Feed alone in quiet, shallow water over sand bars, drift piles, and rocks	2	0.72-1.0	2			6	2			0-0.27	2	Variability in growth depending on habitat. Growth is rapid in early yrs, young in Iowa in October 51-102mm long, at 1 yr 89-190mm long	5
Adult (growth)			Mainly benthopelagic, prefers large rivers and lakes. Found in mainstem of the larger rivers, offshore in L Winnipeg, and eastern tribs of L Winnipeg. Seldom seen in smaller streams. Prefers strong current and shear areas between strong current and eddies. Can be found near surface or in shallow water, likely on feeding excursions Gravel - rubble substrate	5	2-5	5			5	2	low to moderate <100ppm	2			Feed on benthic invertebrates, crayfish, aquatic insects, and small freshwater mussels. Become increasingly piscivorous as they grow Complex life history making use of all accessible reached of Red/Ass/Lake Winnipeg system Range from 800-1000mm total length and weigh 8-12kg. Mature at 10yrs, at a length of 600mm	5
Adult (spawning)	Late June - early July Likely do not spawn every yr	5	Gravel - rubble substrates, higher water velocites Known spawning areas include Netley Creek, Cook's Creek, and Red R south of St. Agathe and at Aubigny	5	2-4	2	>21	5							May move either upstream or downstream to spawning areas Nest excavated under cover, or a cavity, and is cleaned by the male. Female pairs with a single male. Male cleans and fans eggs until hatching.	5

Stonecat (*Noturus flavus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg													Mass of sticky eggs, 3.5-4.0mm in diameter, yellow, opaque Average egg number per female 767-1205	1
Juvenile													Young are 30-81mm in October	1
Adult (growth)			Can be abundant both in mainstems of large rivers and in their tributaries. Also present in lakes near sand and gravel bars where there is wave action Usually substrate of coarse gravel to boulders Interstitial spaces among stones in runs and riffles	1,5	0.3-0.5 along shorelines and tributaries to 10 in deep sections of rivers	5					tolerates turbid water	5	Mainly a benthic, nocturnal feeder, feeding on aquatic insects, with caddis fly larvae being the most frequent food item Range from 120-211mm total length. Max age probably 8-10yrs	1,5
Adult (spawning)	June - July	5	Spawn in streams or shallow, rocky areas of lakes	1			>23	5					Males excavate or clean a nest and tend it after spawning. Nest under cover such as stones	5

Tadpole madtom (*Noturus gyrinus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Other Information	
Egg											Egg number ranges from 50-93 eggs Eggs are light yellow, about 3.5mm in diameter, including a gelatinous envelope, adhesive. The whole egg mass is surrounded by another gelatinous envelope.	1
Juvenile											Underyearlings in August and September range from 28-40mm long, age 1 in June are 28-50mm, and by September range from 56-70mm long Sexual maturity at age 2	5
Adult (growth)			Quiet, clear, protected water, in dense stands of aquatic vegetation. Substrates of mud or silt Most common in tributaries to the larger rivers.	5	<1	5					Benthic, feeding on amphipods and crustaceans Attain length over 85mm. Max age 3yrs	1,5
Adult (spawning)	July	5	Usually in rivers but to a lesser extent in lakes in shallow water	1							Nests under cover, male guards nest. No post-hatching parental care. Females may spawn several times, likely with different males	5

Northern pike (*Esox lucius*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Suitable Velocity (m/s)		Other Information	
Egg	Hatch in 5-26 days at 20 to 6^{o}C respectively	2	Shallow sheltered areas, over dense vegetation or flooded areas with adequate circulation and rising or stable water levels	2	0.2-4.5	2	6.4-19, 9-15 optimal >16 results in high mortality	2	>4.5	2					Adhesive eggs are broadcast onto vegetation, 5 to 60 at a time Sensitive to high rates of siltation	1
Larvae/Fry	Leave spawning site after reaching 15-20 mm in length (about 6 weeks) Absorb yolk sac in 9-10 days	2	Dense vegetation in shallow sheltered area of rivers and lakes	2			7.5-26, 21-26 optimal	2	>3.2	2			<0.1	7	Begin to feed after yolk sac is absorbed Attach to vegetation to stay above low oxygen levels found on bottom	2
Juvenile			Shallow areas with flooded vegetation or weed beds, usually stay close to shore	2	<4	2	3-28, 19-21 optimal	2	>3, >7 optimal	2	Prefer clear water		<0.05	2	Feed mainly on zooplankton and aquatic insects for the first few weeks of life Can tolerate lower O_2 conc. than adults	2, 5
Adult (growth)			Prefer extensive weed beds of submerged and emergent macrophytes, clear, cool water and low current areas, but can also be found in wide variety of environments	2,5	<27, usually <8		4-24, 20-21 optimal	2	>3	2	50-125 ppm	2	<0.05		Visual predators, feeding mainly on fish. Females tend to grow faster, mature later and live longer than males, Largest specimen known was 17.2kg	1, 2, 5
Adult (over-wintering)			Move higher in the water column over winter as O_2 conc. becomes depleted	2					>3	2					More tolerant of low O_2 conc. than many species	2
Adult (spawning)	Occurs shortly after ice out (early April)	2,5	Over flooded vegetation in calm shallow bays, rivers and backwaters	2	<1	5	4-18	1,2					<1.5, greater velocities may block spawning migrations	2	1 female is followed by 1-3 males, no nest is built, eggs are scattered randomly Move upstream soon after ice out, into shallow waters with vegetation. Spawning occurs many times a day over a several day period	1, 2, 5

Muskellunge (*Esox masquinongy*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	Hatch in 8-14 days at water temps 11.7-17.2C	1					>3.5	2					Fertilized eggs 2.5-3.5mm in diameter, clear, and amber coloured. Average egg number 120,000 per female.	1
Larvae/Fry							>3.5	2					Young are 9.5-10.3mm in length at hatching. Remain dormant in vegetation for ~10 days or until yolk is consumed, at which time they become active	1
Juvenile							<32.2	2	5	2			Feed mainly on zooplankton and aquatic insects for the first few weeks of life Growth is rapid, by 10 weeks of age fish are ~152mm in length Sexual maturity at 3-5yrs	1,5
Adult (growth)			Limited to lakes and larger streams with clear or brown-stained water and aquatic vegetation cover	5	usually <5, up to a depth of 15	1,2	16-28, optimum 25.6, 25-28.5 preferred	2	5	2	Secchi disc >0.5m, 25-80ppm (TSS)	2	Visual predators, feeding mainly on fish A fish of ~ 45kg the largest reported. Females tend to grow faster, mature later and live longer than males, less pronounced growth rate differences in northern populations.	1,5
Adult (spawning)	Spawn 1-2 weeks later than northern pike (April - May)	2,5	Over flooded vegetation in calm shallow bays, rivers and backwaters	2	0.38-0.51	1	9.4-15, optimum 12.8	1	>3.5, optimum 6.0-8.5	2			1 female is followed by 1-3 males, no nest is built, eggs are scattered randomly Move upstream soon after ice out, into shallow waters with vegetation. Spawning occurs many times a day over a several day period	5

Central mudminnow (*Umbra limi*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	Eggs hatch in ~6 days												Eggs are adhesive, 1,6mm in diameter Females from 52-94mm contain 220-2286 eggs	1,5
Larvae/Fry													Young are 5mm when hatched	
Juvenile													Move back to the main stream when they are 30mm in length Females grow faster than males. Males become sexually maure at age 2, females at age 3. Max age ~4yrs	1,5
Adult (growth)			Prefer beds of aquatic vegetation in streams and ponds in bogs. Often found in waters that are O2 deficient by mid-summer	5					Can withstand low O2 levels - are able to breathe air using swim bladder to gain additional O2	5			Carnivorous, feed on a wide variety of aquatic invertebrates, fish becoming the most important item during winter Range from 90-127mm total length	5
Adult (spawning)	May - June	5	Move upstream or laterally to shorelines or into ponds or marshes	5			13	1					Eggs deposited on submerged plants. No nest is built	5

Rainbow smelt (*Osmerus mordax*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	hatch in 2-3 weeks after hatching depending on temp, 20-30 days at 4.0-10C, 10 days at 15.5C	2,5							9.5	2			Eggs are adhesive, 0.9-1.0mm in diameter. Sink to bottom Females 127-209mm extruded 8500-69,600, females 140-190mm extruded 9650-26,800	1,2
Larvae/Fry			drift downstream to lake or estuary	1			warm water	2	9.5	2			Young are 5mm long when hatched. Growth is rapid. In a few months the young may measure 20-40mm long	1
Juvenile			Close inshore along sand and gravel beaches				cool water	2	6.5	2			Mature after 2-3 growing seasons	1
Adult (growth)			Midwater fish, preferring cool lakes, reservoirs, or lake-like expansions of large river. Natively anadromous, however non-anadromous populations have been widely introduced	5	Average main depth 11.6, average max depth 35.7	2	15	5	6.5	2	Secchi depth 4.9m mean, 1.3-10.5m range	2	Fish under 150mm total length feed on plankton, becoming increasingly piscivorous as they grow larger Range from 189-211 total length. Females grow faster and larger than males, and live longer	1,5
Adult (over-wintering)			Following breakup of thermal stratification, distribution throughout the lake becomes more random	2			4	2	6.5	2				
Adult (spawning)	shortly after ice-out (March - May)	1,5	Usually ascends streams to spawn, but also spawns on reefs and along shorelines of lakes	5			4.5-15	5	6.5	2			Spawning occurs mainly at night. Two or more tuberculated males maintain positions against a female in swift water, eggs released in clusters and attach to substrate Populations often show apparently natural post-spawning mortalities	2,5

Cisco (Coregonus artedi).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	Hatch in 155-175 days in wild Under experimental conditions: 92 days at 5.6°C 106 days at 5.0°C 236 days at 0.5°C	1,2					2-8	2	6.5	2			1.8-2.1 mm in diameter, develop very slowly due to low temperatures	1
Larvae/Fry	Appear 3-5 days after ice breakup	2	Shallow inshore areas and offshore spawning shoals	2			6.5-12	2	6.5	2			Begin feeding before yolk sac is fully absorbed	1
Juvenile							upper lethal 26	2	6.5	2			Mature in 3-7 years, males usually 1 year younger than females	2
Adult (growth)			Shallow in spring, below thermocline in summer, shallow again as water cools in fall Generally in deep water areas of lakes		occurs in 9-91	2	<17	2	6.5	2	tolerant of some turbidity	5	Feed on plankton mainly, although adults will often feed on benthic fauna, including insect larvae and small molluscs Usually form large schools Range from 350-400mm length, and they reach an age of 10yrs	1,5
Adult (over-wintering)			Deep water areas in lakes	2										
Adult (spawning)	Fall spawners, often under ice cover	1	Lake shoals and river shallows over gravel or rocky substrates, but can spawn over others	1,2	<3	5	<5, optimal 3-4	5					Males move onto spawning grounds a few days before females Spawning time is temperature dependant Repeat spawners Spawning known to occur pelagically at depths of 9-12 m in 64 m of water	1,2

Lake whitefish (Coregonus clupeaformis).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	Hatch in 130-175 days at 1 to 1^{o}C	2					High mortality at temperatures above 10	2	9.5	2			3719 to 7302 eggs per kg of female body-weight egg mortality can be high	1,2
Larvae/Fry	Appear 3-23 days after ice breakup	2	Found in shallow waters in protected areas Leave shallows by early summer	2			0-17		9.5	2			Larvae are free swimming immediately after hatching Spend 2.5-3 months under ice	2
Juvenile			Shallow waters in spring, deeper, cooler waters in the fall	1			1-12	2	6.5	2			Sexually mature at age 4 for males and age 5 for females Distribution can be restricted by thermal stratification	2
Adult (growth)			Shallow waters in spring, deeper, cooler waters in the fall. Lakes and rivers	1	<30	5	1-12	2	6.5-11	2	25-80 ppm	2	Feed mainly on benthic and planktonic invertebrates and small fish Relatively rapid growth Max age 17yrs. Males mature at a younger age and die earlier	1,2
Adult (over-wintering)			In rivers and lakes	1,2			0–0.3	2	13.2	2				
Adult (spawning)	Fall spawners, September - October	1,5	Gravel, mud, sand substrates spawning is primarily in lakes, but also occurs in rivers	1,2,5	1-3	1,2	5.5-9.4 Peak spawning temps usually around 5 but can vary	2,5					Spawning usually at night, eggs are scattered randomly repeat spawners, every 1 to 3 years, 2-3 years in northern populations	1,2

Shortjaw cisco (*Coregonus zenithicus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Other Information	
Adult (growth)			Benthopelagic in deeper water than the cisco	5	found at depths over 40	5	Feed on *Mysis* and *Pontiporeia* mainly <100m in length. Females heavier and live longer than males. Max age 9yrs	5
Adult (spawning)	Fall	5	clay bottom	5	30-70	5		

Rainbow trout (*Oncorhynchus mykiss*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Suitable Velocity (m/s)		Suitable Turbidity		Other Information	
Egg	Hatch in 28-60 days	2	Gravel substrate	2	<0.3	2	7-12	2	5.5 at # 15°C 7.5 at ∃15°C	2	< 0.75	2			200-12 700 eggs per female 3-5 mm in diameter	1
Larvae/Fry	Emerge late June, early July	2	Require cover in the form of vegetation, debris or coarse gravel substrate	2	<1	2	10-21	2	5.5 at # 15°C 7.5 at ∃ 15°C	2	<0.38	2			Remain in gravel for 1-2 weeks after hatching	2
Juvenile			Over gravel and rubble substrates, in and under cover in the form of overhanging banks, riffles, logs and debris	2	<1	2	5-20	2	5.5 at # 15°C 7.5 at ∃15°C	2	0-1.15	2			Mature in 2-3 years Larger individuals are found in deeper water with higher velocities and larger substrates	2
Adult (growth)	Fall upstream migrations and spring downstream migrations	2	Rock and boulder substrate, utilize pools, runs, chutes and riffles of streams and rivers. Most commonly lake dwellers Adequate cover required	2	>0.5	2	<21	5	5.5 at # 15°C 7.5 at ∃15°C	2	0.25-0.85	2	low tolerance of turbidity	5	Feed mostly on invertebrates, larger individuals may feed on fish Some fish migrate from lakes into streams to spawn, other remain in streams year round Largest angler-caught fish in MB was 83cm total length	1, 2, 5
Adult (over-wintering)			Hide in substrate at very low temperatures Some fish migrate into lakes, other remain is streams	2			4-8	2	5.5 at # 15°C 7.5 at ∃ 15°C	2					Prefer to overwinter in deep areas containing abundant cover	2
Adult (spawning)	Some fish spawn in spring (May-June) Other s spawn in fall	2	In streams with cobble substrate, at head of riffles or downstream edges of pools	1,2	0.25-2.5	2	2-16	2	5.5 at # 15°C 7.5 at ∃ 15°C	2	0.45-0.91	2			Naturally spring spawners, fall spawning a result of hatchery selection Multiple spawners	1, 2

Brown trout (Salmo trutta).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Turbidity		Other Information	
Egg											Eggs 4-5mm in diameter, amber-coloured Females age 5-6yrs averaged 2020 eggs	1
Juvenile											Attain 165mm total length at age 1, 249mm at age 2, 388m at age 3, and 427mm at age 4	1
Adult (growth)			Lakes and streams. Larger individuals are almost always in lakes or deep pools and runs in streams. In lakes, they tend to stay close to the shore in water <15m deep	5	<15	5	18-24	5	More tolerant of turbidity than most trout	5	Juveniles and smaller fish feed mainly on invertebrates, larger fish tend to be more piscivorous. Larger fish feed mainly at dusk Commonly from 400-600mm long and 1-2kg in weight, but can exceed 850mm lenght and 10kg in weight. Max age 13yrs	1,5
Adult (spawning)	Fall	5	Do not spawn in the wild in MB. Ascend into headwaters and spawn on riffles, as well as rocky reefs along lakeshores. Shallow water, gravel substrate	1,5			6.7-8.9	1			Female creates shallow depression (redd) in gravel, in which eggs andpserm are deposited. Process repeated many ties, after which female covers redd with gravel	1

Arctic char (*Salvelinus alpinus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Other Information	
Egg	Develop over winter Hatch around April	1					0-2.2 killed by temps >7.8	1	Large, 4-5mm in diameter Anadromous females contain ~3000-5000 eggs	1
Larvae/Fry	Emerge at ice breakup								Fry are ~25mm long at emergence	1
Juvenile									Slow-growing. Amphidromous fish first go to sea at age 5-7yrs and lengths of 150-200mm. First sexual maturity ranges from 7-10yrs after the young first go to sea	5
Adult (growth)			May be amphidromous or non-migratory. Amphidromous char return to fresh water to overwinter every fall. In fresh water, fish live in lakes or rivers that are deep enough that they do not freeze to the bottom during winter	5					At sea, feed on benthic and midwater invertebrates ,and some small fishes. In fresh water, feed on benthic and planktonic insects and crustaceans MB angling record is a 71cm fish caught at the Fort Whyte Centre Max age 30 yrs	5
Adult (spawning)	Fall	5	Reef in lakes or in deep pools in rivers	5	Deep enough that it does not freeze to the bottom over winter while the eggs are developing	5	~4	1	Males defend territory. Females excavate a redd in gravel, eggs are deposited in several different spawning acts, and females covers eggs with gravel	1,5

Brook trout (*Salvelinus fontinalis*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Suitable Velocity (m/s)		Other Information	
Egg	Incubate over winter Hatch in 28 days at14.5^{o}C 45 days at10^{o}C 165 days at 2.8^{o}C	2	Small-large gravel substrate with less than 15-20% sand Groundwater upwellings are essential for most spawning sites	2			3-14 4.5-11.5 optimal	2	>50% saturation in redd	2			0.01-92 0.25-0.65 optimal	2	Eggs are buried in a redd Redd must stay free of silt Suitable spawning habitat is essential for spawning success	2
Larvae/Fry	Remain in redd until yolk is absorbed Begin to feed 23-35 days after hatching	2	Slow water areas near banks, close to cover, may feed in areas with higher current or off the bottom Instream cover is essential	2	<1	2	2-19 8-15 optimal	2	>7 at <15^{o}C >9 at >15^{o}C	2			<0.015-0.52 0.1-0.2 optimal	2	Groundwater levels have a direct effect on fry abundance in a Water Body	2
Juvenile			Leave rapids in mid summer in favour of cooler water in channels and pools with a gravel substrate, move into smaller streams in fall	2	0.6-1.2	2	8-19 11-16 optimal	2	>7 at <15^{o}C >9 at >15^{o}C	2			0-0.85 0.06-0.21 optimal	2	Feed primarily on bottom, occasionally off water surface. Taking in invertebrates mainly Larger fish become more closely associated with overhead cover First maturity usually at 3yrs, but some mature at age 2	2,5
Adult (growth)			Clear, cold spring fed streams with silt free, rocky bottoms, 1:1 riffle to pool ratio with some deep areas, vegetated banks, stable water flows and temperatures Also found in cold, clear lakes.	2	Stream fish <1.2 lake fish<8	2	4-19 11-16 optimal	2	>7 at <15^{o}C >9 at >15^{o}C	2	0-130 JTU 0-30 JTU optimal	2	<0.3	2	Known to use groundwater seepage areas or deep pools when stream temperatures exceed 20^{o}C, Grow to 531mm. Max age 6yrs Predators, feeding on invertebrates, fish, fish eggs, and even small amphibians, reptiles, and mammals	2,5
Adult (over-wintering)			In rubble cover substrates of lakes and deep stream pools	2					>5	2			<0.15	2	Stay in vicinity of cover and groundwater upwellings	2
Adult (spawning)	August to December	5	Shallow gravel shoals in lakes or streams that surround spring upwellings	2			2-13 <9 optimal	2					0.01-0.92	2	Daytime spawners Males territorial Spawning groups of 1 female with 1 or 2 males and 2 or 3 subordinate males. Females excavates a redd where eggs are deposited and covered Most fish probably spawn every year	1,2

Lake trout (*Salvelinus namaycush*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^oC)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	Hatch in 67-85 days at 7.5^oC 108-117 days at 5^oC and 141-156 days at 2.5^oC	2	Cracks and crevices of boulders	2	~12, <3 in shallow lakes	2	0.3-10 0.3-1 optimal	2	2.6-10.4 >6 optimal	2			Eggs are semibouyant Cold temperatures are essential for successful incubation	2
Larvae/Fry	Appear in mid February-April Absorb yolk sac in about 1 month	2	Further develop within the rock crevices on the spawning grounds	2			9-12	2					Move off spawning grounds and into deeper water once yolk sac is absorbed Feed on invertebrate predators, with early juveniles feeding mainly on plankton	2
Juvenile			Found in surface waters following ice breakup in spring Shallows with rock or gravel substrate in fall	1,2	>6	2	8-15 ~11 optimal	2	>6	2	<50ppm	2	Do not form schools Mature at 30 cm in length Slower growing, northern fish mature at a later age (13-17) than southern fish (5-6)	2,5
Adult (growth)			Found at the surface in spring Usually in deep waters in the summer Almost exclusively found in deep lakes, rarely found in rivers or streams. Can be found in shallower lakes in extreme northern MB and Nunavut	1,2	>6 Often found at <1 in small lakes	2	require access to water <10	5	>6	2	<50 ppm	2	Travel over a wide range of distances and depths Feed on benthic invertebrates, becoming piscivorous at larger sizes. Restricted to feeding below thermocline in summer Most angler-caught lake trout weigh from 4-6kg	2,5
Adult (over-wintering)			Dispersed throughout lakes in winter	2										
Adult (spawning)	Fall spawner August to December depending on temperatures. In MB October - November	2,5	Almost exclusively in lakes Over a clean substrate consisting of coarse angular cobble or gravel with no fine substrate	2	0.3-35 <12 optimal	2,5	3-14 9-11 optimal	2					No nest is built. Males arrive at spawning grounds before females and clean substrate by brushing with their fins. Eggs sink into crevices Spawning is triggered by declining water temperatures, photoperiod, and strong onshore winds	2,5

Troutperch (*Percopsis omiscomaycus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Other Information	
Egg							Eggs 1.36-1.85 mm in diameter (1.25-1.45 recorded for Manitoba fish) 240-728 eggs per female	1
Juvenile							Mature at age 1, females are larger than males and live longer (age 4) than males (age 3)	1
Adult (growth)			Lives primarily in lakes, in deeper water during the day, only moving into shallow waters at night. Found in shallow, sometimes turbid streams in Manitoba, Saskatchewan, and possibly in Alberta and the Northwest and Yukon territories. Associated with rocky substrates. Abundant in the south basin of L Winnipeg in the nearshore benthic habitat	1,5			Feed on or near the bottom, mostly on aquatic invertebrates, but very large individual may take the fry and eggs of other fish Range from 88-101mm total length. Max length of ~150mm	5
Adult (spawning)	Prolonged spawning period, from early spring into summer (up to 4 months). Observed in May in MB	1,5	Shallow, rocky streams, shallow water of lakes over sand, gravel, or bedrock substrate	1	0.3	5	Large females and most males die after spawning, with a few fish of each sex surviving to spawn twice Broadcast spawners, depositing non-adhesive eggs over substrate. Eggs fall into crevices among the rocks	1,5

Burbot (*Lota lota*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Other Information	
Egg							4-6	2	9.5	2	0.5 to 1.77mm, semipelagic, non-adhesive eggs About 45 600 eggs in a 343mm female to 1 362 077 eggs in a 643mm female	1
Larvae/Fry			Rocky shores and weedy areas of tributary streams, shallow sandy bottoms of lakes	2					9.5	2		
Juvenile			Stony bottomed riffles, the tails of rapids, or lakeshores	2,5					6.5	2	Most rapid growth in first 4 years of life, slows down when mature. Reach sexual maturity at 3-4yrs and sizes 280-480mm	1, 2, 5
Adult (growth)			Deep waters in lakes, large cool rivers. Main channels or rivers and offshore in lakes	2,5	Can be found at the bottom of MB's deepest lakes	5	15.6-18.3	2	6.5	2	Feed mainly on benthic and planktonic crustaceans, adults also feeding on fish Individuals have a home range of about 4 km in diameter	2, 5
Adult (over-wintering)									6.5	2	Post spawning run into tributary rivers in late winter and early spring	1
Adult (spawning)	Spawns in midwinter (January to March), under ice	1,2	Over sand and gravels shoals and lake bottoms in shallow water	1,2	<0.5-3	2	0.6-1.7 (1 on bottom)	1,2	9-Aug	2	Males arrive on spawning grounds 3 or 4 days before females Spawning at night in a ball of about 10 to 12 fish that moves over bottom	1, 2

Banded killifish (*Fundulus diaphanus*).

Life History Stage	Timing		Suitable Habitat		Suitable Temp. (°C)		Other Information	
Egg	Hatch in 11-12 days at temps of 22.2-26.7C	1					Eggs 2.0mm in diameter ~50 eggs deposited. Eggs stick to the vegetation by means of adhesive threads	1,5
Larvae/Fry							Fry 6-7mm long on hatching	1,5
Juvenile							May attain a total length of 20-58mm by October of their first year, and total lengths of 33-64mm at age 1	1
Adult (growth)			Shallow, clear, quiet water, over sand or gravel bottom with patches of vegetation. This can range from marginal waters of streams, rivers, or lakes, to small ponds. Surface to midwater dwellers	5			Feed from surface to bottom on aquatic insect larvae and planktonic crustaceans Attain a length of 76mm	5
Adult (spawning)	Spring - summer	5	Quiet, heavily vegetated water	5	23	5	Single male defending a territory and mating with a single female.	5

Brook stickleback (*Culaea inconstans*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Velocity (m/s)		Other Information	
Egg	8-9 days at 18.3°C	1			Shallow	1	8-19	1			1 mm diameter 40-80 per female	1,3
Juvenile											Reaches sexual maturity in 1 year	1
Adult (growth)			Quiet, weedy water in stream headwaters, ponds, prairie pothole lakes, and human-made impoundments. Variable substrate	5	0.35-1	5			0-0.1	5	Feed on or near the bottom, on aquatic insects, crustaceans, filamentous algae, and the eggs and hatchlings of fish Range from 36-47mm long. Likely mature at age 1, and likely seldom survive their 2nd winter	5
Adult (spawning)	April to July depending on water temperature	1	Shallow water with dense vegetation	1	Shallow	1	8-19	1			Males arrive in shallow water first, establish spawning territories, and construct a hollow, sphereical nest of grass, fibres and algae Males may spawn with multiple females and can build two nests in a season. Males guard and ventilate eggs, and remain with the young until they disperse after hatching	1,5

Ninespine stickleback (*Pungitius pungitius*).

Life History Stage	Timing		Suitable Habitat		Suitable Velocity		Other Information	
Egg							20-30 eggs laid by each female using a nest	1
Larvae/Fry	Leave nest when ~15 mm long	1						
Juvenile							Most growth occurs in first year of life Mature by end of first year	1
Adult (growth)			Lakes, creeks and streams, also in brackish water in coastal areas. Prefers open water in the mainstems of rivers and in lakes	1,5			Feed mainly on benthic crustaceans and aquatic insects Range from 47-56mm total length. Max age of 3.5yrs	5
Adult (spawning)	Summer (~June - July)	1,5	Shallow weedy areas, fresh water	1	0.05	5	Males build a hollow, tube-like nest in weeds out of aquatic vegetation Males may spawn with several females in the same nest and may build a second nest while caring for the young in the first one	1,5

Mottled sculpin (*Cottus bairdi*).

Life History Stage	Timing		Suitable Habitat		Suitable Temperature (°C)		Other Information	
Egg	Hatch in about one month depending on water temperature	1	Ceiling of nest with flowing water	1			Adhesive eggs are attached in a mass to the ceiling of nest	1
Adult (growth)			Cool streams and lakes, in quiet with aquatic vegetation. Bottom dwelling, found over sand, gravel and bedrock substrate	1,5	~16	1	Feed mostly on aquatic insect larvae, but large individuals may also take crayfish Range from 61-117mm total length. Max age 3-4yrs Usually not found as far upstream or in water as deep as slimy sculpin	1,5
Adult (spawning)	Late May or early June	1			10	1	Males select and guard nests under rocks or ledges and guard eggs and young Usually more than one female deposits eggs in a nest	1

Slimy sculpin (*Cottus cognatus*).

Life History Stage	Timing		Suitable Habitat		Suitable Temp. (°C)		Other Information	
Egg	Hatch in about 4 weeks at 8°C	1					About 1400 adhesive eggs per female	1
Juvenile							Most are sexually mature at 3yrs	5
Adult (growth)			Deeper waters of lakes and cooler streams with a rock or gravel substrate, bottom dwelling. Quiet water	1			Feed on aquatic insects, as well as some crustaceans, fish eggs, and small fish Range from 70-119mm total length. Most are between 70-85mm long. Max age of 7yrs	5
Adult (spawning)	Early May or June	1	Shallow waters with a rock or gravel substrate, under stones, also under submerged tree roots	1	>5	1	Eggs are adhered to the ceiling of the nest, usually from more than one female, males guard eggs and young	1

Spoonhead sculpin (Cottus ricei).

Life History Stage	Timing		Suitable Habitat		Suitable Temperature (°C)		Other Information	
Adult (growth)			Bottom dwelling, found over sand and gravel in small, swift streams, large turbid rivers, shallow & deep lakes	1	~16	1	Feed on amphipods and mysid crustaceans, as well as aquatic insects and fish eggs Range from 54-85mm long Intermediate depth between slimy and deepwater sculpins	1,5
Adult (spawning)	Late summer or early fall	1	Probably shallow with gravel substrate	1	4.5	1		

Deepwater sculpin (*Myoxocephalus thompsoni*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Other Information	
Adult (growth)					Depths from 44.7-182.9, with most abundance at 73.2-91.4	1	Feed on benthic crustaceans ~65mm total length. Largest specimen known was 69mm standard length	1,5
Adult (spawning)	Summer, or early fall	1	Bottom of MB's deepest lakes	5			Parental care is likely practiced	1

White bass (*Morone chrysops*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^oC)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	Hatch in 46hrs at 15.6C	1	Firm, sand substrate or vegetation. Become attached to gravel, boulders, or vegetation on the bottom	2			15.6-21.6	2	6	2			Eggs ~0.8mm in diameter, heavy and adhesive Number of eggs varied from 242,000 - 933,000, and average 565,000	1
Larvae/Fry	Yolk-sac absorbed in 8 days	2	Drift downstream to a reservoir, lake, or a riverine backwater	2	1-2	2	10-32	2	6	2			Larvae 3.7-13.5mm long have been captured in June, and larvae to a length of 18.5mm have been descibed	1
Juvenile			Move into sandy shoals or littoral areas at night to feed	2			12-30	2					Growth strongly correlated with temp, and insect and forage fish availability School before attaining sexual maturity YOY feed on zooplankton Growth is rapid, may attain total lengths of 127-162mm by the fall of their 1st yr. Sexually mature at ~277mm and age 3	1,5
Adult (growth)			Shallow, highly productive lakes and larger, slow-flowing rivers		Upper water layers, usually to a depth of 6.1	1	12-30, 30-34 in summer	2	>5	2	tolerant of turbidity, but prefer clear water	1,5	Feed mainly on emerald shiners in MB. Various fishsuch as yellow perch, bluegills, carp, black crappies in other areas In MB, apparently live longer and grown larger than in their native range Females grown faster and are larger than males In Ontario, average 0.34kg to 0.68kg. Seldom live beyond 7yrs	1,5
Adult (over-wintering)													Prefer deep water as this reduces turbidity problems and provides a heat storage reservoir during the winter	2
Adult (spawning)	early - mid-July	5	Rivers and lakes (L Winnipeg, lower Red and Winnipeg rivers, Icelandic River, Manigotagan River). Hard bottoms ranging from sand to boulders and bedrock outcrops		1-2	5	14.4-21.1	5					Populations spawn for 5-10 days Eggs released near the surface or in midwater, both eggs and sperm released simultaneously, eggs fertilized as they sink. Attach to bottom	1

Rock bass (*Ambloplites rupestris*).

Life History Stage	Timing		Suitable Habitat		Suitable Temp. (°C)		Suitable Turbidity		Other Information	
Egg	Hatch in 3-4 days at 20-5-21.0C								Eggs adhesive Eggs number varies with size of female, from 3000-11,000 eggs	1
Larvae/Fry									Average number of fry from one nest is 800	1
Juvenile			Littoral to limnetic in various lakes	1					Rapid growth, YOY 20-51mm in October	1
Adult (growth)			Rocky habitats in the littoral zone of lakes, and pools and runs in streams and in rivers. Prefers cover such as submerged wood or aquatic plants	5			tolerates turbidity	5	Predatory, feeding on crayfish, other aquatic crustacea, aquatic insects, and small fishes In MB, under 100mm total length. Size usually 152-203mm in other areas. Max age 10-12yrs	1,5
Adult (spawning)	June	5	Swamps - gravel shoals	1	16-21	5			Males excavates shallow nest depression, which he defends against other males. Female is driven into the nest and deposits eggs in several separate spawning acts. Male guards nest and fans eggs uring development, with tending ceasing as young disperse from nest	5

Pumpkinseed (Lepomis gibbosus).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Turbidity		Other Information	
Egg	Hatch in as few as 3 days at 28C	1									Eggs 1mm in diameter, amber-coloured, adhesive Egg number increases with size and for females 2-5yrs of age and 61-02mm in length egg numbers varied from 600-2923 with the average number ranging between 1684 and 2923	1
Larvae/Fry											Newly hatched young are minute and transparent	1
Juvenile											Growth moderately fast. YOY reaching 20-81mm in length in October	1
Adult (growth)			Quiet, clear to slightly turbid water. Usually found in weedbeds or submerged wood cover. Found in lakes, ponds, and slow-moving areas of rivers. Usually seen in large numbers near the surface of the water	1,5			Upper lethal temps of 24 for fish acclimated at 18, and 30.2 for fish acclimated at 28	1	clear to slightly turbid water	5	Feed on aquatic insects, as well as a variety of other invertebrates. Small fish may be a significant diet item seasonally Reach an age of 9yrs and a fork length of 241mm	5
Adult (spawning)	June	5	Swamps - gravel shoals. Aquatic vegetation	5	shallow water, usually in depths 0.152-0.305	1	16-21	5			Males excavates shallow nest depression, which he defends against other males. Female is driven into the nest and deposits eggs in several separate spawning acts. Male guards nest and fans eggs during development, with tending ceasing as young disperse from nest Eggs adhere to bottom of nest on soil particles	1,5

Bluegill (*Lepomis macrochirus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	Hatching ~3-5 days												Eggs are small, demersal, and adhesive Egg number varies with size of female, egg number for females 140-183mm standard length and 142-269g range from 7200-38,184	1
Larvae/Fry													Newly-hatched fry are 2-3mm in length	1
Juvenile													Growth is rapid, YOY are 18-81mm long Mature at 2-3yrs	5
Adult (growth)			Lakes, streams, and rivers, usually in areas of slow or no current. It also does well in small human-made impoundments Prefers cover such as weedbeds, submerged wood, or boulders.	5							tolerates turbid water	5	Feed on aquatic insects, small crayfish and other crustaceans, other aquatic invertebrates, and small fish. Plant material can also make up a signifiant proportion of stomach contents Usually does not exceed 152-203mm. Max age 8-10yrs. Largest in MB was 235mm total length which was 8yrs old	1,5
Adult (over-wintering)									>0.8mg/L	5			Groups of fish retreat to deeper water in winter where they congregate in colonies but continue feeding	1
Adult (spawning)	early- to mid-summer, with peak spawning in early July	5	Gravel to mud substrates	5			16-21	5					Winter aggregations break up when water temps reach 10C, and males appear first in shallow water of spawning areas Males excavates shallow nest depression, which he defends against other males. Female is driven into the nest and deposits eggs in several separate spawning acts. Male guards nest and fans eggs uring development, with tending ceasing as young disperse from nest	5

Smallmouth bass (*Micropterus dolomieu*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^oC)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Suitable Velocity (m/s)		Other Information	
Egg	Hatching usualy takes place in 4-10 days		Out of current or near cover which provides current breaks	2	0.3-6.1 range, 0.3-0.9 optimal	2	11.7-25	2	>6	2					Eggs are 1.2-2.5mm in diameter, amber, demersal, and adhesive Egg number in females, depending on size, ranges from 5000-14,000 Sudden temps shifts (>8) may kill eggs, as well as flooding	1,2
Larvae/Fry	Remain in nest for 6-15 days	2	Calm, shallow areas near rocky shelters or fallen logs over sandy substrate	2	4.6-6.1	2	18-32 range, 25-29 optimal	2	>6	2	<250JTU	2	0.08-0.2	2	Often, 40% of nests fail, and approximately 2000 fry result from most successful nests Young are 5.6-5.9mm at hatching. Leave nest after 5-7 days but are still guarded by male for several days	1
Juvenile			Avoid thick, shallow weed beds. Seek the quiet dark water in the lee of boulders and logs	2			16-30 range, 25-29 optimal								Feed on small crustaceans and insects Growth is rapid at first, growth of young is 0.8-0.9mm per day Sexual maturity usually attained by males in their 3rd -5th year, and females in their 4th-6th year Strong homing to spawning grounds	1,2,5
Adult (growth)	Max growth in May-October. Gradual dispersal after brood protection	2	Found mostly in lakes and lake-like, usually impounded, reaches of rivers. Rocky substrates, using boulders and bedrock ledges for cover, as well as submerged wood or aquatic vegetation. Moderately shallow water	1,5	3-12	2	20.3-21.3, upper lethal temp as high as 35	1	>6	2	tolerates some turbidity	5	0.10-0.32	2	Predacious, feeding on insects, fish and crayfish Largest sizes range from 450-500mm total length. Max age 13-15yrs	5
Adult (over-wintering)	Begin overwintering habits in early September	2	Deep pools near cover. Prefer boulders for cover	2			<6.7 hide in cover, 12-13 optimal	2							Aggregate near the bottom, are very inactive and eat little. Begin feeding in the spring when water temps reach 8.5C	1
Adult (spawning)	Late spring - early summer, usually over a period of 6-10 days	1	Lakes and rivers, usually near the protection of rocks, logs, or more rarely, dense vegetation. Sandy, gravel, or rocky bottom	1	0.4-6.1, 7 max		nest building begins at>12, spawning at 16-18	5							Male excavates nest in gravel or rubble substrate, and cleans substrate of nest. Nest is circular and has a diameter ~ twice the body length of the male. Eggs attached to clean stones near centre of nest	5

Largemouth bass (*Micropterus salmoides*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Suitable Velocity (m/s)		Other Information	
Egg	Hatching takes 3-5 days	1	Protected gravel beds. Will use exposed roots and emergent vegetation in nests	2	0.3-0.9 optimal, 7.5 maximum	2	13-26	2	>2	2			<0.1	2	Eggs are demersal, adhesive, amber in colour, and when fertilized are 1.5-1.7mm in diameter Egg number per female varies with size and reported to be from 2000-109,314 per female Changes in temp, wind, waves, nest desertion, turbidity and predation by fish limit success of the hatch	1
Larvae/Fry	Remain on bottom of nest until yolk is absorbed (6-7 days), then they rise and begin feeding and schooling May remain in brood for as long as 31 days and are guarded over by male	1	Flooded terrestrial vegetation or emergents used for cover	2			21-34 range, 27-30 optimal	2			5-25ppm (TDS)	2	<0.27	2	Hatchlings form a dense swarm guarded by the male for a time after feeding begins Feed on plankton, but shift to fish during their first summer Number of fry resulting from a single nest from 751-11,457, wih an average of 5000-7000. On hatching, young are transparent and 3mm long	1,5
Juvenile			Similar to adult	2			21-32	2	>5	2	5-25ppm (TDS)	2	<0.06	2	Growth rapid at first. YOY in October 51-127mm Males sexually mature at 3-4yrs, females at 4-5yrs	1,2
Adult (growth)	Max length increase in 1st 2 years	2	Lakes and large rivers, usually in quiet marginal waters. Prefers submerged wood or weedbeds.	5	rarely caught at depths over 6.1	1	26.6-27.7	1	low tolerance of low O2 levels - avoid levels <1.5mg/litre, >8 optimal		Somewhat tolerant of turbidity, <25ppm (TDS)	2,5	<0.06	2	active at dawn and dusk Feed on fish , as well as frogs, snakes, small rodents, and ducklings Max age 15yrs, and a max total length of 544mm. Angling record for MB is 53cm	5
Adult (over-wintering)			Move to the bottom.	1	>6	2									Are more active than smallmouth bass	1
Adult (spawning)	June - August	5	Gravelly sand to marl and soft mud substrate. Will spawn on finer substrates if there are hard surfaces available for the eggs to adhere to	2,5	0.2-1.8, 7.5max	2	nest building at 15.6, spawning at 16-18	5							Males excavate nests up to 1m in diameter and 30cm deep. Males guard nest and remain with young for a time after feeding begins Females may spawn with several males on different nests	1,5

White crappie (*Pomoxis annularis*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Turbidity		Other Information	
Egg	Hatch in ~4 days, with a range of 2-41/2 days depending on temp	1									Eggs are 0.89mm in diameter, colourless, demersal, and adhesive. Adhere to substrate and to one another Egg number per female likely similar to the 27,000-68,000 noted for black crappies of the same size	1
Larvae/Fry	Remain on nest for short time period, in some cases only 4 days elapse from start of hatching to departure of young	1									Young are tiny and transparent	1
Juvenile											Feed on plankton Growth is rapid at first. YOY in October are 25-97mm long. Sexual maturity attained in 2nd to 4th yr and fish on nests are usually 152-203mm	1,5
Adult (growth)			Lakes and rivers. Found over a variety of substrates from mud or silt to gravel. Most often, found in or near cover such as submerged wood	5					Prefer turbid water	5	Feed on aquatic insects and fish Grow to 363mm total length. Max age 9yrs. Schooling fish	5
Adult (spawning)	May - June, for approximately a 29-day period	1,5	Rooted plants or algae usually beside or in the nest. At times, nests are established in the protection of undercut banks	1	0.2-0.97	1	16-20	5			Nests cleaned or excavated in finer grained substrates than most centrarchids use. Males guard nest and fan eggs Females may spawn in the nests of several different males	1,5

Black crappie (*Pomoxis nigromaculatus*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Turbidity		Other Information	
Egg	Hatch in 3-5 days	1									Eggs slightly less than 1mm in diameter, whitish, demersal, and adhesive Egg number for females 195-230mm, 3-4yrs averages 37,796	1
Larvae/Fry	Guarded by male for a few days and then desert nest	1									Hatchlings begin feeding on plankton	5
Juvenile											Growth rapid at first. YOY are 25-76mm in October	1
Adult (growth)			Clear, quiet waters of lakes and rivers. Usually associated with cover such as weedbeds or submerged wood.	2					Can tolerate slightly turbid water	5	Feed on fish and aquatic insects, but also continue to feed on planktonic crustacea Grow to a fork length of 318mm in Ontario In MB, range from 120-150mm total length. Max years 9yrs. Schooling, midwater fish	5
Adult (over-wintering)											Active, feed all winter. However seem to feed little before mid-April	1
Adult (spawning)	June - July	5	Clay to fine gravel substrate. Some vegetation. At times nests are made in the protection of an undercut bank	1,5	0.254-0.61	1	18-20	5			Male excavates or cleans a nest on substrate ranging from clay to fine gravel Females likely spawn with different males in more than one nest Males guard and fan nest, and guard young for a short time	1,5

Iowa darter (*Etheostoma exile*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Turbidity		Other Information	
Egg	Hatch in 9-10 days at 13-16°C	1									Eggs 1.1 mm in diameter Eggs deposited in groups of 3-7,550-2048 eggs per female	1
Adult (growth)			Clear, standing or slowly moving water in lakes or rivers in areas containing rooted aquatic vegetation and a substrate consisting of organic debris, sand or peat. In MB, in weedbeds along shores of lakes and rivers, in oxbow lakes, and in headwater streams and ponds including bog habitats.	1,5					Intolerant of turbid, muddy waters with low visibility	1	Feed on a variety of aquatic insect larvae and crustaceans Large specimens are 35-40mm total length, but most are 30mm or less. Adults may live at least 3 years	1,5
Adult (spawning)	April to June	1	Shallow waters near shore, fibrous roots of plants under undercut banks, or on bottom organic debris	1	<0.5	1	13	5			Males establish territories in shallow water before females arrive Females mate with several males Male guards nest, but provides no other care for the eggs	1,5

Johnny darter (*Etheostoma nigrum*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth(m)		Suitable Velocity (m/s)		Other Information	
Egg	Hatch in 5-8 days at 22-24°C	1							Females lay 5-6 clutches of 30-200 eggs Adhesive eggs, 1.5 mm in diameter	1
Adult (growth)			Most commonly found in waters with moderate or no current with a sand, sand and gravel or sand and silt substrate Do not inhabit weedy areas or gravel riffles of streams	1	0.35-1	5	Low, 0-0.15	1,5	Feeds on aquatic insects and crustaceans Up to 60-65mm total length, but most are less than 35mm Males grow to a larger size than females, but females live longer (4 years) than males (3 years)	1,5
Adult (spawning)	May to June	1	Quiet water, in pools in streams and along lakeshores. Nest on undersides of rocks	1,5					Males arrive in spawning areas before females, establish territories and prepare the underside of a rock for a nesting site Males guard eggs and keep them free of silt	1

Yellow perch (*Perca flavescens*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^oC)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Suitable Velocity (m/s)		Other Information	
Egg	Hatch in 6 days at 20^{o}C and 50 days at 5-6^{o}C	2	Aquatic rooted vegetation or flooded terrestrial vegetation, also rocks, sand or gravel substrate	2	0.6-3.7	2	7-20	2	6	2					Strands of semibouyant eggs are anchored to vegetation or brush, no parental care Eggs 3.5 mm in diameter	1,2
Larvae/Fry	Move into open water within 2 months	2	Littoral zone, over sand, silt, rock or gravel substrates	2	0.9-3.0	2	3-28 10-20 optimal	2	6	2			<0.025	2	Pelagic larvae	2
Juvenile			Shoreline areas in lakes and rivers with moderate vegetation over a mud, sand, or gravel substrate	2			17-26 20-23 optimal	2	5	2					Often found in mixed schools with other species, such as cyprinids Rapid growth in young fish, females grow faster and larger than males	1
Adult (growth)			Shoreline areas of clear lakes, also in large slow moving rivers with moderate amounts of vegetation	2	<10	2	11-25	2	5	2	25-80pmm (TSS)	2	Prefer low velocities	2	Opportunistic feeder, taking a wide variety of invertebrates and fish Primarily active during the day, move up or down in water column depending on light levels Usually found in schools Grow to 302mm fork length. Max age 9 Stunting occurs in many populations due to high densities	1,2,5
Adult (over-wintering)			Deeper waters in lakes	2	3-15	2			>1.5	2					Active during the winter	1,2
Adult (spawning)	Spring spawners May - June	2,5	Aquatic vegetation or flooded terrestrial vegetation in sheltered areas with little current	1,2	0.6-3	2	>6	5	>5	2			<0.05	2	Migrate into tributaries and shallow areas of lakes to spawn Spawning occurs at night and early morning	1,2

Logperch (*Percina caprodes*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Other Information	
Egg							about 22-26	1	10-20 eggs per spawning act, 1060-3085 per female, 1.3 mm in diameter	1
									Feed on aquatic insects	
Adult (growth)			Usually in deeper waters offshore and in large rivers, sometimes in areas with swift current. Tolerant of turbid water Found over sand, gravel, or rocky substrates	1	>1	5			Grow to 90mm total length, but most are 40-50mm. Max age 4yrs Use snout to roll over stones, leaves, or other objects on the bottom to feed on organisms underneath them	1,5
Adult (spawning)	May - late June	5	Sandy shoals in shallow water	1	<2	5	16-23	5	Males form large schools over spawning grounds, females swim through school when they are ready to spawn, eggs are buried and abandoned Females spawn several times with different males	1,5

Blackside darter (*Percina maculata*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable Turbidity		Suitable Velocity (m/s)		Other Information	
Egg	minimum incubation of ~6 days	1											Eggs are ~2mm in diameter and colourless Egg number ranged from 1000-1758 per female	1
Larvae/Fry													Feed near surface on planktonic crustaceans, but become benthic feeders as they grow Newly-hatched larvae area 5.75mm total length	1,5
Adult (growth)			Flowing water ranging from small streams to large rivers, and, less commonly, in the littoral zone of lakes.Common in tributaries of Red and Assiniboine Rivers Rocky substrate, often around vegetation.	5	0.35-1	5			Clear to slightly turbid water	5	0-0.15	5	Feed on on aquatic insects and some fish eggs Reach 90mm total length, but most are from 40-50mm. Max age 4yrs	5
Adult (spawning)	May - June	5	Move upstream. Slow-moving water of pools and runs and riffles in streams. Gravel or coarse sand substrate	1,5	>0.3	1	16.5	1			<0.10	5	Males defend a moving territory around a ripe female and mount female during spawning. Eggs extruded into interstitial spaces in substrate or are covered with sand stirred up by the spawning act. Eggs abandoned	5

River darter (*Percina shumardi*).

Life History Stage	Timing		Suitable Habitat		Other Information	
Juvenile					Sexually mature at Age 1 Feed on aquatic insects mainly, as well as zooplankton and fish eggs	5
Adult (growth)			Large rivers with rubble or boulder-strewn gravel substrate, in fair to moderate current, little to no vegetation May also be found in silted, turbid tributaries and lakes In MB, found in the littoral areas of the MB Great Lakes and our larger rivers	1,5	Most 40mm or less total length, with a range of 28-56mm Max age 2yrs	5
Adult (spawning)	May - July in Manitoba	5				

Sauger (*Sander canadensis*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^oC)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Other Information	
Egg	Hatch in 25-29 days at 4.5 to 12.8^oC 8-13 days at 15^oC	2	In crevices in rocks or among gravel on the bottom, out of current	2			9-18 12-15 optimal	2	6	2			Eggs are semi buoyant and non-adhesive 1.44 to 1.6 mm in diameter, 9000-96 000 per female	1,2
Larvae/Fry	Remain on bottom for 7-9 days after hatching	1,2	May be found on shallow mud flats	2			>6 15-21 optimal	2	6	2				
Juvenile			Large shallow lakes and large slow rivers that have high turbidity	2	prefer <6	2	16-28	2	5	2			Feed on zooplankton and aquatic insects Growth is rapid but still slower than walleye in same water bodies Avoid light Males mature in 2-3 years, females in 4-6 years	1,2,5
Adult (growth)			Prefer shallower, more turbid water than the walleye, and is more common in turbid rivers than walleye. Substrates ranging from clay or silt to rubble and boulders Found in Red River, Assiniboine River, and MB Great Lakes	5			18.6-19.2 optimal	2	5	2			Feed on fish, crayfish, leeches, and aquatic insects Large adults are 400mm or less total length, with most from 250-350mm long. Max age 7yrs Better adapted to turbid water than walleye	2,5
Adult (over-wintering)							<12	2	5	2				
Adult (spawning)	May to June, usually no longer than 2 weeks in duration	2	Shallows over sand or gravel shoals in large turbid lakes and rivers Prefer to spawn in flowing water	2	2.5-4	5	3.9-15 9-15 optimal	2	>2.4	2	high	2	Broadcast spawners, no nest is built Spawn at night May make extensive spawning migrations Spawn later than walleye in areas where both species are present	2

Walleye (*Sander vitreum*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (^{o}C)		Suitable O_2 Conc. (ppm)		Suitable Velocity (m/s)		Other Information	
Egg	Hatch in 26 days at 4.4^{o}C, 14-21 days at 8-15^{o}C	2	Clean gravel or cobble substrates, or mats of vegetation Require rising or stable water depths and areas with current	1,2	0.5-3	2	2-18 9-15 optimal	2	>5	2	0-1.05 0.75-0.9 optimal	2	High mortality can be caused by siltation, fluctuations in water temperature or heavy wave action Eggs 1.5-2.0 mm in diameter	1,2
Larvae/Fry	Absorb yolk sac in 3-5 days Disperse with current 10-15 days after hatching	2	In shallow shoreline areas before dispersing	2			17-24 22 optimal Will not feed if under 15	2	>5	2	Slight current	2	Form small schools, attracted to light Drift with current Highest fry survival occurs in years when warm temperatures lead to short incubation period	2
Juvenile			Deep or turbid water near bottom or under overhead cover to avoid light	2			16-28 20-25 optimal	2	>4	2			Start feeding on plankton, shifting to larger invertebrates Avoid light Need <10^{o}C chill period for gonad maturation, males mature in 2-4 years, females in 3-8 years	2,5
Adult (growth)			Large shallow mesotrophic, turbid lakes and rivers are most suitable habitat Primarily in deeper water in the day, moving inshore to feed at night	1,2	<15	2	13-25 20-25 optimal	2	>3	2	Slight current	2	Beyond their first year, mainly feed on fish Daily movements dictated by food, light and temperature requirements and preferences Commonly from 350-500mm total length May school in open water areas	2,5
Adult (over-wintering)			Deeper waters with little or no current over a gravel-cobble substrate	2									Avoid light and current High levels of activity during times of ice breakup and freeze-over	2
Adult (spawning)	Spring spawner, shortly after ice breakup April-late May	2	Lakes or streams. Shallow waters along shorelines, shoals, riffles, and dam faces, over areas with clean gravel-cobble substrate with good water circulation Also known to use flooded vegetation in some areas Red River mainstem and tribs (Cook's Creek, Rat and Roseau Rivers)	1,2,5	0.05-3 0.5-1.2 optimal	2	>4	5	>2.4	2	<1.4 optimal velocity varies with location	2	No nest is built, no parental care, eggs are broadcast over bottom Nocturnal spawners Spawn annually, spawning stream homing behaviour has been observed	2

Freshwater drum (*Aplodinotus grunniens*).

Life History Stage	Timing		Suitable Habitat		Suitable Depth (m)		Suitable Temp. (°C)		Suitable O_2 Conc. (ppm)		Suitable Turbidity		Suitable Velocity (m/s)		Other Information	
Egg	Hatch in 25-30hrs at temps of ~22C	1	Float on water surface	2			22	2	6	2					Eggs are 1.15-1.7mm in diameter, have a large oil globule, buoyant - float to surface Egg number per female usually range from 209,000-341,000	5
Larvae/Fry	Attached to surface film for approx 24-48hrs	2	Float on water surface, or attached to surface film	2					6	2					Scattered by water currents and wind. Once larvae are ~10mm they move to deeper water	2
Juvenile			>25mm found on or near bottom, where they remain for most of their lives	2					5	2					Mature at Age 2 or 3	5
Adult (growth)			Large, shallow bodies of water. Prefers clear water but can adapt to relatively high turbidity levels. Lives mostly in shallows Mainstems of large rivers and in the MB Great Lakes	1,5	12-18	2	<25.6	2	5	2	Prefers clear water but can adapt to relatively high turbidity levels, 25-80ppm (TSS)	1,2	Avoids strong currents	2	Feed mostly on benthic invertebrates, especially crayfish, snails, and mussels. Adapted to bottom feeding Average sizes are about 0.68-1.36kg. Largest angler-caught freshwater drum in MB was 89cm. Females larger than males.	1,5
Adult (over-wintering)															Move into shallower waters in the spring then back to deeper water of the main channel in late fall. Activity and feeding are greatly reduced in winter	2
Adult (spawning)	June	5	Open water, far from shore, with current. Bays and lower portions of rivers,over substrates ranging from silt and clay to rubble	2,5	3-4	5	20-23	5							Midwater Males make croaking sounds with swim bladder during spawning period - increasing in intensity during evening as the light level drops before and after sunset	5

Table B-4. Fish utilization and fish habitat data for water bodies within the Bipole III Transmission Project preferred route corridor and select water bodies within the Study Area (from FIHCS). Presence Codes: A = Abundant, C = Common, E = Expected, EXT = Extirpated R = Rare, U = Uncommon, X = Unknown

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Apussigamasi Lake	ALL	1	Contamination	2	Heavy Metals	2	CISCO	C
			Flow Levels - Above Optimum	2	Water regulation	2	GOLDEYE	X
			Turbidity	2	Primarily upstream	2	LAKE WHITEFISH	A
							NORTHERN PIKE	C
							WALLEYE	C
Assean Lake	ALL	1					BURBOT	X
							CISCO	X
							EMERALD SHINER	X
							LAKE CHUB	X
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	X
							NORTHERN PIKE	C
							SAUGER	C
							SLIMY SCULPIN	X
							SPOTTAIL SHINER	X
							TROUT PERCH	X
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Assiniboine River	ALL	2	Fish species competition	2	Stress	2	BIGMOUTH BUFFALO	X
			Nutrient Surplus	2	Agriculture	1	BIGMOUTH SHINER	C
					Municipal	2	BLACK BULLHEAD	X
					Nonpoint source	1	BLACK CRAPPIE	X
			Temperature too High	2	Point source discharge	1	BLACKCHIN SHINER	C
			Flow Levels - Below Optimum	2	Water regulation	2	BLACKNOSE DACE	C
							BLACKNOSE SHINER	C
							BLACKSIDED DARTER	U

1 - 1 = Water bodies that have high capability for production of fish
2 = Water bodies that have slight limitations to production of fish
3 = Water bodies that have moderate limitations to production of fish
4 = Water bodies that have severe limitations to production of fish

2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Assiniboine River (cont)							BROOK STICKLEBACK	C
							BROWN BULLHEAD	C
							BURBOT	X
							CARP	C
							CENTRAL MUDMINNOW	X
							CHANNEL CATFISH	C
							CHESTNUT LAMPREY	X
							COMMON SHINER	C
							CREEK CHUB	C
							EMERALD SHINER	C
							FATHEAD MINNOW	C
							FINESCALE DACE	C
							FLATHEAD CHUB	C
							FRESHWATER DRUM	C
							GOLDEN REDHORSE	R
							GOLDEN SHINER	C
							GOLDEYE	C
							IOWA DARTER	C
							JOHNNY DARTER	U
							LAKE STURGEON	X
							LOGPERCH	R
							LONGNOSE DACE	C
							MIMIC SHINER	C
							MOONEYE	X
							NINESPINE STICKLEBACK	U
							NORTHERN PIKE	C
							PEARL DACE	C
							QUILLBACK	C
							RIVER DARTER	C
							RIVER SHINER	C
							ROCK BASS	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Assiniboine River (cont)							SAND SHINER	C
							SAUGER	X
							SHORTHEAD REDHORSE	X
							SILVER CHUB	X
							SILVER REDHORSE	X
							SPOTFIN SHINER	X
							SPOTTAIL SHINER	U
							STONECAT	U
							TADPOLE MADTOM	U
							TROUT PERCH	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	X
Bell Creek							BLACKNOSE SHINER	X
							BROOK STICKLEBACK	C
							FATHEAD MINNOW	X
							FINESCALE DACE	X
							NORTHERN PIKE	X
							WHITE SUCKER	X
Bell River	ALL	4	Turbidity	2	Natural	2	BLACKNOSE DACE	C
			Undercut banks	1	Bank erosion	1	BLACKSIDED DARTER	X
							CREEK CHUB	X
							FATHEAD MINNOW	X
							LONGNOSE DACE	X
							MOTTLED SCULPIN	X
							NORTHERN PIKE	C
							RAINBOW TROUT	X
							RIVER DARTER	X
							SPLAKE	X
							SPOTTAIL SHINER	C
							WHITE SUCKER	U

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Birch Tree Lake	ALL	1	Contamination	2	Heavy Metals	2	BURBOT	C
							CISCO	C
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							NORTHERN PIKE	C
							SAUGER	C
							SHORTHEAD REDHORSE	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Bowden Lake	ALL	1					BURBOT	C
							CISCO	C
							EMERALD SHINER	C
							LAKE TROUT	C
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							NINESPINE STICKLEBACK	C
							NORTHERN PIKE	C
							RAINBOW TROUT	C
							SPOTTAIL SHINER	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Boyne River	ALL	2	Flow Levels - Above Optimum	2	Natural	2	BLACKNOSE DACE	X
			Other	2	Migration blockage	2	BLACKNOSE SHINER	X
							BLACKSIDED DARTER	C
							BROOK STICKLEBACK	X
							CENTRAL MUDMINNOW	X
							COMMON SHINER	X
							CREEK CHUB	X
							EMERALD SHINER	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification$_1$	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight$_2$	Probable Source	Weight$_2$		
Boyne River (cont)							FATHEAD MINNOW	C
							FINESCALE DACE	X
							IOWA DARTER	X
							JOHNNY DARTER	C
							NORTHERN PIKE	E
							PEARL DACE	X
							RAINBOW TROUT	EXT
							RIVER DARTER	X
							WALLEYE	X
							WHITE SUCKER	X
							YELLOW PERCH	X
Burntwood River	ALL	1	Contamination	2	Heavy Metals	2	BURBOT	C
			Flow Levels - Above Optimum	2	Water regulation	2	CARP	X
			Nutrient Surplus	1	Municipal	1	CISCO	C
			Toxic Substances	1	Mining	1	EMERALD SHINER	X
				1	Urban runoff	1	FRESHWATER DRUM	X
			Turbidity	2	Primarily upstream	1	GOLDEYE	X
					Within reach	2	JOHNNY DARTER	A
							LAKE CHUB	A
							LAKE STURGEON	C
							LAKE WHITEFISH	C
							LOGPERCH	A
							LONGNOSE SUCKER	C
							MOONEYE	C
							MOTTLED SCULPIN	X
							NORTHERN PIKE	C
							RAINBOW SMELT	X
							RIVER DARTER	A
							SAUGER	C
							SHORTHEAD REDHORSE	C
							SLIMY SCULPIN	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Burntwood River (cont)							SPOTTAIL SHINER	A
							TROUT PERCH	A
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Cedar Lake	ALL	1	Flow Levels - Below Optimum	1	Primarily upstream	1	BLACKNOSE SHINER	U
			Human intervention	1	Other	1	BLACKSIDED DARTER	U
							BROOK STICKLEBACK	C
							BURBOT	C
							CARP	C
							CISCO	A
							COMMON SHINER	X
							EMERALD SHINER	A
							FATHEAD MINNOW	A
							FLATHEAD CHUB	E
							GOLDEYE	C
							IOWA DARTER	C
							JOHNNY DARTER	C
							LAKE CHUB	E
							LAKE STURGEON	EXT
							LAKE TROUT	EXT
							LAKE WHITEFISH	A
							LOGPERCH	C
							LONGNOSE DACE	C
							LONGNOSE SUCKER	C
							MOONEYE	E
							MOTTLED SCULPIN	U
							NINESPINE STICKLEBACK	C
							NORTHERN PIKE	A
							QUILLBACK	E
							RAINBOW SMELT	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Cedar Lake (cont)							RIVER DARTER	C
							RIVER SHINER	E
							SAUGER	C
							SHORTHEAD REDHORSE	C
							SLIMY SCULPIN	C
							SPOONHEAD SCULPIN	X
							SPOTTAIL SHINER	A
							TADPOLE MADTOM	X
							TROUT PERCH	C
							WALLEYE	A
							WHITE SUCKER	A
							YELLOW PERCH	C
Clarke Lake	ALL	1					CISCO	C
							LAKE WHITEFISH	C
							NORTHERN PIKE	C
							WALLEYE	C
							WHITE SUCKER	C
Clearwater Lake	ALL	1					BLACKNOSE SHINER	C
							BROOK STICKLEBACK	C
							BROOK TROUT	X
							BROWN TROUT	X
							BURBOT	C
							CISCO	C
							KOKANEE	X
							LAKE CHUB	R
							LAKE TROUT	A
							LAKE WHITEFISH	C
							LONGNOSE DACE	C
							LONGNOSE SUCKER	C
							NINESPINE STICKLEBACK	C
							NORTHERN PIKE	C

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Clearwater Lake (cont)							RAINBOW TROUT	X
							SILVER CHUB	C
							SLIMY SCULPIN	C
							SPLAKE	X
							SPOTTAIL SHINER	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	R
Cooks Creek	APR - JUL	1					BLACK CRAPPIE	C
							BLACKSIDED DARTER	X
							BROOK STICKLEBACK	C
							BROWN BULLHEAD	C
							BURBOT	C
							CARP	C
							CENTRAL MUDMINNOW	C
							CHANNEL CATFISH	C
							CHESTNUT LAMPREY	U
							CISCO	U
							EMERALD SHINER	C
							FATHEAD MINNOW	X
							FRESHWATER DRUM	C
							GOLDEN SHINER	C
							GOLDEYE	C
							GOLDFISH	X
							IOWA DARTER	X
							JOHNNY DARTER	C
							MOONEYE	U
							NORTHERN PIKE	C
							QUILLBACK	C
							RIVER SHINER	C
							ROCK BASS	C

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Cooks Creek (cont)							SAUGER	C
							SHORTHEAD REDHORSE	C
							SILVER REDHORSE	C
							SPOTFIN SHINER	C
							SPOTTAIL SHINER	C
							TADPOLE MADTOM	C
							TROUT PERCH	C
							WALLEYE	C
							WHITE BASS	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Cormorant Lake	ALL	1					BURBOT	C
							CISCO	C
							LAKE TROUT	C
							LAKE WHITEFISH	C
							NORTHERN PIKE	C
							SAUGER	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Dauphin Lake	ALL	3	Eggs/larvae habitat	1	Channelization	2	BIGMOUTH BUFFALO	R
			Gravel	1	Channelization	2	BLACKCHIN SHINER	X
			Nutrient Surplus	1	Agriculture	1	BLACKNOSE DACE	A
					Municipal	1	BLACKNOSE SHINER	X
			Turbidity	1	Agriculture	1	BRASSY MINNOW	C
			Flow Levels - Below Optimum	1	Water regulation	2	BROOK STICKLEBACK	R
							BURBOT	C
							CARP	C
							CISCO	R
							COMMON SHINER	A
							CREEK CHUB	A

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Dauphin Lake (cont)							EMERALD SHINER	A
							FATHEAD MINNOW	C
							GOLDEYE	R
							IOWA DARTER	C
							JOHNNY DARTER	A
							LAKE WHITEFISH	R
							LOGPERCH	C
							LONGNOSE DACE	A
							NORTHERN PIKE	A
							PEARL DACE	C
							QUILLBACK	C
							RIVER DARTER	A
							SHORTHEAD REDHORSE	C
							SILVER REDHORSE	C
							SPOTTAIL SHINER	A
							TROUT PERCH	A
							WALLEYE	R
							WEED SHINER	X
							WHITE SUCKER	A
							YELLOW PERCH	A
Dolomite Lake	ALL	1					CISCO	C
							LAKE WHITEFISH	C
							NORTHERN PIKE	C
							WALLEYE	C
							WHITE SUCKER	C
Dyce Lake	ALL	1					CISCO	C
							LAKE WHITEFISH	C
							NORTHERN PIKE	C
							WALLEYE	C
Fifteen Creek							BROOK STICKLEBACK	C
							BROOK TROUT	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Fifteen Creek (cont)							BURBOT	X
							FATHEAD MINNOW	X
							FINESCALE DACE	C
							LONGNOSE DACE	C
							LONGNOSE SUCKER	X
							NORTHERN REDBELLY DACE	X
							PEARL DACE	C
							SLIMY SCULPIN	C
							WHITE SUCKER	X
File Lake	ALL	1					BROOK STICKLEBACK	C
							BURBOT	C
							LAKE TROUT	C
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							NORTHERN PIKE	C
							SLIMY SCULPIN	C
							SPOTTAIL SHINER	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Fishtown Creek							BLACKNOSE DACE	X
							BROOK STICKLEBACK	X
							CENTRAL MUDMINNOW	X
							COMMON SHINER	X
							CREEK CHUB	C
							FATHEAD MINNOW	X
							FINESCALE DACE	C
							JOHNNY DARTER	X
							LONGNOSE DACE	X
							NORTHERN PIKE	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Fishtown Creek (cont)							WHITE SUCKER	X
Garland River	ALL	2	Flow Levels - Below Optimum	2	Natural	1	BLACKNOSE DACE	C
					Water regulation	1	BROOK STICKLEBACK	C
							CREEK CHUB	C
							FATHEAD MINNOW	C
							FINESCALE DACE	C
							IOWA DARTER	C
							NORTHERN PIKE	C
							NORTHERN REDBELLY DACE	C
							PEARL DACE	C
							QUILLBACK	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Garrioch Creek							WHITE SUCKER	X
German Creek							BLACKNOSE DACE	C
							IOWA DARTER	C
							LOGPERCH	C
							LONGNOSE DACE	C
							MOTTLED SCULPIN	X
							NORTHERN PIKE	X
							RIVER DARTER	C
							WALLEYE	X
							WHITE SUCKER	C
							YELLOW PERCH	C
Goose Creek	ALL	3					BLACKNOSE DACE	X
							BROOK STICKLEBACK	A
							BROOK TROUT	X
							BURBOT	X
							FATHEAD MINNOW	C

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Goose Creek (cont)							FINESCALE DACE	A
							LAKE CHUB	C
							LONGNOSE DACE	A
							LONGNOSE SUCKER	C
							MOTTLED SCULPIN	X
							NORTHERN PIKE	X
							NORTHERN REDBELLY DACE	C
							PEARL DACE	A
							SLIMY SCULPIN	X
							WHITE SUCKER	C
Grass River							BROOK TROUT	C
							BURBOT	X
							CISCO	C
							GOLDEYE	X
							JOHNNY DARTER	C
							LAKE TROUT	C
							LAKE WHITEFISH	C
							LOGPERCH	C
							LONGNOSE DACE	C
							MOONEYE	X
							MOTTLED SCULPIN	C
							NINESPINE STICKLEBACK	C
							NORTHERN PIKE	C
							SAUGER	C
							SHORTHEAD REDHORSE	C
							SLIMY SCULPIN	C
							SPOTTAIL SHINER	C
							TROUT PERCH	C
							WALLEYE	C
							WHITE SUCKER	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Grass River (cont)							YELLOW PERCH	C
Halfway Lake	ALL	1					-	
Hargrave Lake	ALL	1					CISCO	C
							LAKE WHITEFISH	C
							NORTHERN PIKE	C
							WALLEYE	C
							WHITE SUCKER	C
Hunting River							BURBOT	X
							CISCO	X
							FRESHWATER DRUM	X
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	X
							NORTHERN PIKE	C
							SHORTHEAD REDHORSE	X
							SLIMY SCULPIN	X
							TROUT PERCH	X
							WALLEYE	C
							WHITE SUCKER	X
							YELLOW PERCH	X
Indian Birch River							BROOK STICKLEBACK	X
							CREEK CHUB	C
							FATHEAD MINNOW	X
							NORTHERN PIKE	X
							WHITE SUCKER	X
Kiski Lake	ALL	1					CISCO	C
							LAKE WHITEFISH	C
							NORTHERN PIKE	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Limestone River	ALL	1					BROOK TROUT	X
							BURBOT	X
							CISCO	A
							FRESHWATER DRUM	X
							LAKE STURGEON	X
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							NORTHERN PIKE	C
							SHORTHEAD REDHORSE	X
							SILVER LAMPREY	X
							WALLEYE	C
							WHITE SUCKER	C
Mafeking Creek							-	
Manasan River	ALL	2	Flow Levels - Above Optimum	1	Water regulation	1	-	
Manitoba, Lake	ALL	1	Nutrient Surplus	1	Agriculture	1	BIGMOUTH BUFFALO	R
					Combined sewer	1	BLACK BULLHEAD	C
					Individual sewage disposal	1	BLACKNOSE DACE	X
					Municipal	1	BLACKNOSE SHINER	X
					Natural	1	BROOK STICKLEBACK	C
					Nonpoint source	1	BROWN BULLHEAD	C
					Urban runoff	1	BURBOT	C
							CARP	C
							CHANNEL CATFISH	U
							CHESTNUT LAMPREY	U
							CISCO	C
							COMMON SHINER	X
							CREEK CHUB	X
							EMERALD SHINER	C
							FATHEAD MINNOW	X
							FLATHEAD CHUB	X

1 - 1 = Water bodies that have high capability for production of fish
2 = Water bodies that have slight limitations to production of fish
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4 = Water bodies that have severe limitations to production of fish

2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Manitoba, Lake (cont)							FRESHWATER DRUM	C
							GOLDEN SHINER	X
							GOLDEYE	U
							IOWA DARTER	X
							JOHNNY DARTER	C
							LAKE CHUB	C
							LAKE WHITEFISH	U
							LOGPERCH	C
							LONGNOSE DACE	X
							LONGNOSE SUCKER	C
							MIMIC SHINER	X
							MOONEYE	U
							MOTTLED SCULPIN	X
							NINESPINE STICKLEBACK	C
							NORTHERN PIKE	C
							PEARL DACE	X
							QUILLBACK	C
							RIVER DARTER	X
							RIVER SHINER	X
							SAUGER	C
							SHORTHEAD REDHORSE	C
							SILVER REDHORSE	C
							SLIMY SCULPIN	X
							SMALLMOUTH BUFFALO	X
							SPOONHEAD SCULPIN	X
							SPOTTAIL SHINER	C
							TADPOLE MADTOM	X
							TROUT PERCH	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C

1 - 1 = Water bodies that have high capability for production of fish
2 = Water bodies that have slight limitations to production of fish
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4 = Water bodies that have severe limitations to production of fish

2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
McMillan Creek	ALL	1					BROOK TROUT	X
							NORTHERN PIKE	C
Morris River	ALL						BROOK STICKLEBACK	X
							FATHEAD MINNOW	C
							QUILLBACK	X
							RIVER SHINER	X
							SAND SHINER	C
							TROUT PERCH	X
Mossy River	ALL	2	Adult/Juvenile Habitat	1	Migration blockage	1	BLACKCHIN SHINER	X
			Nutrient Surplus	1	Agriculture	1	BLACKNOSE SHINER	X
					Nonpoint source	1	BURBOT	X
							CARP	C
							EMERALD SHINER	X
							FATHEAD MINNOW	X
							GOLDEYE	X
							IOWA DARTER	X
							JOHNNY DARTER	X
							LOGPERCH	X
							NORTHERN PIKE	C
							SAUGER	C
							SHORTHEAD REDHORSE	C
							SPOTTAIL SHINER	X
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Mystery Lake	ALL	1	Contamination	2	Heavy Metals	2	CISCO	C
			Turbidity	2	Within reach	2	GOLDEYE	C
			Flow Levels - Above Optimum	2	Water regulation	2	LAKE STURGEON	X
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							NORTHERN PIKE	C
							WALLEYE	C

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2 = Water bodies that have slight limitations to production of fish
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2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Norquay Channel							BLACK BULLHEAD	X
							BLACKSIDED DARTER	X
							BROOK STICKLEBACK	X
							CARP	X
							CENTRAL MUDMINNOW	X
							CREEK CHUB	X
							FATHEAD MINNOW	X
							IOWA DARTER	X
							JOHNNY DARTER	X
							NORTHERN PIKE	X
							RIVER DARTER	X
							SAND SHINER	X
							SAUGER	X
							SPOTFIN SHINER	X
							TADPOLE MADTOM	X
							TROUT PERCH	X
							WHITE SUCKER	X
							YELLOW PERCH	X
North Duck River	ALL	2	Eggs/larvae habitat	1	Siltation	1	BLACKNOSE DACE	C
			Flow Levels – Above Optimum	1	Other	1	BROOK STICKLEBACK	X
			Flow Levels – Below Optimum	2	Drainage – Agriculture	1	BROOK TROUT	C
			Gravel	1	Bank erosion	1	CREEK CHUB	C
			Turbidity	1	Agriculture	1	EMERALD SHINER	C
							FATHEAD MINNOW	C
							FINESCALE DACE	C
							JOHNNY DARTER	C
							LOGPERCH	C
							LONGNOSE DACE	C
							MOTTLED SCULPIN	X
							NORTHERN PIKE	C
							RAINBOW TROUT	C

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2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
North Duck River (cont)							SHORTHEAD REDHORSE	C
							SPOTTAIL SHINER	C
							TROUT PERCH	C
							WHITE SUCKER	C
							YELLOW PERCH	C
North Moose Lake	ALL	2	Flow Levels - Below Optimum	1	Water regulation	1	CISCO	C
			Loss of Flushing Flows	1	Water regulation	1	GOLDEYE	C
							LAKE WHITEFISH	C
							NORTHERN PIKE	C
							SAUGER	C
							WALLEYE	C
							WHITE SUCKER	C
North Pine River							BLACKNOSE DACE	C
							BRASSY MINNOW	C
							BROOK STICKLEBACK	C
							BROOK TROUT	C
							CREEK CHUB	C
							FATHEAD MINNOW	C
							FINESCALE DACE	C
							IOWA DARTER	C
							JOHNNY DARTER	C
							LONGNOSE DACE	C
							MOTTLED SCULPIN	C
							PEARL DACE	C
							RAINBOW TROUT	C
							WHITE SUCKER	C
Odei River	ALL	2					BROOK TROUT	X
							CISCO	C
							GOLDEYE	X
							NORTHERN PIKE	C
							SAUGER	C

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Odei River (cont)							WALLEYE	C
Orr Lake	ALL	2					LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							WALLEYE	C
							WHITE SUCKER	C
Ospwagan Lake	ALL	1					BROOK STICKLEBACK	A
							BROOK TROUT	X
							BURBOT	X
							CISCO	C
							EMERALD SHINER	A
							GOLDEYE	C
							LAKE TROUT	R
							LAKE WHITEFISH	C
							NINESPINE STICKLEBACK	A
							NORTHERN PIKE	C
							SPLAKE	R
							SPOTTAIL SHINER	A
							WALLEYE	C
							WHITE SUCKER	C
Overflowing River	ALL	2	Eggs/larvae habitat	1	Silviculture/logging	1	EMERALD SHINER	C
							FATHEAD MINNOW	C
							GOLDEYE	U
							JOHNNY DARTER	C
							LOGPERCH	C
							LONGNOSE DACE	C
							NORTHERN PIKE	C
							QUILLBACK	U
							RIVER DARTER	C
							SAUGER	C
							SHORTHEAD REDHORSE	C
							SPOTTAIL SHINER	C
							WALLEYE	U

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Overflowing River (cont)							WHITE SUCKER	A
							YELLOW PERCH	U
Paint Lake	ALL	2	Water regulation	2	Mining	2	BURBOT	C
							CISCO	C
							COMMON SHINER	A
							JOHNNY DARTER	A
							LAKE TROUT	C
							LAKE WHITEFISH	C
							LOGPERCH	A
							LONGNOSE DACE	A
							LONGNOSE SUCKER	A
							MOTTLED SCULPIN	X
							NINESPINE STICKLEBACK	A
							NORTHERN PIKE	C
							SAUGER	C
							SLIMY SCULPIN	X
							SPOTTAIL SHINER	A
							TROUT PERCH	A
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Pakwa Lake	ALL	1					CISCO	C
							LAKE WHITEFISH	C
							NORTHERN PIKE	C
							SAUGER	C
							WALLEYE	C
							YELLOW PERCH	C
Phillips Lake	ALL	1					NORTHERN PIKE	C
Rat Creek	APR-AUG	4	Adult/Juvenile Habitat		Natural		BLACK BULLHEAD	E
			Eggs/larvae habitat		Natural		BROOK STICKLEBACK	C
			Flow Levels – Below Optimum		Natural		FATHEAD MINNOW	C

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Rat Creek (cont)			Water regulation		Natural		FINESCALE DACE	X
							NORTHERN PIKE	E
							NORTHERN REDBELLY DACE	X
							WHITE SUCKER	C
Rat River	ALL	2	Temperature too High	1	Natural	1	BLACK BULLHEAD	U
							BLACK CRAPPIE	X
							BLACKNOSE DACE	U
							BLACKSIDED DARTER	U
							BLUEGILL	X
							BROOK STICKLEBACK	A
							BROOK TROUT	X
							BROWN BULLHEAD	X
							BROWN TROUT	X
							BURBOT	R
							CARP	X
							CENTRAL MUDMINNOW	U
							CHANNEL CATFISH	X
							CHESTNUT LAMPREY	X
							COMMON SHINER	X
							EMERALD SHINER	U
							FATHEAD MINNOW	C
							FINESCALE DACE	C
							GOLDEN REDHORSE	X
							GOLDEYE	X
							IOWA DARTER	X
							JOHNNY DARTER	U
							LONGNOSE DACE	R
							NORTHERN PIKE	X
							NORTHERN REDBELLY DACE	A
							PEARL DACE	C
							QUILLBACK	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Rat River (cont)							RAINBOW TROUT	X
							RIVER SHINER	C
							ROCK BASS	R
							SAND SHINER	R
							SAUGER	X
							SHORTHEAD REDHORSE	X
							SILVER CHUB	U
							SILVER LAMPREY	X
							SILVER REDHORSE	X
							SPOTFIN SHINER	C
							STONECAT	R
							TADPOLE MADTOM	R
							WALLEYE	X
							WHITE SUCKER	X
							YELLOW PERCH	X
Red Deer Lake	ALL	2	Dissolved Oxygen	1	Natural	1	BROOK TROUT	X
			Flow Levels – Below Optimum	1	Natural	1	GOLDEYE	C
			Human intervention	1	Other	1	NORTHERN PIKE	C
							SAUGER	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Red River	ALL	1	Contamination	1	Heavy Metals	1	BANDED KILLIFISH	R
					Pesticides	1	BIGMOUTH BUFFALO	C
			Human intervention	1	Stress	1	BIGMOUTH SHINER	X
			Nutrient Surplus	2	Agriculture	2	BLACK BULLHEAD	C
					Combined sewer	2	BLACK CRAPPIE	C
					Construction	1	BLACKCHIN SHINER	X
					Individual sewage disposal	2	BLACKNOSE DACE	X
					Industrial	2	BLACKNOSE SHINER	X
					Municipal	1	BLACKSIDED DARTER	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Red River (cont)					Nonpoint source	2	BLUNTNOSE MINNOW	X
					Urban runoff	2	BRASSY MINNOW	X
			Toxic Substances	1	Agriculture	2	BROOK STICKLEBACK	C
					Combined sewer	1	BROWN BULLHEAD	C
					Industrial	1	BURBOT	C
							CARP	C
							CENTRAL MUDMINNOW	C
							CHANNEL CATFISH	C
							CHESTNUT LAMPREY	X
							CISCO	C
							COMMON SHINER	R
							CREEK CHUB	X
							EMERALD SHINER	A
							FATHEAD MINNOW	C
							FLATHEAD CHUB	X
							FRESHWATER DRUM	A
							GOLDEN REDHORSE	R
							GOLDEN SHINER	X
							GOLDEYE	C
							GOLDFISH	X
							HORNYHEAD CHUB	X
							IOWA DARTER	C
							JOHNNY DARTER	C
							LAKE CHUB	R
							LAKE STURGEON	R
							LAKE WHITEFISH	U
							LOGPERCH	C
							LONGNOSE DACE	X
							LONGNOSE SUCKER	C
							MIMIC SHINER	X
							MOONEYE	R
							NINESPINE STICKLEBACK	C

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Red River (cont)							NORTHERN PIKE	C
							PEARL DACE	X
							QUILLBACK	U
							RIVER DARTER	C
							RIVER SHINER	X
							ROCK BASS	C
							ROSYFACE SHINER	X
							SAND SHINER	U
							SAUGER	C
							SHORTHEAD REDHORSE	C
							SILVER CHUB	C
							SILVER LAMPREY	X
							SILVER REDHORSE	C
							SMALLMOUTH BASS	X
							SPOTFIN SHINER	X
							SPOTTAIL SHINER	C
							STONECAT	X
							TADPOLE MADTOM	C
							TROUT PERCH	C
							WALLEYE	C
							WHITE BASS	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Reed Lake	ALL	1					BURBOT	C
							CISCO	C
							EMERALD SHINER	C
							FATHEAD MINNOW	C
							IOWA DARTER	C
							JOHNNY DARTER	C
							LAKE TROUT	C
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	C

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Reed Lake (cont)							NORTHERN PIKE	C
							SPOTTAIL SHINER	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Rock Island Lake	ALL	1					LAKE TROUT	C
							LAKE WHITEFISH	C
							WALLEYE	C
Saskatchewan River	ALL	3	Adult/Juvenile Habitat	1	Natural	1	BLACKNOSE SHINER	X
			Eggs/larvae habitat	1	Bank erosion	2	BURBOT	C
					Siltation	2	EMERALD SHINER	C
			Flow Levels – Above Optimum	2	Water regulation	2	FATHEAD MINNOW	X
			Flow Levels – Below Optimum	2	Water regulation	2	FRESHWATER DRUM	C
			Human intervention	1	Water regulation	1	GOLDEYE	C
			Loss of Flushing Flows	2	Water regulation	2	JOHNNY DARTER	X
			Nutrient Surplus	1	Point source discharge	1	LAKE CHUB	X
			Plants, plant debris	1	Migration blockage	2	LAKE STURGEON	R
			Temperature too High	1	Industrial	1	LAKE WHITEFISH	C
					Municipal	1	LOGPERCH	X
			Toxic Substances	1	Combined sewer	1	LONGNOSE SUCKER	C
					Individual sewage disposal	1	NINESPINE STICKLEBACK	C
			Turbidity	1	Primarily upstream	1	NORTHERN PIKE	C
							QUILLBACK	C
							SAUGER	C
							SHORTHEAD REDHORSE	C
							SILVER REDHORSE	X
							SPOTTAIL SHINER	C
							TROUT PERCH	C
							WALLEYE	A
							WHITE SUCKER	C
							YELLOW PERCH	C

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Sclater River	ALL	3	Eggs/larvae habitat	1	Siltation	1	BLACKNOSE DACE	C
			Flow Levels - Above Optimum	2	Land Clearing - Agriculture	2	BROOK STICKLEBACK	C
					Natural	2	BROOK TROUT	C
			Flow Levels - Below Optimum	2	Natural	2	CREEK CHUB	X
			Gravel	1	Siltation	1	FATHEAD MINNOW	C
			Turbidity	1	Agriculture	1	FINESCALE DACE	C
							IOWA DARTER	X
							JOHNNY DARTER	C
							LONGNOSE DACE	C
							PEARL DACE	C
							RAINBOW TROUT	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Seine River	ALL	4	Adult/Juvenile Habitat	2	Bank erosion	2	BIGMOUTH BUFFALO	X
					Channelization	2	BLACK BULLHEAD	C
					Natural	1	BLACK CRAPPIE	X
					Siltation	2	BLACKNOSE DACE	X
			Dissolved Oxygen	1	Agriculture	1	BLACKSIDED DARTER	X
					Nonpoint source	1	BROOK STICKLEBACK	R
			Fish Kills	2	Natural	2	BROWN BULLHEAD	X
					Pesticides	1	BURBOT	X
					Toxic Substances	1	CARP	X
			Flow Levels - Above Optimum	1	Natural	1	CENTRAL MUDMINNOW	X
					Water regulation	1	CHANNEL CATFISH	X
			Flow Levels - Below Optimum	2	Natural	1	COMMON SHINER	C
					Water regulation	2	EMERALD SHINER	C
			Nutrient Deficiency	1	Natural	1	FATHEAD MINNOW	X
			Pools/profundal zone	2	Migration blockage	2	FRESHWATER DRUM	X
			Rifles/littoral zone	2	Migration blockage	2	GOLDEN REDHORSE	X
			Temperature too High	1	Natural	1	GOLDEYE	X
			Temperature too Low	2	Natural	2	GOLDFISH	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Seine River (cont)			Toxic Substances	1	Agriculture	1	JOHNNY DARTER	X
					Nonpoint source	1	LONGNOSE DACE	C
							NORTHERN PIKE	X
							PEARL DACE	C
							QUILLBACK	X
							ROCK BASS	C
							SAUGER	X
							SHORTHEAD REDHORSE	X
							SPOTTAIL SHINER	X
							TADPOLE MADTOM	X
							TROUT PERCH	X
							WALLEYE	X
							WHITE SUCKER	X
							YELLOW PERCH	X
Seine River Diversion							BIGMOUTH BUFFALO	X
							BLACK CRAPPIE	X
							BLACKSIDED DARTER	C
							BURBOT	X
							FATHEAD MINNOW	X
							JOHNNY DARTER	X
							LONGNOSE DACE	X
							NORTHERN PIKE	X
							RIVER DARTER	X
							RIVER SHINER	C
							ROCK BASS	X
							SAUGER	X
							SHORTHEAD REDHORSE	X
							SILVER REDHORSE	X
							TROUT PERCH	C
							WALLEYE	X
							WHITE SUCKER	X

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Seine River Diversion (cont)							YELLOW PERCH	X
Setting Lake	ALL	1					BURBOT	C
							CISCO	C
							GOLDEYE	C
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							NORTHERN PIKE	C
							SAUGER	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Sinclair River	ALL	3	Flow Levels – Above Optimum	1	Drainage – Agriculture	1	BLACKNOSE DACE	X
			Turbidity	1	Drainage – Agriculture	1	BROOK STICKLEBACK	X
							COMMON SHINER	X
							CREEK CHUB	X
							EMERALD SHINER	X
							FATHEAD MINNOW	X
							FINESCALE DACE	X
							JOHNNY DARTER	X
							NORTHERN PIKE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
South Moose Lake	ALL	2	Flow Levels – Above Optimum	2	Water regulation	2	-	
			Loss of Flushing Flows	2	Water regulation	2		
Split Lake	ALL	1					BURBOT	C
							CARP	X
							CISCO	C
							EMERALD SHINER	X
							FRESHWATER DRUM	X
							GOLDEYE	C
							LAKE CHUB	C

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Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Split Lake (cont)							LAKE STURGEON	X
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							MOONEYE	C
							NORTHERN PIKE	C
							RAINBOW SMELT	X
							SAUGER	C
							SHORTHEAD REDHORSE	C
							SPOTTAIL SHINER	X
							TROUT PERCH	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Squirrel Creek	MAR-DEC	2	Adult/Juvenile Habitat		Migration blockage		BLACKNOSE DACE	X
			Dissolved Oxygen		Agriculture		BLACKSIDED DARTER	X
					Natural		BROOK STICKLEBACK	X
					Nonpoint source		CENTRAL MUDMINNOW	X
			Flow Levels – Below Optimum		Natural		FATHEAD MINNOW	X
							IOWA DARTER	X
							JOHNNY DARTER	X
							NORTHERN PIKE	X
							SAND SHINER	C
							WHITE SUCKER	C
Steeprock River							BLACKNOSE DACE	X
							BLACKNOSE SHINER	X
							BLACKSIDED DARTER	X
							LONGNOSE DACE	X
Stephens Lake	ALL	1	Contamination	2	Heavy Metals	2	BROOK STICKLEBACK	X
							BURBOT	X
							CARP	X
							CISCO	C
							EMERALD SHINER	C

1 - 1 = Water bodies that have high capability for production of fish
2 = Water bodies that have slight limitations to production of fish
3 = Water bodies that have moderate limitations to production of fish
4 = Water bodies that have severe limitations to production of fish

2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Stephens Lake (cont)							FATHEAD MINNOW	X
							FRESHWATER DRUM	X
							IOWA DARTER	X
							JOHNNY DARTER	X
							LAKE CHUB	C
							LAKE STURGEON	X
							LAKE WHITEFISH	C
							LOGPERCH	X
							LONGNOSE DACE	X
							LONGNOSE SUCKER	C
							MOONEYE	C
							MOTTLED SCULPIN	X
							NINESPINE STICKLEBACK	C
							NORTHERN PIKE	C
							PEARL DACE	X
							RAINBOW SMELT	C
							SAUGER	C
							SHORTHEAD REDHORSE	X
							SILVER LAMPREY	X
							SLIMY SCULPIN	X
							SPOONHEAD SCULPIN	X
							SPOTTAIL SHINER	C
							TROUT PERCH	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Swan River	ALL	2	Dissolved Oxygen	1	Agriculture	1	BIGMOUTH SHINER	C
					Municipal	1	BLACKNOSE DACE	X
			Eggs/larvae habitat	2	Bank erosion	2	BLACKSIDED DARTER	C
					Channelization	2	BURBOT	X
					Migration blockage	2	CARP	X

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4 = Water bodies that have severe limitations to production of fish

2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Swan River (cont)					Siltation	2	COMMON SHINER	C
			Flow Levels - Above Optimum	1	Land Clearing - Agriculture	1	CREEK CHUB	C
			Nutrient Surplus	1	Agriculture	1	FATHEAD MINNOW	X
					Municipal	1	JOHNNY DARTER	X
			Turbidity	1	Agriculture	1	LONGNOSE DACE	C
							NORTHERN PIKE	X
							RIVER DARTER	C
							SAND SHINER	C
							SHORTHEAD REDHORSE	X
							TROUT PERCH	X
							WALLEYE	X
							WHITE SUCKER	X
							YELLOW PERCH	X
Talbot Lake	ALL	1					BURBOT	C
							CISCO	C
							EMERALD SHINER	C
							FATHEAD MINNOW	C
							IOWA DARTER	C
							JOHNNY DARTER	C
							LAKE WHITEFISH	C
							LOGPERCH	C
							LONGNOSE DACE	C
							LONGNOSE SUCKER	C
							NORTHERN PIKE	C
							SLIMY SCULPIN	C
							SPOTTAIL SHINER	C
							TROUT PERCH	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C

1 - 1 = Water bodies that have high capability for production of fish
2 = Water bodies that have slight limitations to production of fish
3 = Water bodies that have moderate limitations to production of fish
4 = Water bodies that have severe limitations to production of fish

2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Thompson Creek							LAKE WHITEFISH	X
							WALLEYE	C
							WHITE SUCKER	X
Threepoint Lake	ALL	1	Contamination	2	Heavy Metals	2	BURBOT	C
							CISCO	C
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							NORTHERN PIKE	C
							SAUGER	C
							SHORTHEAD REDHORSE	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Tourond Creek							BROOK STICKLEBACK	C
							CENTRAL MUDMINNOW	X
							NORTHERN PIKE	X
							WHITE SUCKER	X
Waskaiowaka Lake	ALL	1					BURBOT	X
							CISCO	X
							EMERALD SHINER	C
							LAKE TROUT	C
							LAKE WHITEFISH	C
							LONGNOSE SUCKER	X
							NINESPINE STICKLEBACK	C
							NORTHERN PIKE	C
							SLIMY SCULPIN	X
							SPOTTAIL SHINER	C
							TROUT PERCH	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C

1 - 1 = Water bodies that have high capability for production of fish
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4 = Water bodies that have severe limitations to production of fish

2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Weir River	ALL	1	Human intervention	1	Stress	1	BROOK STICKLEBACK	C
							BROOK TROUT	X
							BURBOT	X
							CISCO	C
							EMERALD SHINER	X
							FATHEAD MINNOW	X
							FINESCALE DACE	X
							GOLDEYE	X
							JOHNNY DARTER	C
							LAKE CHUB	C
							LAKE STURGEON	X
							LAKE WHITEFISH	X
							LONGNOSE DACE	C
							LONGNOSE SUCKER	C
							MOONEYE	X
							MOTTLED SCULPIN	X
							NINESPINE STICKLEBACK	X
							NORTHERN PIKE	C
							NORTHERN REDBELLY DACE	X
							PEARL DACE	C
							SILVER LAMPREY	X
							SLIMY SCULPIN	C
							SPOTTAIL SHINER	C
							TROUT PERCH	X
							WALLEYE	X
							WHITE SUCKER	C
							YELLOW PERCH	X
Wekusko Lake	ALL	1					BURBOT	C
							CISCO	C
							JOHNNY DARTER	C
							LAKE TROUT	C

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2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Wekusko Lake (cont)							LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							MOTTLED SCULPIN	C
							NINESPINE STICKLEBACK	C
							NORTHERN PIKE	C
							RIVER DARTER	C
							SAUGER	C
							SLIMY SCULPIN	C
							SPOONHEAD SCULPIN	C
							SPOTTAIL SHINER	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Whitemud River	ALL	3	Adult/Juvenile Habitat	2	Migration blockage	2	BLACK BULLHEAD	C
			Dissolved Oxygen	2	Agriculture	2	BLACKNOSE DACE	C
					Industrial	2	BLACKNOSE SHINER	C
					Municipal	2	BROOK STICKLEBACK	C
					Nonpoint source	2	BURBOT	C
					Water regulation	2	CARP	C
			Eggs/larvae habitat	2	Siltation	2	CISCO	C
			Human intervention	2	Water regulation	2	CREEK CHUB	C
			Nutrient Surplus	2	Agriculture	2	EMERALD SHINER	X
					Industrial	2	FATHEAD MINNOW	C
					Municipal	2	FINESCALE DACE	X
					Nonpoint source	2	FRESHWATER DRUM	C
					Urban runoff	2	JOHNNY DARTER	C
							NORTHERN PIKE	C
							PEARL DACE	X
							SAND SHINER	X
							SAUGER	C
							SHORTHEAD REDHORSE	C

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2 = Water bodies that have slight limitations to production of fish
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4 = Water bodies that have severe limitations to production of fish

2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Whitemud River (cont)							SPOTTAIL SHINER	X
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Winnipegosis, Lake	ALL	2	Fish Kills	1	Unknown	1	BLACKSIDED DARTER	X
			Human intervention	2	Other	1	BROOK STICKLEBACK	X
							BURBOT	C
							CARP	C
							CISCO	C
							EMERALD SHINER	X
							FATHEAD MINNOW	X
							GOLDEYE	X
							IOWA DARTER	X
							LAKE WHITEFISH	C
							LOGPERCH	X
							NINESPINE STICKLEBACK	X
							NORTHERN PIKE	C
							SAUGER	U
							SPOTTAIL SHINER	C
							TROUT PERCH	X
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C
Woody River	ALL	2	Eggs/larvae habitat	1	Siltation	1	BIGMOUTH BUFFALO	X
			Human intervention	1	Stress	1	BLACKNOSE DACE	X
							BLACKSIDED DARTER	C
							BROOK STICKLEBACK	X
							BROOK TROUT	X
							BROWN TROUT	X
							BURBOT	X
							COMMON SHINER	C
							CREEK CHUB	C

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2 = Water bodies that have slight limitations to production of fish
3 = Water bodies that have moderate limitations to production of fish
4 = Water bodies that have severe limitations to production of fish
2 - 1 = Minor Concern, 2 = Major Concern

Table B-4. (cont)

Water Body Name	Seasonal Habitat Suitability	Habitat Classification[1]	Habitat Conditions				Species Common Name	Presence
			Limiting Factors	Weight[2]	Probable Source	Weight[2]		
Woody River (cont)							GOLDEYE	X
							JOHNNY DARTER	X
							LONGNOSE DACE	X
							RAINBOW TROUT	X
							SAND SHINER	X
							SHORTHEAD REDHORSE	X
							SLIMY SCULPIN	X
							WALLEYE	X
							WHITE SUCKER	X
							YELLOW PERCH	X
Wuskwatim Lake	ALL	2	Contamination	1	Heavy Metals	1	BURBOT	C
			Turbidity	2	Bank erosion	2	CISCO	C
			Flow Levels - Above Optimum	2	Water regulation	2	LAKE WHITEFISH	C
							LONGNOSE SUCKER	C
							NORTHERN PIKE	C
							SAUGER	C
							WALLEYE	C
							WHITE SUCKER	C
							YELLOW PERCH	C

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2 = Water bodies that have slight limitations to production of fish
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4 = Water bodies that have severe limitations to production of fish

2 - 1 = Minor Concern, 2 = Major Concern

APPENDIX C. AQUATIC RESOURCE USE

Table C-1. Aquatic resource of selected water bodies within the Bipole III Transmission Line Study Area as indicated by FIHCS.

Major Basin	sub-basin	Water bodies	Wild Rice Lease	Commercial Fishing	Bait Fishing	Commercial Sport Fishing	Recreational Sport Fishing	Lodges
Nelson River	Lower Nelson River	Goose Creek					y	
		Limestone River					y	
		Stephens Lake					y	
		Split Lake		y			y	
		Assean Lake		y			y	
	Burntwood River	Orr Lake		y				
		Odei River					y	
		Burntwood River		y			y	
		Apussigamasi Lake		y			y	
		Mystery Lake					y	
		Birchtree Lake					y	
		Ospwagan Lake		y			y	
		Manasan River					y	
		Wuskwatim Lake		y				
		Threepoint Lake		y			y	
	Grass River	Grass River				y	y	y
		Phillips Lake					y	
		Halfway Lake		y			y	
		Setting Lake		y			y	
		Rock Island Lake		y				
		Bowden Lake		y			y	
		Kiski Lake		y			y	
		Dyce Lake	y	y				
		Wekusko Lake	y	y	y	y	y	y
		Reed Lake	y	y	y	y	y	y
		Paint Lake		y	y	y	y	y
		Pakwa Lake		y			y	
		File Lake		y		y	y	y
	Upper Nelson River	Hargrave Lake	y					
		Clarke Lake		y			y	
Churchill River	Lower Churchill River	Waskaiowaka Lake		y		y		y
Saskatchewan River	Clearwater Lake / Moose Lakes	North Moose Lake	y	y				
		South Moose Lake	y	y				
		Dolomite Lake	y	y		y	y	y
		Cormorant Lake	y	y	y	y	y	y
		Clearwater Lake		y		y	y	y
		Talbot Lake		y			y	
	Cedar Lake	Saskatchewan River		y	y	y	y	y
		Cedar Lake		y		y	y	y

Table C-1 (cont)

Major Basin	sub-basin	Water bodies	Wild Rice Lease	Commercial Fishing	Bait Fishing	Commercial Sport Fishing	Recreational Sport Fishing	Lodges
Lake Manitoba	Lake Winnipegosis	Overflowing River		y			y	
	Water	Lake Winnipegosis		y	y	y	y	y
		Dauphin Lake		y		y	y	y
		Lake Manitoba		y		y	y	y
		Red River			y		y	
		Mossy River		y			y	
		Red Deer Lake		y			y	
	Swan Lake	Swan River					y	
		Woody River					y	
	Duck Mountain	Sinclair River					y	
		North Duck River		y		y	y	y
		Sclater River		y		y	y	
		Garland River					y	
	Whitemud River	Whitemud River					y	
Assiniboine River	Central Assiniboine	Assiniboine River					y	
Red River	Morris River	Boyne River					y	
	Seine River	Seine River					y	
	Cooks Creek / Devils Creek	Cooks Creek			y		y	
	Rat River	Rat River					y	

Table C-2. Land use of selected water bodies within the Bipole III Study Area (FIHCS).

Water body name	Classification	Sub Classification
Apussigamasi Lake	Fisheries	Commercial Fishing stations and camps
	Recreation	Remote Cottaging
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Transportation and Transmission	Transmission Lines Crossing Sensitive Areas
	Water Development and control	Interbasin Water Transfers
Bell River	Agriculture	Farming (general)
	Forestry	Logging
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Boyne River	Agriculture	Farming (general)
	Agriculture	Feedlots
	Recreation	Campgrounds
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Channelization
	Water Development and control	Water Supply Impoundments
Burntwood River	Transportation and Transmission	Airports
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Sea plane bases
	Transportation and Transmission	Transmission Lines Crossing Sensitive Areas
	Water Development and control	Interbasin Water Transfers
	Waste Treatment/Disposal	Sewage Treatment Plants
	Waste Treatment/Disposal	Water Treatment Plants (wastewater)
Cedar Lake	Energy Production	Electric Generating station > 100MW
	Fisheries	Commercial Fishing stations and camps
	Fisheries	Sport fishing lodges/outcamps
	Forestry	Insecticide and Herbicide spraying
	Forestry	Logging
	Forestry	Main and Secondary Haul Roads
	Forestry	Sawmills
	Recreation	Campgrounds
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Lake Regulation
	Water Development and control	Water Supply Impoundments
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Clarke Lake	Recreation	Campgrounds
	Transportation and Transmission	All Season Roads
Cooks Creek	Agriculture	Farming (general)
	Energy Production	Thermal plants
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Railroads
	Transportation and Transmission	Sea plane bases
	Transportation and Transmission	Seasonal Roads
Dyce Lake	Agriculture	Wild Rice lease
	Fisheries	Commercial Fishing stations and camps
	Mining	Ongoing Exploration
	Transportation and Transmission	Railroads

Table C-2 (cont)

Water body name	Classification	Sub Classification
Fifteen Creek	Transportation and Transmission	All Season Roads
Garland River	Agriculture	Farming (general)
	Agriculture	Feedlots
	Forestry	Logging
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Goose Creek	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Transmission Lines Crossing Sensitive Areas
Grass River	Fisheries	Commercial Fishing stations and camps
	Fisheries	Sport fishing lodges/outcamps
	Forestry	Logging
	Recreation	Campgrounds
	Recreation	Cottage Development
	Recreation	Major Recreation and Tourism Development
	Recreation	Provincial, Municipal and Federal Parks
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Railroads
	Transportation and Transmission	Seasonal Roads
	Transportation and Transmission	Transmission Lines Crossing Sensitive Areas
Limestone River	Recreation	Remote Cottaging
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Railroads
	Transportation and Transmission	Seasonal Roads
	Transportation and Transmission	Transmission Lines Crossing Sensitive Areas
Manasan River	Water Development and control	Interbasin Water Transfers
Lake Manitoba	Agriculture	Farming (general)
	Agriculture	Feedlots
	Fisheries	Commercial Fishing stations and camps
	Fisheries	Fish Hatcheries
	Fisheries	Sport fishing lodges/outcamps
	Recreation	Campgrounds
	Recreation	Cottage Development
	Recreation	Major Recreation and Tourism Development
	Recreation	Provincial, Municipal and Federal Parks
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Railroads
	Transportation and Transmission	Sea plane bases
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Flood Control Works
	Water Development and control	Lake Regulation
	Water Development and control	Shoreline and Floodplain Development
	Water Development and control	Wetland Development
	Waste Treatment/Disposal	Sewage Treatment Plants
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
	Waste Treatment/Disposal	Water Treatment Plants (wastewater)
McMillan Creek	Transportation and Transmission	Transmission Lines Crossing Sensitive Areas
Morris River	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads

Table C-2 (cont)

Water body name	Classification	Sub Classification
Mossy River	Agriculture	Farming (general)
	Agriculture	Feedlots
	Fisheries	Commercial Fishing stations and camps
	Recreation	Cottage Development
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Lake Regulation
	Water Development and control	Stream/River Regulation
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
North Duck River	Agriculture	Farming (general)
	Agriculture	Feedlots
	Fisheries	Fish Hatcheries
	Forestry	Logging
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Odei River	Transportation and Transmission	All Season Roads
Ospwagan Lake	Fisheries	Commercial Fishing stations and camps
	Mining	Ongoing Exploration
	Transportation and Transmission	All Season Roads
Overflowing River	Fisheries	Sport fishing lodges/outcamps
	Forestry	Logging
	Recreation	Campgrounds
	Transportation and Transmission	All Season Roads
Paint Lake	Fisheries	Commercial Fishing stations and camps
	Forestry	Logging
	Mining	Ongoing Exploration
	Mining	Potash and Metal Producing > 1000 tons/da
	Recreation	Campgrounds
	Recreation	Cottage Development
	Recreation	Provincial, Municipal and Federal Parks
	Recreation	Remote Cottaging
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Phillips Lake	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
Rat Creek	Agriculture	Farming (general)
	Agriculture	Feedlots
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
Rat River	Agriculture	Farming (general)
	Forestry	Insecticide and Herbicide spraying
	Recreation	Fish and Wildlife Refugia and Management
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Stream/River Regulation
	Waste Treatment/Disposal	Wastewater Treatment Lagoons

Table C-2 (cont)

Water body name	Classification	Sub Classification
Red Deer Lake	Agriculture	Feedlots
	Fisheries	Commercial Fishing stations and camps
	Forestry	Logging
	Recreation	Campgrounds
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Waste Treatment/Disposal	Water Treatment Plants (wastewater)
Red River	Agriculture	Dairy plants
	Agriculture	Farming (general)
	Agriculture	Feedlots
	Agriculture	Food processing plants
	Agriculture	Meat processing/slaughtering plants
	Agriculture	Rendering plants
	Energy Production	Thermal plants
	Fisheries	Commercial Fishing stations and camps
	Forestry	Insecticide and Herbicide spraying
	Manufacturing	General Manufacturing/Processing Plants
	Recreation	Campgrounds
	Recreation	Cottage Development
	Recreation	Fish and Wildlife Refugia and Management
	Recreation	Major Recreation and Tourism Development
	Recreation	Provincial, Municipal and Federal Parks
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Pipelines Crossing Sensitive Areas
	Transportation and Transmission	Railroads
	Transportation and Transmission	Sea plane bases
	Transportation and Transmission	Seasonal Roads
	Transportation and Transmission	Transmission Lines Crossing Sensitive Areas
	Water Development and control	Flood Control Works
	Water Development and control	Shoreline and Floodplain Development
	Water Development and control	Stream/River Regulation
	Waste Treatment/Disposal	Sewage Treatment Plants
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
	Waste Treatment/Disposal	Water Treatment Plants (wastewater)
Rock Island Lake	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads

Table C-2 (cont)

Water body name	Classification	Sub Classification
Saskachewan River	Agriculture	Farming (general)
	Energy Production	Electric Generating station > 100MW
	Fisheries	Commercial Fishing stations and camps
	Forestry	Logging
	Forestry	Main and Secondary Haul Roads
	Forestry	Pulp and Paper Plants
	Forestry	Sawmills
	Recreation	Campgrounds
	Recreation	Cottage Development
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Railroads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Flood Control Works
	Water Development and control	Shoreline and Floodplain Development
	Water Development and control	Stream/River Regulation
	Water Development and control	Wetland Development
	Water Development and control	Within Basin Diversions
	Waste Treatment/Disposal	Sewage Treatment Plants
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
	Waste Treatment/Disposal	Water Treatment Plants (wastewater)
Sclater River	Agriculture	Farming (general)
	Agriculture	Feedlots
	Fisheries	Sport fishing lodges/outcamps
	Forestry	Logging
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Seine River	Agriculture	Farming (general)
	Agriculture	Feedlots
	Fisheries	Fish Hatcheries
	Manufacturing	General Manufacturing/Processing Plants
	Recreation	Provincial, Municipal and Federal Parks
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Pipelines Crossing Sensitive Areas
	Transportation and Transmission	Railroads
	Transportation and Transmission	Seasonal Roads
	Transportation and Transmission	Transmission Lines Crossing Sensitive Areas
	Water Development and control	Channelization
	Water Development and control	Flood Control Works
	Water Development and control	Stock Watering Dams
	Water Development and control	Stream/River Regulation
	Water Development and control	Water Supply Impoundments
	Water Development and control	Within Basin Diversions
	Recreation	Fish and Wildlife Refugia and Management
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
	Water Development and control	Irrigation
Seine River Diversion	Waste Treatment/Disposal	Wastewater Treatment Lagoons

Table C-2 (cont)

Water body name	Classification	Sub Classification
Sinclair River	Agriculture	Farming (general)
	Agriculture	Feedlots
	Forestry	Logging
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
Squirrel Creek	Agriculture	Farming (general)
	Agriculture	Feedlots
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Channelization
	Water Development and control	Flood Control Works
	Water Development and control	Water Supply Impoundments
Stephens Lake	Fisheries	Commercial Fishing stations and camps
	Recreation	Cottage Development
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Interbasin Water Transfers
	Water Development and control	Lake Regulation
	Water Development and control	Stream/River Regulation
	Water Development and control	Within Basin Diversions
	Energy Production	Electric Generating station > 100MW
Swan River	Agriculture	Farming (general)
	Agriculture	Feedlots
	Forestry	Sawmills
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Weir River	Transportation and Transmission	Railroads
	Transportation and Transmission	Transmission Lines Crossing Sensitive Areas
Whitemud River	Agriculture	Dairy plants
	Agriculture	Farming (general)
	Agriculture	Feedlots
	Agriculture	Meat processing/slaughtering plants
	Fisheries	Fish Hatcheries
	Forestry	Wood treatment plants
	Recreation	Provincial, Municipal and Federal Parks
	Transportation and Transmission	All Season Roads
	Water Development and control	Channelization
	Water Development and control	Irrigation
	Water Development and control	Stock Watering Dams
	Water Development and control	Water Supply Impoundments
	Waste Treatment/Disposal	Wastewater Treatment Lagoons

Table C-2 (cont)

Water body name	Classification	Sub Classification
Lake Winnipegosis	Agriculture	Farming (general)
	Agriculture	Feedlots
	Fisheries	Commercial Fishing stations and camps
	Fisheries	Fish Hatcheries
	Fisheries	Sport fishing lodges/outcamps
	Forestry	Logging
	Forestry	Wood treatment plants
	Mining	Ongoing Exploration
	Recreation	Campgrounds
	Recreation	Cottage Development
	Recreation	Provincial, Municipal and Federal Parks
	Transportation and Transmission	Airports
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Railroads
	Transportation and Transmission	Sea plane bases
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Channelization
	Water Development and control	Flood Control Works
	Water Development and control	Shoreline and Floodplain Development
	Water Development and control	Wetland Development
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Woody River	Agriculture	Farming (general)
	Agriculture	Feedlots
	Forestry	Logging
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Assean Lake	Transportation and Transmission	All Season Roads
Assiniboine River	Agriculture	Farming (general)
	Agriculture	Feedlots
	Agriculture	Food processing plants
	Agriculture	Irrigation
	Energy Production	Thermal plants
	Recreation	Campgrounds
	Recreation	Provincial, Municipal and Federal Parks
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Railroads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Flood Control Works
	Water Development and control	Stream/River Regulation
	Water Development and control	Water Supply Impoundments
	Water Development and control	Within Basin Diversions
	Waste Treatment/Disposal	Sewage Treatment Plants
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Birch Tree Lake	Water Development and control	Interbasin Water Transfers
	Water Development and control	Lake Regulation
	Water Development and control	Stream/River Regulation
	Water Development and control	Within Basin Diversions
Bowden Lake	Fisheries	Commercial Fishing stations and camps
	Transportation and Transmission	All Season Roads
	Waste Treatment/Disposal	Wastewater Treatment Lagoons

Table C-2 (cont)

Water body name	Classification	Sub Classification
Clearwater Lake	Fisheries	Fish Hatcheries
	Fisheries	Sport fishing lodges/outcamps
	Forestry	Logging
	Forestry	Main and Secondary Haul Roads
	Mining	Ongoing Exploration
	Recreation	Campgrounds
	Recreation	Cottage Development
	Recreation	Major Recreation and Tourism Development
	Recreation	Provincial, Municipal and Federal Parks
	Transportation and Transmission	Airports
	Transportation and Transmission	Seasonal Roads
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Cormorant Lake	Agriculture	Wild Rice lease
	Fisheries	Commercial Fishing stations and camps
	Fisheries	Sport fishing lodges/outcamps
	Forestry	Logging
	Forestry	Main and Secondary Haul Roads
	Mining	Ongoing Exploration
	Recreation	Campgrounds
	Recreation	Cottage Development
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Lake Regulation
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Dauphin Lake	Agriculture	Farming (general)
	Agriculture	Feedlots
	Fisheries	Commercial Fishing stations and camps
	Fisheries	Sport fishing lodges/outcamps
	Recreation	Campgrounds
	Recreation	Cottage Development
	Recreation	Major Recreation and Tourism Development
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Lake Regulation
	Water Development and control	Shoreline and Floodplain Development
	Water Development and control	Wetland Development
	Waste Treatment/Disposal	Sewage Treatment Plants
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
Dolomite Lake	Agriculture	Wild Rice lease
	Fisheries	Commercial Fishing stations and camps
	Mining	Ongoing Exploration
File Lake	Fisheries	Commercial Fishing stations and camps
	Mining	Ongoing Exploration
	Recreation	Remote Cottaging
Halfway Lake	Fisheries	Commercial Fishing stations and camps
	Forestry	Logging
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Railroads

Table C-2 (cont)

Water body name	Classification	Sub Classification
Hargrave Lake	Agriculture	Wild Rice lease
	Mining	Ongoing Exploration
	Transportation and Transmission	Seasonal Roads
Kiski Lake	Fisheries	Commercial Fishing stations and camps
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
Mystery Lake	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Interbasin Water Transfers
North Moose Lake	Agriculture	Wild Rice lease
	Fisheries	Commercial Fishing stations and camps
	Forestry	Logging
	Forestry	Main and Secondary Haul Roads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Lake Regulation
Pakwa Lake	Fisheries	Commercial Fishing stations and camps
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
Reed Lake	Agriculture	Wild Rice lease
	Fisheries	Sport fishing lodges/outcamps
	Forestry	Logging
	Forestry	Main and Secondary Haul Roads
	Mining	Ongoing Exploration
	Recreation	Campgrounds
	Recreation	Provincial, Municipal and Federal Parks
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Sea plane bases
Setting Lake	Fisheries	Commercial Fishing stations and camps
	Forestry	Logging
	Forestry	Main and Secondary Haul Roads
	Recreation	Campgrounds
	Recreation	Cottage Development
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Seasonal Roads
South Moose Lake	Agriculture	Wild Rice lease
	Fisheries	Commercial Fishing stations and camps
	Forestry	Logging
	Forestry	Main and Secondary Haul Roads
	Recreation	Remote Cottaging
	Transportation and Transmission	All Season Roads
	Water Development and control	Lake Regulation
	Water Development and control	Water Supply Impoundments
	Waste Treatment/Disposal	Wastewater Treatment Lagoons

Table C-2 (cont)

Water body name	Classification	Sub Classification
Split Lake	Fisheries	Commercial Fishing stations and camps
	Transportation and Transmission	Airports
	Transportation and Transmission	All Season Roads
	Transportation and Transmission	Railroads
	Transportation and Transmission	Seasonal Roads
	Water Development and control	Interbasin Water Transfers
	Water Development and control	Lake Regulation
	Water Development and control	Stream/River Regulation
	Water Development and control	Within Basin Diversions
	Waste Treatment/Disposal	Wastewater Treatment Lagoons
	Energy Production	Electric Generating station > 100MW
Talbot Lake	Fisheries	Commercial Fishing stations and camps
	Forestry	Logging
	Forestry	Main and Secondary Haul Roads
	Transportation and Transmission	All Season Roads
Threepoint Lake	Fisheries	Commercial Fishing stations and camps
	Water Development and control	Interbasin Water Transfers
	Water Development and control	Lake Regulation
	Water Development and control	Stream/River Regulation
	Water Development and control	Within Basin Diversions
Waskaiowaka Lake	Fisheries	Sport fishing lodges/outcamps
	Transportation and Transmission	Airports
Wekusko Lake	Agriculture	Wild Rice lease
	Fisheries	Commercial Fishing stations and camps
	Fisheries	Sport fishing lodges/outcamps
	Forestry	Logging
	Forestry	Main and Secondary Haul Roads
	Mining	Ongoing Exploration
	Mining	Surface and Underground Mines
	Recreation	Campgrounds
	Recreation	Cottage Development
	Transportation and Transmission	All Season Roads
Wuskwatim Lake	Fisheries	Commercial Fishing stations and camps
	Water Development and control	Interbasin Water Transfers
	Water Development and control	Lake Regulation
	Water Development and control	Stream/River Regulation
	Water Development and control	Within Basin Diversions

Table C-3. Species quotas and restrictions for commercial lakes within the Study Area.

Waterbody	Species	Closed Time	Mesh Size Extension Measure (mm)	Round Weight Quota (Kilograms in the aggregate)
Lake Winnipegosis	Walleye	April 1 to July 11, September 6 to March 31	not less than 102	specified on commercial fisherman's Quota Entitlement
	All Species	April 1 to when ice makes on or after Nov. 1	not less than 102	Unlimited
	Carp and Sucker	Oct. 30 to Nov. 1	not less than 203	Unlimited
Lake Manitoba	Walley and Sauger	March 16 to when ice makes on or after Nov. 1	not less than 95	907,200
	Carp and Sucker	Oct. 30 to Nov. 1	not less than 203	Unlimited
Assean Lake	Walleye and Pike	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	4,600
Cedar Lake	Walleye, Goldeye, Whitefish and Sauger	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	496,600 of which not more than 300,000 kg may be walleye
Clearwater Lake	Walleye, Whitefish and Pike	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	9,100
Cormorant Lake	Walleye, Trout and Pike	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	20,500 (to be divided between two individual quotas of 9,100 kg and 11,400 kg/license)
Dauphin Lake	1. Walleye 2. Carp and Sucker	1. Feb. 1 to when ice makes on or after Nov.14 2. Oct. 30 to Nov. 1	1. not less than 102 2. not less than 203	1. individual quotas, with total of all quotas not exceeding 8,000 kg of walleye 2. Unlimited
Dolomite Lake	Walleye, Whitefish and Pike	May 1 to when ice makes on or after Nov. 1	not less than 108	2,300 of which not more than 500 kg may be walleye and pike
Dyce Lake	Walleye, Whitefish and Pike	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	2,300
Halfway Lake	Whitefish	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	13,700
Kiski Lake	Walleye and Pike	1. May 16 to July 14 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	4,600
North Moose Lake (North Arm)	Walleye and Whitefish	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	Zone 1: 34,100 Zone 2: 11,400 (Zone 2-6: individual quotas of 1,900 kg/license)
South Moose Lake (East Arm)	Walleye and Whitefish	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 127	34,100
South Moose Lake (Pickerel Channel)	Walleye and Whitefish	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	136,100
Ospwagan Lake	Walleye, Whitefish and Pike	1. May 1 to July 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	4,600 of which not more than 500 kg may be walleye

Table C-3 (cont)

Waterbody	Species	Closed Time	Mesh Size Extension Measure (mm)	Round Weight Quota (Kilograms in the aggregate)
Pakwa Lake	Walleye and Pike	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	20,000 of which not more than 10,000 kg may be walleye
Red Deer Lake	Walleye	Apr. 1 to when ice makes on or after Nov. 1	not less than 102	20,000
Saskatchewan River	Walleye, Goldeye, Pike and Sauger	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	90,700
Setting Lake	Walleye and Pike	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	27,300 (individual quota of 6,825 kg/license of which not more than 2,300 kg may be walleye)
Split Lake	Walleye, Goldeye, Sauger, Whitefish and Pike	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	59,000
Talbot Lake	Walleye	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	12,500
Threepoint Lake	Walleye and Whitefish	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 127	4,600
Wekusko Lake	Walleye, Sauger, Whitefish and Pike	Apr. 1 to when ice makes on or after Nov. 1	not less than 108	80,800 of which not more than 10,000 kg may be walleye
Wuskwatim Lake	Walleye and Whitefish	1. May 1 to May 31 2. Oct. 31 to when ice makes on or after Nov. 1	not less than 108	18,200

Table C-4. Fishing lodges and outfitters operating on select water bodies within the study area.

Location	Lodge / Outfitter	Lakes	Number of beds	Lodge / Outcamp
Cedar lake	Hobbs Resort	Cedar Lake		Lodge
	Moak Lodge	Cedar Lake	11	Lodge
	Pine Grove Cabins	Cedar Lake	48	Lodge
	River View Cabins	Cedar Lake		Lodge
Grass River	Seven Lakes Lodge	File Lake		Outcamp
		Morton Lake		
		Corley Lake		
		Vickers		
		Loonhead		
Lake Manitoba	Lake Manitoba Narrows Lodge	Lake Manitoba	60	Lodge
	Rainbow Camp	Lake Manitoba	8	Lodge
	St. Ambroise Hunting and Fishing Lodge	Lake Manitoba		Lodge
North Duck River	Trapper Don's Lodge & Outfitting Services	North Duck River	12	Lodge
Paint Lake	Pat's Paint Lake Resort	Paint Lake		Lodge
	Reid's Paint Lake Marina	Paint Lake	22	Lodge
Saskatchewan River	Riverview Lodge	Saskatchewan River	46	Lodge
Lake Winnipegosis	Riverside Lodge	Lake Winnipegosis	12	Lodge
Clearwater Lake	Carpenter's Clearwater Lodge	Clearwater Lake		Lodge
	Evergreen Resort	Clearwater Lake		Lodge
	The New Vickery Lodge	Clearwater Lake		Lodge
Cormorant Lake	Cormorant Lake Lodge	Cormorant Lake		Lodge
Reed Lake	Reed Lake Lodge	Reed Lake		Lodge
		Morton Lake		
Waskaiowaka Lake	Dunlop's Fly-in Lodge & Outpost	Waskaiowaka Lake		Lodge
		Campbell Lake		Outcamp
		Pelletier Lake		Outcamp

Table C-5. Fish stocking information for lakes in the Bipole III Transmission Study Area.

Waterbody	Year	Date	Common Name	Number Stocked	Lifestage
Bowden Lake	2002	Jun-14	Lake Trout	15,000	Fry
	2009	Sep-24	Lake Trout	10,000	Fingerling
Cormorant Lake	2002	Jul-03	Lake Trout	50,000	Fry
	2009	Sep-30	Lake Trout	49,000	Fingerling
Dauphin Lake	2002	May-30	Walleye	100,000	Fry
	2008	May-26	Walleye	100,000	Fry
	2009	May-26	Walleye	100,000	Fry
Lake Manitoba	2002	May-24	Walleye	21,551,000	Fry
		May-22	Walleye	17,600,000	Fry
		May-22	Sauger	400,000	Eyed eggs
	2003	May-22	Walleye	29,050,500	Fry
	2004	May-15	Walleye	30,725,000	Fry
	2005	May-17	Walleye	n/a	Fry
	2006		Walleye	10,000,000	Fry
	2007		Walleye	41,100,000	Fry
	2008	May-08	Walleye	44,000,000	Fry
	2009	May-06	Walleye	2,000,000	Fry
		May-23	Walleye	600,000	Fry
		May-24	Walleye	1,500,000	Fry
		May-24	Walleye	500,000	Fry
		May-24	Walleye	500,000	Fry
		May-24	Walleye	1,000,000	Fry
		May-25	Walleye	500,000	Fry
		May-25	Walleye	20,000	Fry
		May-27	Walleye	1,100,000	Fry
		May-28	Walleye	1,500,000	Fry
		May-29	Walleye	400,000	Fry
		May-29	Walleye	200,000	Fry
		May-29	Walleye	500,000	Fry
		May-29	Walleye	2,000,000	Fry
		May-29	Walleye	1,500,000	Fry
Lake Winnipegosis	2002	May-23	Walleye	1,000,000	Eyed eggs
		May-29	Walleye	5,000,000	Fry
	2003	May-20	Walleye	5,200,000	Fry
	2004	May-26	Walleye	3,000,000	Fry
	2005	May-20	Walleye	5,000,000	Fry
	2006		Walleye	3,900,000	Fry
	2007		Walleye	5,000,000	Fry
	2008	May-25	Walleye	5,000,000	Fry
	2009	May-26	Walleye	600,000	Fry
		May-26	Walleye	600,000	Fry
		May-27	Walleye	800,000	Fry
Upper Ospawagan Lake	2002	Jun-14	Lake Trout	35,000	Fry
	2004	Jun-26	Lake Trout	25,000	Fingerling
	2009	Sep-10	Lake Trout	50,000	Fingerling
		Sep-24	Lake Trout	30,000	Fingerling

Table C-5 (cont)

Waterbody	Year	Date	Common Name	Number Stocked	Lifestage
Overflowing River	2002	May-27	Walleye	800,000	Fry
	2004	Jun-02	Walleye	1,000,000	Fry
Steeprock River	2002	Sep-26	Brook Trout	10,000	Fry
		May-27	Walleye	400,000	Fry
	2003	Sep-16	Brook Trout	12,000	Fingerling
	2005	May-18	Brook Trout	7,000	Fingerling
	2006		Brook Trout	3,800	Fingerling
	2007		Brook Trout	6,000	Fingerling
	2008	May-27	Brook Trout	3,000	18+ cm
		May-27	Brook Trout	3,000	Fingerling