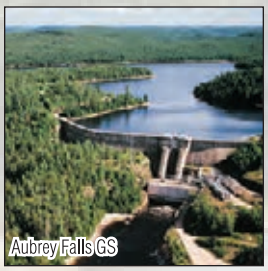
Brookfield Renewable Power

Ontario

Mississagi River Water Management Plan

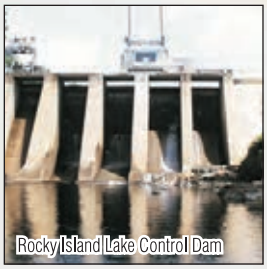
Volume -1 Main Report

March 2010


Aubrey Falls GS


Rayner GS


Wells GS


Rocky Island Lake Control Dam


Red Rock GS

prepared by

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prepared by

HATCH™

This water management plan has been prepared exclusively for Brookfield Renewable Power (BRP) and the Ontario Ministry of Natural Resources (MNR). Any use of this plan by any other party is done at their own risk and the authors hereby disclaim any responsibility or liability in connection therewith. This plan is based on information gathered by Brookfield Renewable Power, MNR, Hatch, Natural Resource Solutions Inc., and Water's Edge and contains opinions, conclusions and recommendations using professional judgment and care.

Acknowledgment

Input provided by the Planning Team, Steering Committee, Public Advisory Committee (PAC) and government agency reviewers to this water management plan is gratefully acknowledged. BRP, MNR and the PAC particularly wish to posthumously acknowledge the valuable contribution made by the following:

- Dale Peters, for his technical knowledge of water power operations on the Mississagi River, including his assistance with modelling of the water management options, and assessing the energy value of various options
- Larry Kissau, for his contribution to the identification of values and issues, assistance with the Resort User Survey, and the wildlife nesting platform monitoring program.

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1 Approval Page

1. Approval Page

Water Management Plan
for the
Mississagi River
Ministry of Natural Resources, Sault Ste. Marie District
Northeast Region
for the 10-year period April 1, 2010 to March 31, 2020

In submitting this plan, we confirm that this water management plan has been prepared in accordance with Water Management Planning Guidelines for Waterpower, as approved by the Minister of Natural Resources on May 14, 2002.

Normand Perreault Eng. — 16/02/10
Normand Perreault Eng.
Vice-President, Canadian Operations
Brookfield Renewable Power
Gatineau, Quebec

Phil Reader — FEB 17/2010
Phil Reader, General Manager
Mississagi Operations
Brookfield Renewable Power, Thessalon, Ontario

I concur that this water management plan has been prepared in accordance with Water Management Planning Guidelines for Waterpower, as approved by the Minister of Natural Resources on May 14, 2002, and recommend it be approved for implementation.

Bob Johnston — Feb 26/10
Bob Johnston, District Manager
Sault Ste. Marie District
Ministry of Natural Resources and
Chair, Steering Committee

Approved by:

Corrinne Nelson — March 22/10
Corrinne Nelson, A/Director
Northeast Region
Ministry of Natural Resources

Approval of this plan does not relieve the owner/operators from their responsibility to comply with any applicable legislation or provide authority to flood private or public lands without the consent of the owners of the affected land. Nothing in this water management plan (WMP) precludes the Minister from making further orders under the Lakes and Rivers Improvement Act. Also, approval of this plan does not imply that existing dam(s) meet with safe design, operation, maintenance, inspection, monitoring and emergency preparedness to provide for the protection of persons and property under the Lakes and Rivers Improvement Act (LRIA).

In 2008, MNR revised its Statement of Environmental Values (SEV) under the Environmental Bill of Rights (EBR). The SEV is a document that describes how the purposes of the EBR are to be considered whenever decisions are made that might significantly affect the environment are made by the Ministry. During the development of this WMP, the Ministry has considered its SEV.

2 Introduction, Plan Rationale and Guiding Principles

2 Introduction, Plan Rationale and Guiding Principles

2.1 Introduction and Background

Brookfield Renewable Power (BRP) owns and operates four waterpower facilities, along the Mississagi River [Aubrey Falls Generating Station (GS), Wells GS, Rayner GS, and Red Rock Falls GS]. The Mississagi River watershed is situated in the Sudbury and Algoma Districts north of Lake Huron and originates at Lebel Lake, located approximately 110 km northeast of the City of Elliot Lake (Figure 2.1). The river runs generally southwest from its origin, through Rocky Island Lake, a primary storage reservoir for the four downstream generating stations on the river system. From there the river generally follows a meandering pattern south through Aubrey Lake, Tunnel Lake and Red Rock Lake, prior to emptying into the North Channel of Lake Huron, approximately 5 km west of the Town of Blind River. The Mississagi River above Tunnel Lake has been designated a provincial park (see Section 4.8, Figure 4.3) and Highway 129 is located adjacent to the east bank.

The year of commissioning and installed capacities for the four generating stations are provided in Table 2.1. These stations operate as a cascading system with each facility dependent on flow released from upstream facilities. Aubrey Falls, Rayner and Wells GS are operated as peaking facilities, meaning that they store water in their reservoirs for use during peak demand hours. Red Rock Falls GS reregulates the flow from the upstream generating facilities resulting in a more uniform generation pattern to the lower river throughout the day.

Table 2.1
Generating Stations on the Mississagi River

Generating Station	Year Commissioned	Capacity (MW)
Aubrey Falls	1969	162
Rayner	1950	46
Wells	1970	239
Red Rock Falls	1961	41
Totals		488

Prior to this water management plan (WMP), there was an interim WMP in place for the Mississagi River that broadly followed the voluntary operating practices implemented by Ontario Power Generation (OPG). OPG owned and operated the waterpower facilities prior to their purchase by Mississagi Power Trust (MPT) in May 2002. Brookfield Renewable Power (formerly Brascan Power) has an operating agreement with MPT for the Mississagi facilities and a controlling interest in the Great Lakes Hydro Income Fund (GLHIF). GLHIF is the parent company of MPT. Brookfield Renewable Power will be referred to as the owner and operator of the Mississagi River generating facilities for the remainder of this plan. The interim plan takes into consideration the multiple water resource uses and beneficiaries on the Mississagi system and reflects a multifaceted ecosystem approach to water management in that it makes provision for water power generation, flood management, fisheries protection, scenic flows during the summer, and flow restrictions to accommodate recreational users of the downstream channel.

Section 23.1 of the Lakes and Rivers Improvement Act (LRIA) gives the Minister of Natural Resources the authority to require that a water management plan be prepared by water power producers in the province. The Ministry of Natural Resources (MNR) has requested a new water management plan be developed for the Mississagi River using MNR's *Water Management Planning Guidelines for Waterpower* (MNR, 2002).

2.2 Plan Rationale and Purpose

Most existing waterpower facilities have operating plans in place, and many accommodate the multiple uses of a river system. However, MNR has indicated that "the absence of a formal planning framework for managing existing waterpower facilities in conjunction with other riverine interests has often resulted in inconsistent valuing of environmental, social and economic attributes, rather than a balancing of resource values among waterpower operators, First Nations, resource users, interest groups and resource managers" (MNR, 2002).

The purpose of water management planning is to ensure that due consideration is given to all aspects of the existing ecosystem when selecting a preferred water management strategy that may encompass water power, flood control, and natural resource management, as well as commercial, recreational, cultural and heritage activities. Accordingly, WMPs are developed through public, agency and First

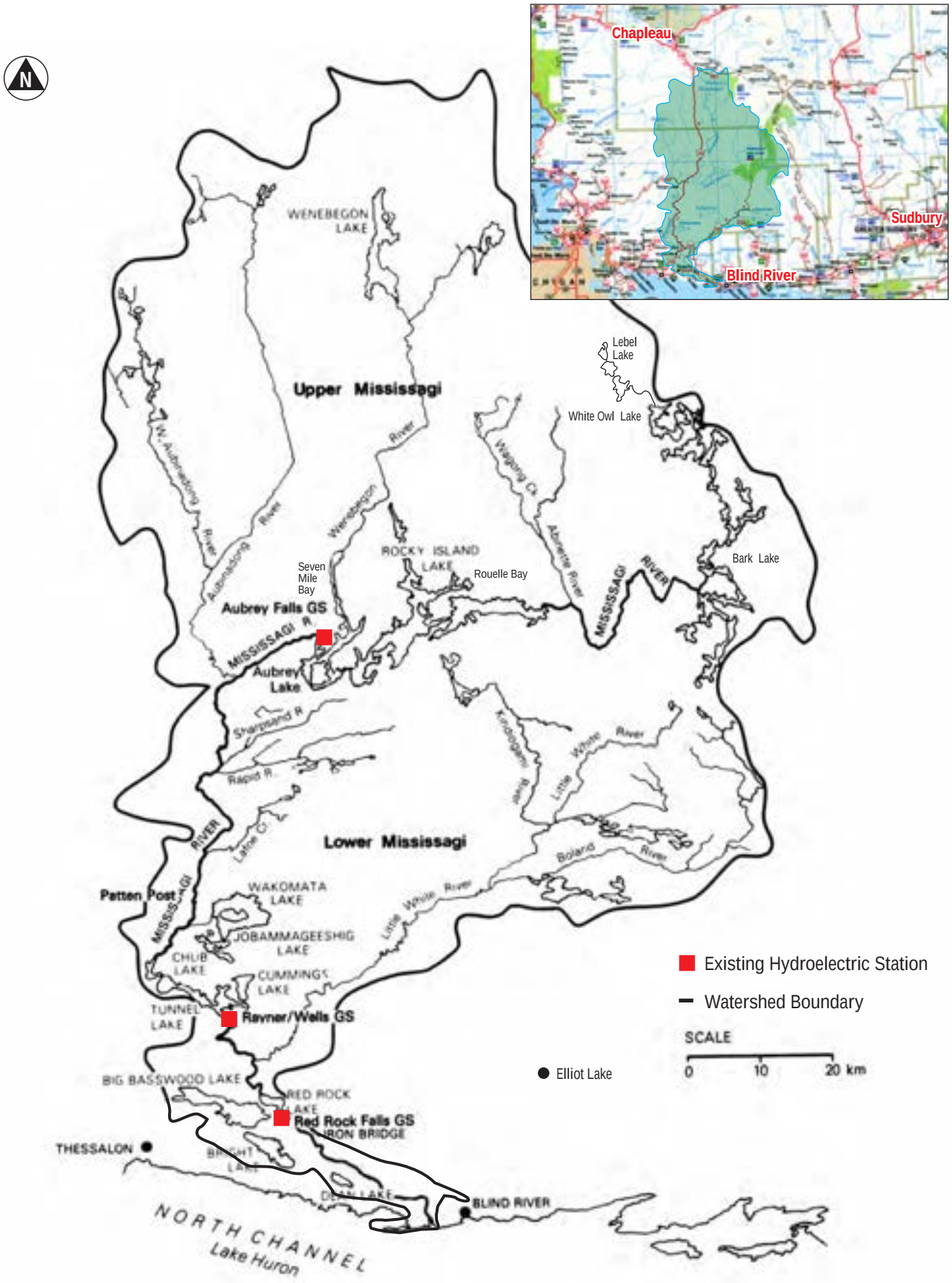

Figure 2.1
Brookfield Renewable Power
Mississagi River Water Management Plan
Location Map

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Nation consultation in an effort to achieve a balanced plan that considers the interests of all parties involved in the planning process.

2.3 Plan Goal and Guiding Principles

The goal of water management planning is to "contribute to the environmental, social and economic well being of the people of Ontario through the sustainable development of waterpower resources and to manage these resources in an ecologically sustainable way for the benefit of present and future generations. This will be achieved through the management of water levels and flows as they are affected by the operations of waterpower facilities and associated water control structures" (MNR, 2002).

The following principles, as defined in the *Water Management Planning Guidelines for Waterpower* (MNR, 2002), guide planning through the preparation, review, approval and implementation of the WMP:

- Strive to maximize the net environmental, social and economic benefits to society.
- Seek to improve and, where possible, restore riverine ecosystems.
- Use the best available information at the time of decision making during preparation of the WMP.
- Conduct a thorough assessment of a reasonable number of options in an open and participatory way.
- Use an adaptive management approach to planning, resource protection and enhancement.
- Implement water management recommendations (based on results of effectiveness monitoring study findings or other information) arising after the approval of the WMP, in a timely manner.
- Undertake water management planning without prejudice to the rights of Aboriginal people and treaty rights.

- Encourage public participation to ensure accountability and transparency in the planning process.

2.4 Terms of Reference

Terms of Reference for the Mississagi River Water Management Plan were prepared by Brookfield Renewable Power's consultant in consultation with the MNR (Blind River and Sault Ste. Marie) and approved by MNR's Northeast Regional Director (South Porcupine). The approved Terms of Reference are included in Appendix A. Some changes to the planning team and steering committee have occurred during the water management planning process, and an updated listing of members is provided in Appendix B.

2.5 Scoping for the Water Management Plan

In accordance with MNR's Water Management Planning Guidelines for Waterpower (MNR, 2002), the scope of the WMP for the Mississagi River focused on the existing waterpower facilities and associated water control structures on the river, as well as the environmental, social and economic issues related to the management of water flows and levels on the river.

More specifically, the WMP for the Mississagi River focused on the stretch of river between Rocky Island Lake (uppermost reservoir) and the mouth of the Mississagi River as well as those portions of tributaries that may be influenced by waterpower operations on the Mississagi River. The river reach between Rocky Island Lake and Tunnel Lake (Figure 2.1) is part of Mississagi River Provincial Park (also see Section 4.8, Figure 4.3).

Scoping for this WMP included the following activities:

- identification of WMP objectives
- description of the physical, biological and social/socioeconomic environment (resource values/baseline conditions)
- identification of issues and data gaps (including public and First Nations consultation)
- baseline data collection program to fill data gaps

- documentation of existing water management strategy

- preparation of a scoping report (Acres, 2004).

2.6 Water Management Plan Objectives

The primary objective of this WMP was to review current hydro plant operations on the Mississagi River to determine whether improvements could be made to any of the multiple uses of the water resource of the Mississagi River for power production, flood management, aquatic ecology and habitat, and tourism/ recreational activities. As noted in MNR's water management planning guidelines (MNR, 2002), "operating regimes that reduce or eliminate adverse effects and increase net benefits without diminishing the waterpower facilities' financial performance, are preferred over those that would require revenues to be foregone."

A more specific objective was to address the priority issues that were identified during the WMP process as described in Section 6 (Table 6.5) of this WMP. It is acknowledged, however, as noted in MNR's Water Management Planning Guidelines for Waterpower (MNR, 2002a) "that there are practical limits to the changes that can be made within a planning cycle."

2.7 Public Consultation

Public consultation was an important part of the water management planning process. A public consultation program was developed early in the planning process and is included in Appendix C. A listing of Public Advisory Committee (PAC) members is included in Appendix B.

The first series of Public Information Centres (PIC) were held as follows:

- Elliot Lake Public Information Centre No. 1 – June 2, 2003
- Iron Bridge Public Information Centre No. 1 – June 5, 2003.

The purpose of the first series of open houses was to advise stakeholders and the general public of the water management planning process underway for the Mississagi River and to solicit input on the environmental/socioeconomic environment within the watershed and any issues to be addressed related to water

levels and flows. Ten people (including 2 PAC members) attended the Open House in Elliot Lake, and 26 people (including 4 PAC members) attended the Open House in Iron Bridge. The issues raised at the PICs are presented in Section 6 of this WMP.

A second PIC was held in Iron Bridge on May 26, 2004. The purpose of the second public consultation opportunity was to

- provide an opportunity for public review and comment on the scoping phase of the WMP process
- provide additional opportunities to contribute input to the WMP process.

Seventeen people signed in at the open house not including several PAC members who also attended the session. Two completed forms were submitted at the second PIC and only one additional issue was raised, i.e., low water levels below Red Rock Falls GS, especially from December 2003 to March 2004, when a resident had an insufficient well water supply. The latter issue was added to the list of public issues in Section 6.1, Table 6.2.

A third PIC was held in Iron Bridge on June 27, 2007. The purpose of the third public consultation opportunity was to

- provide an opportunity for public review and comment on the water management options considered and to examine the options report
- review and comment on the preliminary preferred water management strategy
- advise the public on the final stages of the water management planning process prior to finalization and approval of the plan by MNR.

Approximately 20 to 25 people attended the June 2007 Information Centre in Iron Bridge (13 signed in). When asked whether they were in agreement with the proposed WMP for the Mississagi River, the following responses were received.

		In Agreement with Plan		
	No. Submitting Comment Forms	**Yes**	**No**	**Unsure**
Iron Bridge PIC	7	1	3*	3

* All three "no" responses were related to navigation during low summer water levels on Rocky Island Lake. One of the "no" responses also noted high water levels on Aubrey Lake from May to July 2007 (when substantial rain occurred in June but BRP was still below their legal Full Supply Level).

As a result of the concerns noted above, further investigations were undertaken and the results are presented in Section 9.7 of this WMP.

A fourth PIC was held in Iron Bridge on August 19, 2009. The purpose of the fourth public consultation opportunity was to

- advise the public on maintenance activities proposed for the Rocky Island Lake area to improve access and navigation during low summer water levels
- provide an opportunity for public review and comment on the draft WMP
- review and comment on the proposed effectiveness monitoring plan
- advise the public on the final stages of the WMP process leading to approval of the plan by MNR.

Three members of the public signed in at the August 2009 Information Centre in Iron Bridge. No issues were raised and no comment forms were completed.

2.8 First Nation Participation

A First Nation Participation Protocol is included in Appendix D. Meetings and activities with First Nations are also documented in Appendix D. Issues raised by the Mississauga First Nation are noted in Section 6.3 of this plan and in the Summary of Aboriginal Involvement (Appendix D). No issues were raised by Thessalon First Nation (FN).

First Nation Information Centres were held at the Mississauga First Nation's facilities on June 3, 2003, May 27, 2004, June 26, 2007, and August 20, 2009.

Seventeen First Nation members attended the June 2003 Information Centre. Issues raised at that time are noted in Section 6.3 of this plan. Ten First Nation members attended the May 2004 Information Centre. No issues were raised at this Information Centre.

Approximately 35 people attended the June 2007 Information Centre held at the Mississauga First Nation Band Office (29 signed in). When asked whether they were in agreement with the proposed WMP for the Mississagi River, the following responses were received.

		In Agreement with Plan		
	No. Submitting Comment Forms	**Yes**	**No**	**Unsure**
Mississauga FN Information Centre	5	2	-	3

A committee of the Mississauga FN met separately with the planning team on August 20, 2009 prior to the Information Centre held on the same date. At that meeting, three comment forms were completed, all indicating their agreement with the mitigation efforts proposed to make the proposed minimum summer water level (405 m) on Rocky Island Lake more acceptable (also see Section 9.4). Also at that meeting, an erosion issue was raised regarding a cemetery site near the Mississagi River Delta, which was added to the First Nations issues list (see Section 6, Table 6.3). Mississauga FN, BRP and MNR subsequently had a site visit on October 14, 2009 to investigate the concern (see Section 8.1.19 for results).

One Mississauga FN band member signed in at the August 2009 Information Centre but no issues were raised

A presentation was made by MNR (Blind River) to the Thessalon FN Council on March 21, 2007 on WMP activities and the status regarding completion of the plan. No issues were raised by Thessalon FN council members. A presentation and/or Information Centre was also offered to the Thessalon FN in July 2009 but was unable to be arranged.

2.9 Environmental Bill of Rights

MNR issued an order for Mississagi Power Trust (now owned/operated by Brookfield Renewable Power) to prepare a WMP under Section 23(1) of the LRIA. This action caused the WMP to be subject to publishing in the EBR registry in accordance with Ontario Regulation 681/94 (EBR Classification of Proposals for Instruments).

The EBR Registry Number for the Mississagi WMP is XB03E2002. The first notice was published on January 29, 2003, with subsequent updated notices published on July 11, 2005, and June 18, 2007. Copies of these EBR notices are included in Appendix L.

3 Physical and Biological Environment (Including Resource Values)

3 Physical and Biological Environment (Including Resource Values)

This section describes the existing physical and biological environment within the Mississagi River watershed. The primary focus of the WMP is on the Mississagi River, its shoreline and the mouths of its tributaries where the existing dams and generating facilities affect water levels and flows (Figure 3.1).

3.1 Physical Environment

3.1.1 Climate

The climate of the area is classified as continental with some slight moderation due to the presence of Lake Huron. Typically, winters are cold and summers warm, with maximum precipitation accumulation in early fall. Meteorological conditions have been monitored within the river basin for over 40 years from weather data collected for Environment Canada's Mississagi Climate Station near the Rayner GS by Ontario Hydro. January is the coldest month with a mean minimum temperature of -17.4^{o}C and July is the warmest with a mean daily maximum temperature of 25.7^{o}C. The mean annual temperature is 4.4^{o}C. Based on climate normals for the Mississagi Climate Station, given in Table 3.1, the average annual precipitation is 977 mm with 735 mm falling as rain and 242 mm as the water equivalent of snowfall. Rainfall is heaviest in August through October and snowfall is greatest in December and January (Table 3.1). The frost-free period averages 100 days in the northern part of the watershed, to 120 days along the Lake Huron shoreline. On average, there are 1138 cumulative degree-days of freezing each year. River and lake freeze-up typically occurs in early December followed by river ice breakup in early April and lake ice cover breakup in late April. Mean annual precipitation and evapotranspiration for the Mississagi River basin are estimated at 900 mm and 450 mm, respectively.

3.1.2 Geology, Surficial Geology and Topography

The watershed lies within the Precambrian Shield. The northern section (approximately north of Wakomata Lake) is within the Superior Province of the Shield and in particular the Abitibi Belt subprovince. Rocks here are of Archaean age (early Precambrian) and are mainly metamorphosed volcanic

Table 3.1
Climate Normals, 1971 to 2000
Mississagi Station
(Latitude 46°25.800N; Longitude 83°22.800W)
(Environment Canada Website)

Criteria	Month												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Maximum Daily Temperature (°C)	-5.5	-3.7	2.4	10.2	18.6	22.9	25.7	24.2	18.6	11.1	3.5	-2.9	10.4
Minimum Daily Temperature (°C)	-17.4	-17.0	-10.3	-2.0	3.9	8.7	12.0	11.4	7.2	1.5	-4.8	-12.6	-1.6
Mean Daily Temperature (°C)	-11.5	-10.4	-4.0	4.1	11.3	15.8	18.9	17.8	13.0	6.3	-0.6	-7.8	4.4
Mean Rainfall (mm)	7.6	4.9	32.2	61.6	76.8	80.4	82.8	96.0	105.7	102.6	65.7	19.2	735.3
Mean Snowfall (mm)*	65.5	42.2	31.8	9.1	0.1	0.0	0.0	0.0	0.0	1.9	22.1	69.3	241.9
Mean Precipitation (mm)	73.1	47.1	63.9	70.7	76.9	80.4	82.8	96.0	105.7	104.4	87.8	88.6	977.2

*Water equivalent

Aubrey Falls Generating Station

Rayner Generating Station

Wells Generating Station

Rocky Island Reservoir Control Structure

Red Rock Falls Generating Station

Figure 3.1
Brookfield Renewable Porwer
Mississagi River Water Management Plan
Mississagi River Watershed

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and sedimentary rocks including diabase, gneiss, biotite, hornblende and quartzite gneiss (Noble, 1991, Paterson, 1981). The southern part of the watershed is within the Southern Province of the Shield. This is an area underlain by rocks of the Proterozic age (middle Precambrian) and has a complex geology of metasedimentary and igneous intrusions (MNR, 1983).

The surficial geology is related to the recent glacial history. The last ice sheet retreated northward from the area approximately 10,000 years ago with periodic halts marked by recessional moraines and extensive deposits of outwash sands and gravels laid down along the floor of the Mississagi River from Aubrey Falls to Red Rock Lake. The meltwater flowed south into a post-Algonquin glacial lake (VanDine, 1980a). The northern section of the study area is characterized as a bedrock-drift complex, with large expanses of bare bedrock and minor pockets of bouldery silty sand till (Noble, 1991). Valley slopes are mainly exposed bedrock with shallow overburden or talus slopes (Paterson, 1981). Glaciolacustrine sandy silts are found in the lower reaches of the watershed adjacent to Lake Huron and represent deposits laid down during the post Algonquin glacial lake that inundated this area (VanDine, 1980b). These deposits are typically found within depressions with bedrock knobs forming the higher land.

The topography reflects the underlying geology. A number of ancient fault lines dissect the bedrock and predominantly determine the orientation of the lakes and the river courses. Local relief is commonly 60 m and can increase to 100 m (Van Dine, 1980a and b). The elevation in the upper watershed is over 480 m Canadian Geodetic Datum (CGD). The lower watershed has moderate to low local relief, dropping in elevation to 177 m CGD at Lake Huron.

3.1.3 Bathymetry

Bathymetric mapping is available for the three reservoirs at Rocky Island Lake, Tunnel Lake and Red Rock Lake. A copy of these maps is included in Appendix E. New bathymetric mapping for Rocky Island Lake was undertaken in 2003 and is available digitally at the MNR Blind River office.

Previous bathymetric mapping was done for Rocky Island Lake in 1976 (MNR 1976a). However, only a moderately accurate bathymetric map could

be produced at that time and many underwater features were missed. Fieldwork conducted by MNR staff during 2002 on Rocky Island Lake confirmed that there were some areas of the lake with significant mapping errors.

The planning team recognized the importance of accurate bathymetric information as an essential tool to help address issues, evaluate and develop options, delineate habitats, and determine navigability. For these reasons new bathymetric mapping of Rocky Island Lake reservoir was conducted during the summer of 2003.

The method used for this survey was the Bathymetric Automated Survey System (BASS). This method integrates global positioning satellite data, digital bathymetric data, and Geographic Information System (GIS). Specialized hardware, software, and training are required to do this type of survey. The method works by continuously compiling simultaneous position information with depth information, as provided by the GPS and sonar, assembling the data, and displaying some of the information in real time on a map, displayed on a laptop computer. The actual track of the boat is displayed on an outline map of the lake. The software applies a user-defined series of transects on the display map of the lake for the operator to follow. The operator can see exactly where the boat has traveled on this display, and corrects deviations from the transect as required. A shoreline cruise is also done by traveling the entire perimeter of the reservoir and all islands, at a distance of approximately 5 m from shore.

Completion of the BASS survey on Rocky Island Lake required almost 1 month for an MNR field crew of three or four persons to complete, using two boats. A smaller boat was used primarily to complete the 250 km of shoreline mapping. A second boat did most of the transect lines in the main water body. One problem faced by this BASS crew was the relatively short timing window available when Rocky Island Lake was at or near the maximum elevation. Any lowering of the water level would prevent the mapping of dewatered areas. Following completion of data collection, the data was compiled and developed into mapping by GIS staff at MNR (Blind River).

The new bathymetric mapping for Rocky Island Lake reservoir enables accurate volume and surface area determination and display at any incremental elevation. This was an important tool in assessing impacts on aquatic habitat for various drawdown scenarios (see Section 8.1.1).

3.1.4 Hydrology

Watershed and Reservoir Characteristics

The Mississagi River basin encompasses a total drainage area of 9300 km^2 of which 9010 km^2 is regulated through the operation of the Mississagi River generating stations for the production of power. Total elevation change in the river system from the highest point in the catchment boundary to where the river discharges into the North Channel of Lake Huron is 366 m (with a drop of 250 m from Rocky Island Lake to Lake Huron, Figure 3.2).

The main river course originates just upstream of White Owl Lake at Lebel Lake and runs in a southwest direction picking up major tributary inflow from the east and west Abinette Rivers before discharging into Rocky Island Lake. Rocky Island Lake has a surface area of 5416 ha at full supply level (FSL) and a drainage area of 2150 km^2, which represents 23.9% of the total catchment area. Rocky Island Lake has a mean depth of 10 m and a maximum depth of approximately 75 m that occurs primarily in Rouelle Bay in the North Arm Basin (see Appendix E). The reservoir has a total live storage capacity of 394 $m^3 \times 10^6$ and the main control structure at the outlet discharges flow directly into Aubrey Lake. Aubrey Lake reservoir has a total surface area of approximately 2050 ha, with a maximum depth of approximately 26 m and a mean depth of approximately 8 m (MNR, 1976b). The Aubrey Falls GS is the first of four generating facilities on the river system and the reservoir (Aubrey Lake) has a live storage capacity of 61 $m^3 \times 10^6$. It receives natural inflow from a local contributing drainage area of 1890 km^2, primarily, the Wenebegon River tributary (1568 km^2). From Aubrey Falls GS, the river generally follows a meandering pattern south toward Tunnel Lake with Highway 129 running parallel for much of the way. Major tributary inflow from the Aubinadong River joins the main stem of the river about 12 km downstream of Aubrey Falls, with inflow contribution from a drainage area of 1440 km^2. Additional local drainage area, equal to 1360 km^2, joins the river course over the downstream river reach distance extending approximately

75 km. This is made up of a number of small creeks (Black, Sharpsand, Grindstone and Lafoe) and various lakes including Wakomata Lake.

Two separate generating facilities are located on the Tunnel Lake reservoir, Rayner GS and the Wells GS. Tunnel Lake has a surface area of 1575 ha (MNR, 1966) and a live storage capacity of 61 $m^3 \times 10^6$. The reservoir has a mean depth of 9.7 m with a maximum depth of 51.8 m (MNR, 1966).

Downstream of Tunnel Lake the river runs for a distance of about 18 km before entering Red Rock Lake reservoir. Midway along the reach is the confluence with the Little White River tributary, with a contributing drainage area of 1960 km^2. This accounts for most of the total local drainage area of 2170 km^2 to the Red Rock Falls GS site. The Little White River conveys runoff from a catchment area located on the east side of the overall basin. This watershed is long and narrow and the river course descends quite steeply resulting in a quick runoff response to storm rainfall events.

Red Rock Lake is a small reservoir with a maximum surface area of 444 ha and a live storage capacity of 22 $m^3 \times 10^6$. The reservoir has a mean depth of 11.5 m with a maximum depth of 26 m occurring in the northwest corner (MNR, 1978). Downstream of Red Rock Falls GS the river course heads in a southeast direction and passes through the Village of Iron Bridge about 6 km downstream. The river slope is quite flat through this reach and extends another 17 km to a bedrock control in the river (adjacent to Mississauga First Nation lands) known as Mississagi Chutes. From this point the river drops about 1 m and swings to the south where it empties into the North Channel of Lake Huron through a delta area, approximately 5 km west of the Town of Blind River. The total drainage area upstream of the Red Rock Falls GS site is 9010 km^2 and represents 97% of the total watershed. The remaining 290 km^2 between Red Rock Falls and the mouth of the river has only one major inflow source and that is the Bolton River, which enters the river downstream of Iron Bridge. The Bolton River conveys flow from Basswood and Bright Lake catchment areas.

Runoff Characteristics

Runoff from the Mississagi River basin is monitored at a series of hydrometric stations maintained and operated by both the Water Survey of Canada (WSC) and BRP and through the latter's operational data. Real time data from these

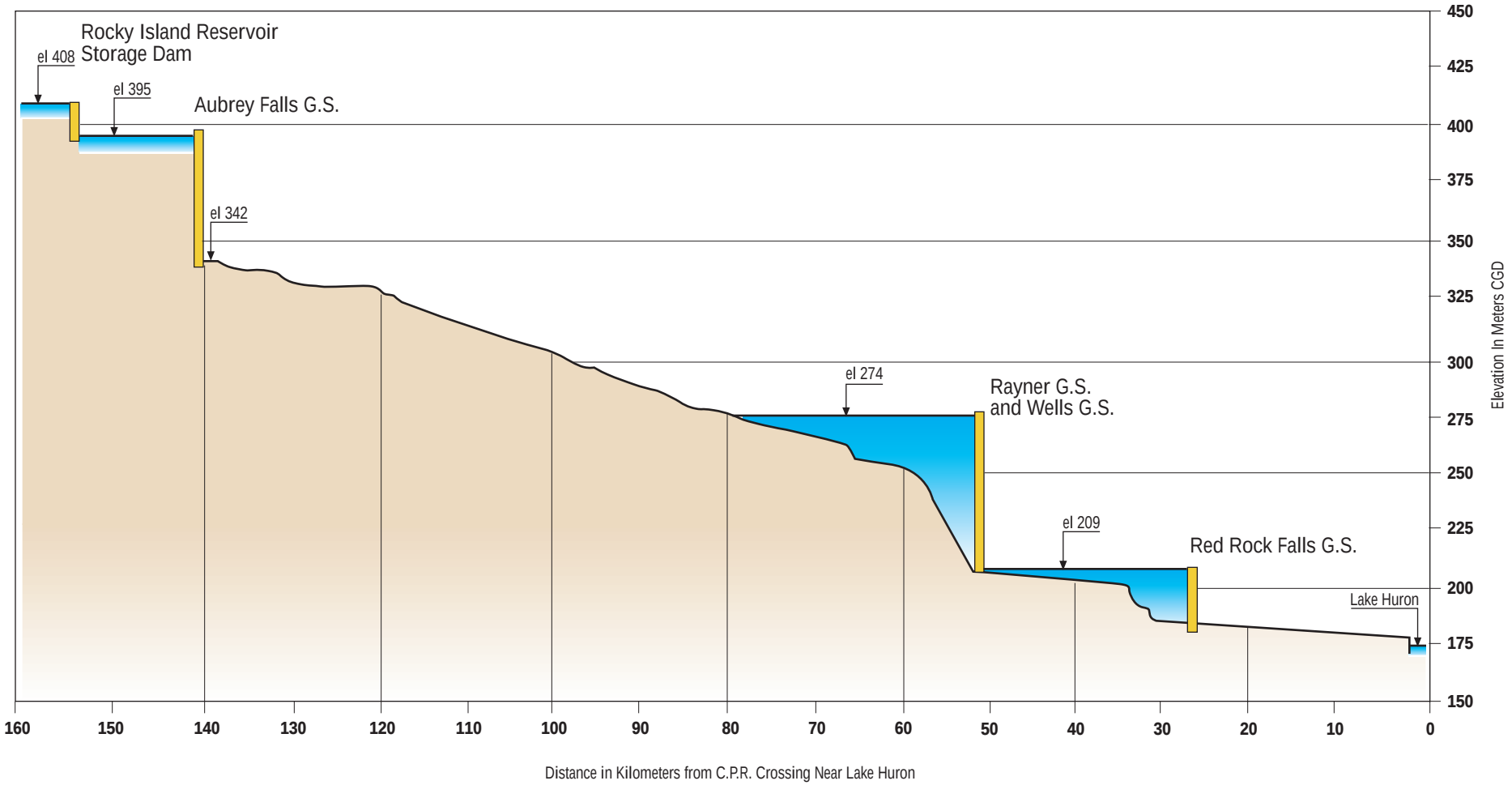

Figure 3.2
Brookfield Renewable Power
Mississagi River Water Management Plan
Water Surface Profile

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stations is accessed either by satellite through a data collection platform (DCP), or by dial up through land-based telephone lines, to assist in water management decisions. BRP presently owns two DCP stations and has a cost sharing agreement with MNR/WSC, which allows them to access two additional DCP stations in the Mississagi River basin. Details of the data availability and source are given in Table 3.2.

Table 3.2
Mississagi River Hydrometric Stations

Station No.	Drainage Area (km^2)	Name	Location	Type	Period of Record
MPT-DCP1	2150	Upper Mississagi River	Rocky Island Lake	DCP	1950 to present
MPT-GS	4040	Mississagi River at Aubrey Falls	Aubrey Falls GS	GS	1964 to present
MPT-DCP2	1568	Wenebegon River	N. Hwy 129	DCP	1998 to present
02CC005 (WSC)	1440	Aubinadong River	Sesabic Creek	DCP	1981 to present
MPT-GS	6840	Mississagi River at Rayner/Wells	Rayner/ Wells GS	GS	1950 to present
02CC010 (WSC)	1190	Little White River	Boland	DCP	1981 to present
02CC005 (WSC)	1960	Little White River	Bellingham	Dial up	1943 to present
MPT-GS	9010	Mississagi River at Red Rock Falls	Red Rock Falls GS	GS	1961 to present
02CC008 (WSC)	9300	Mississagi River	Mississagi Chutes	Dial up	1961 to present

Some additional hydrometric data is available prior to hydroelectric development on the river and extends back as far as the 1920's. Analysis of present runoff characteristics has concentrated on the post development period in the river and considered a long-term period from 1969 to 2002. This 34-yr period contains a reasonable mix of runoff conditions to show the variation in water supply covering average, wet and dry conditions and capturing any persisting trends in these conditions. The Mississagi River basin can be effectively divided into a northern and southern section. The northern section includes contributing drainage to Rocky Island Lake and Aubrey Falls reservoir, primarily via the Wenebegon River tributary and Aubinadong River

tributary flows. The southern portion of the basin receives runoff primarily from the Little White River. Long-term flow data for the neighboring Aux Sables River at Massey, which is located to the east of the Little White River, was used for comparison and verification of long term records for the Little White River as it is quite representative of regional hydrologic conditions, being very similar to the Little White River. The Aux Sables River has a drainage area of 1350 km^2.

A comparison of long-term average specific runoff for the Mississagi River at various locations in the river basin is given in Table 3.3.

Table 3.3
Mississagi River Specific Runoff

Name	Location	Drainage Area (km^2)	Specific Runoff ($L/s/km^2$)
Upper Mississagi River	Rocky Island Lake	2150	13.18
Mississagi River at Aubrey Falls	Aubrey Falls GS	4040	10.43
Aubinadong River	Sesabic Creek	1440	13.11
Mississagi River at Rayner/Wells	Rayner / Wells GS	6840	11.41
Little White River	Boland	1190	13.51
Little White River	Bellingham	1960	14.06
Mississagi River at Red Rock Falls	Red Rock Falls GS	9010	11.92
Mississagi River	Mississagi Chutes	9300	13.10
Aux Sables River	Massey	1350	13.62

The specific runoff data summarized in Table 3.3 is relatively consistent between values for the contributing tributaries. The Little White River is slightly higher reflecting the more southern location that is probably influenced by the proximity to the North Channel area of Lake Huron. The more inland location of the upper Mississagi watershed yields a comparatively lower long term runoff condition. The results also show generally lower values for the main river locations at the generating station locations. This may reflect additional losses due to evaporation and possible errors introduced by the mass balance calculation using reservoir storage volume.

3.1.5 Water Balance Budget

Long-term average specific runoff for the Mississagi River basin is 13.10 L/s/km^2, which is equivalent to an annual runoff depth of 413 mm over the catchment. Mean annual precipitation for the watershed is estimated at 900 mm. The loss of water in the watershed by evapotranspiration processes throughout the course of the year is the difference between these two figures and equals 487 mm or 54% of annual precipitation. This is typical for this region of the province.

3.1.6 Water Power Potential

The reach of the Mississagi River that is presently developed for hydropower has 66 m of undeveloped head remaining between Aubrey Falls GS and Wells/Rayner GS. The former owner of the existing facilities, Ontario Hydro, carried out feasibility studies and preliminary environmental investigations between 1950 and 2001 to examine a large scale development in this area. Two primary sites were examined (Patten Post approximately 60 km downstream of Aubrey GS and Gros Cap located 9.6 km downstream of Patten Post) (Figure 3.3), which maximized the potential head and comprised a reservoir extending to the tailrace at Aubrey Falls GS.

In recent years, the section of the Mississagi River below Aubrey Falls GS to Tunnel Lake (which includes the above-noted sites) has now been incorporated into the Mississagi River Provincial Park (Figure 4.3) as regulated under the Provincial Parks Act in June 2003.

3.1.7 Surface Water Quality

Water quality data is available from the Ontario Ministry of the Environment (MOE) monitoring stations on the Mississagi River:

- Station 003 – Mississagi River at Dean Lake Road Bridge, approximately 6 km downstream of Village of Iron Bridge

- Station 001 – Mississagi Chutes, approximately 2 km upstream of river mouth

- Station 004 – At the mouth of the Mississagi River at Lake Huron.

The monitoring station at the mouth of the river (Station 004) was discontinued following the 1987 monitoring season. Table 3.4 presents water quality data for Stations 003 and 001.

More recent surface water quality data was collected on June 21, 2004 at five sampling stations farther upstream as shown in Figure 3.1. Analysis was conducted by the Elliot Lake Research Field Station of Laurentian University, in Elliot Lake, Ontario and the results are summarized in Table 3.5.

Table 3.4
Lower Mississagi River Water Quality Data

Parameter	Units	Station 003			Station 001	PWQO[1]
		1987	1990	1999	1970-1979[3]	
Alkalinity	mg/L as $CaCO_3$	22.6	19.2	23.69	21.0	
Aluminum (Unfil. Tot)	µg/L			38.29	**110**	75.0
Ammonium (Tot. Unfil. Reac.)	mg/L			0.0125		
Barium (Unfil. Tot.)	µg/L			7.97		
Beryllium (Unfil. Tot.)	µg/L			0.0027		11
Cadmium (Unfil. Tot.)	mg/L	**0.0044**	0.0002	0.00002	**0.01**	0.0002
Chloride (Unfil. Reac.)	mg/L			1.1250	2.6	
Chromium (Unfil. Tot.)	µg/L			0.0823		
Cobalt (Unfil. Tot.)	µg/L			0.1633		0.9
Conductivity (at 25°)	µhos/cm	64.8	56.5	60.63	71.0	
Copper (Unfil. Tot.)	mg/L	**0.006**	0.0001	0.00052	**0.03**	0.001
Iron (Unfil. Tot.)	µg/L			113.825	**330**	300
Lead (Unfil. Tot.)	µg/L	4.5	5.0	2.4	**40.0**	1.0
Manganese (Unfil. Tot.)	µg/L			24.1463	30.0	
Mercury (Unfil. Tot.)	µg/L	0.0100	0.0200	0.020	0.04	0.20

Table 3.4
Lower Mississagi River Water Quality Data

Parameter	Units	Station 003			Station 001	PWQO[1]
		1987	1990	1999	1970-1979[3]	
Nickel (Unfil. Tot.)	µg/L			0.4519	**30.0**	25.0
Nitrates (Fil. Reac.)	mg/L	0.1091	0.1001	0.0915[4]	0.12[4]	
Nitrites (Fil.Reac.)	mg/L	0.0050	0.0042	0.0024	0.005	
Kjedahl N (Unfil.Reac.)	mg/L			0.2714	0.34	
pH	No unit	7.59	7.54	7.45	7.3	6.5-8.5
Phosphate (Fil. Reac.)	mg/L	0.0007	0.0007	0.0025		
Phosphorus (Unfil. Tot.)	mg/L	0.0130	0.0060	0.0054	0.030	0.030[2]
Particulate residue	mg/L	2.9	2.4	2.250		
Strontium (Unfil. Tot.)	µg/L			23.6875		
Titanium (Unfil. Tot.)	µg/L			0.6839		
Vanadium (Unfil. Tot.)	µg/L			0.4349		6.0
Zinc (Unfil. Tot.)	µg/L			0.9984	**70.0**	20.0

[1] Ministry of the Environment and Energy. 1994. *Water Management Policies, Guidelines and Provincial Water Quality Objectives of the Ministry of Environment and Energy*. Queen's Printer for Ontario. July 1994, reprinted February 1999.

[2] "Excessive plant growth in rivers and streams should be eliminated at a total phosphorus concentration below 30 µg/L." (MOEE, 1994).

[3] Paterson, W.M. 1981. *Mississagi River Preliminary Environmental Appraisal of Hydraulic Development Potential Between Aubrey Falls and Rayner/Wells Generating Stations*. Environmental Studies and Assessments Department, Ontario Hydro. Report No. 81034. April 1981.

[4] Unfiltered Reactive.

Table 3.5
2004 Surface Water Quality for the
Mississagi River Upstream of Red Rock GS

Parameter	Units	Sample Site and Sample Number (see Figure 3.1)					Water Quality Standards	
		Red Rock Lake (WQ-5)	Tunnel Lake (WQ-4)	Aubrey Lake (WQ-3)	Rocky Island Lake (WQ-2)	Mississagi River (WQ-1)	PWQO	CWQG
pH		7.2	7.2	7.1	7.2	6.8	6.5-8.5	6.6-9.0
Temperature	ºC	16.5	16.5	15.0	17.0	18.5		
Acidity	mg/L	3	7	9	3	3		
Alkalinity	mg/L	19	23	27	14	11		
TSS	mg/L	<1	<1	<1	<1	2		
TDS	mg/L	60	68	72	58	30		
Conductivity	µS/cm	56.9	52.2	58.7	36.1	33.5		
TKN	mg/L	0.13	0.14	0.05	0.06	0.04		
Ammonia	mg/L	0.046	0.047	0.036	0.037	0.033		
Nitrate	mg/L	0.11	0.11	0.10	0.14	0.02		
Nitrite	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01		0.06
Sulfate	mg/L	5.42	4.86	4.39	4.73	5.05		
Chloride	mg/L	1.16	1.00	0.98	0.43	0.53		
DOC	mg/L	21	7.1	26.5	11.9	6.68		
Mercury	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.0002	0.0001
Silver	mg/L	<0.0006	0.0010	0.0005	<0.0006	<0.0006	0.0001	
Aluminum	mg/L	0.060	0.045	0.040	0.040	0.035	0.075	0.005-0.100
Arsenic	mg/L	0.002	0.003	0.005	0.004	0.002	0.005	
Barium	mg/L	0.0068	0.0044	0.0032	0.0034	0.0037		
Beryllium	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.011	
Calcium	mg/L	8.71	10.2	12.1	6.54	4.86		
Cadmium	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.0002	0.00017
Cobalt	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.0009	0.0006
Chromium	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.001	0.0089
Copper	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002-0.004
Iron	mg/L	0.124	0.080	0.102	0.102	0.102	0.3	0.3

Table 3.5 2004 Surface Water Quality for the Mississagi River Upstream of Red Rock GS								
Parameter	**Units**	**Sample Site and Sample Number (see Figure 3.1)**					**Water Quality Standards**	
		Red Rock Lake (WQ-5)	**Tunnel Lake (WQ-4)**	**Aubrey Lake (WQ-3)**	**Rocky Island Lake (WQ-2)**	**Mississagi River (WQ-1)**	**PWQO**	**CWQG**
Potassium	mg/L	0.26	0.28	0.32	0.25	0.28		
Magnesium	mg/L	1.88	2.20	2.73	1.73	1.38		
Manganese	mg/L	0.0139	0.0072	0.0072	0.0073	0.0254		
Molybdenum	mg/L	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	0.010	0.073
Sodium	mg/L	1.09	1.08	1.15	0.80	0.84		
Nickel	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.025	0.025-0.1
Phosphorus	mg/L	0.006	0.002	0.001	0.002	0.003	0.020*	
Lead	mg/L	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.0001	0.001-0.007
Selenium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.10	
Strontium	mg/L	0.018	0.016	0.018	0.017	0.011		
Titanium	mg/L	0.0010	0.0004	<0.0004	<0.0004	<0.0004		
Vanadium	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.007	
Zinc	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.020	0.030

Notes:
PWQO – Provincial Water Quality Objectives (MOE, 2002)
CWQG – Canadian Water Quality Objectives, Criteria for Protection of Aquatic Life (CCME, 2002)

Shaded values represent exceedances of PWQO.

*"To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 µg/L" (MOEE, 1994).

3.2 Biological Environment

3.2.1 Species at Risk

Lake Sturgeon *(Acipenser fulvescens)*

Lake sturgeon are known to be present in the Mississagi River below Red Rock Lake and local fishermen have reported that they are also present upstream between Aubrey Falls and Tunnel Lake. On the Species at Risk in Ontario (SARO) list under Ontario's Endangered Species Act (2007) lake sturgeon are listed as a species of special concern as of June 30, 2008 (MNR 2008a). In November 2006, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) divided Canada's lake sturgeon species into eight separate populations or designatable units (DU). The Great Lakes – Upper St. Lawrence sturgeon population is in DU8 which is classified as threatened by COSEWIC. However, as of July 2008, this population of lake sturgeon is still under review by the federal government to determine whether it will be added to the List of Wildlife Species at Risk (Schedule 1) as threatened under the federal Species at Risk Act (SARA).

Studies have recently been done on lake sturgeon to better understand the population in terms of size, age structure, movements, spawning location and reproductive success) on the lower Mississagi River (UGLMU, 2008; UGLMU, 2007; Seyler, 2003). Spawning sites on the river are considered important by MNR in maintaining the lake sturgeon population in the North Channel of Lake Huron.

According to a report from the Anishinabek/Ontario Fisheries Resource Center (AOFRC, 2003), sturgeon from the river have been a food source for this Mississauga FN for centuries and spear harvesting in the summer months is the traditional method used. Due to concerns with a declining lake sturgeon population, the Mississauga FN, with technical support from the AOFRC, assessed lake sturgeon during their spawning period for 4 years between 1999 and 2002. A total of 363 lake sturgeon were captured, tagged and live released during this period on the lower Mississagi River. The age range was 6 to 60 years, but they are known to live up to 100 years (MNR, 2008). The absence of a significant number of small juveniles in net catches suggests that they were sexually immature and did not use the spawning sites, utilize habitat

elsewhere in the North Channel, and/or they were too small to recruit in the netting gear (AOFRC, 2003).

Follow-up investigations were conducted on lake sturgeon in the Mississagi River by MNR's Upper Great Lakes Management Unit (Lake Huron office) in May 2007 and May-June 2008. The purpose of these investigations was to collect information on the reproductive status of lake sturgeon below Red Rock Dam. Sturgeon movements were assessed through tagging and recapture, and the level of successful reproduction was determined through larval sampling. In addition, suitable habitat was documented for adult and larval sturgeon, and biological data was collected for aging and genetics purposes (UGLMU, 2008; UGLMU, 2007). The May 2007 investigations focused on a portion of the Mississagi River <1 km downstream of Red Rock Dam while the May-June 2008 investigations focused on a 3.6 km portion of the Mississagi River downstream of Red Rock Dam between a single waterfall and the river's mouth. The results confirmed the importance of the lower Mississagi River as

- general habitat for lake sturgeon
- an important spawning location for lake sturgeon.

Wood Turtles *(Glyptemys insculpta)*

Wood turtles are known to be present within MNR's Sault Ste. Marie District. Wood turtles are classified as endangered on Ontario's SARO list (February 2009) and of Special Concern in Schedule 3 by COSEWIC under SARA. The location of their habitat is of interest as it could be potentially affected by water level changes on the Mississagi River system and/or near the mouth of tributaries entering the Mississagi River. Also see Section 8.1.14 of this WMP for information on baseline field investigations undertaken on wood turtles for the WMP.

Other Species at Risk

Bald eagles *(Haliaeetus leucocephalus)* are listed as a species of Special Concern north of the French and Mattawa Rivers on Ontario's SARO list. They are known to nest in the Mississagi River watershed. Other species at risk that may use the Mississagi River and its shoreline, based on range maps, include Peregrine Falcon (*Falco peregrinus)*, listed as Threatened under Ontario's SARO list and Schedule 1 of SARA; Least bittern (*Ixobrychus*

exilis), listed as Threatened under Ontario's Endangered Species Act and Schedule 1 of SARA; Black Tern (*Chlidonias niger)*, listed as Special Concern on Ontario's SARO list; and Yellow Rail (*Coturnicops noveboracensis)*, listed as Special Concern on Ontario's SARO list and Schedule 1 of SARA. All four of these species nest along shorelines within marshes or swamps.

Range maps also indicate that the False Hop Sedge (*Carex Iupuliformis),* listed as Endangered on Ontario's SARO list) may be in the Mississagi River watershed area, although sites identified to date are all on private land in southwestern Ontario (ROM/MNR, 2006).

In addition, Northern Brook Lamprey (*Ichthyomyzon fossor)*, is listed as Special Concern on Ontario's SARO list and Schedule 3 of SARA, and a range map indicates that it may occur in the lower Mississagi River. However, if it is present, its primary threat would likely be the lampricide used on the Mississagi River to control the invasive sea lamprey (*Petromyzan marinus*) (DFO, 2008).

3.2.2 Fisheries

The Mississagi River system has a diverse fish community, with habitats ranging from relatively deep, cold water lake trout lakes and cold headwater tributary creeks, to moderately productive cool/warm water lake communities, to a migratory population of fish species entering the river from the North Channel of Lake Huron. Table 3.6 provides a summary of fish species present in the reservoirs on the Mississagi River system.

Brief descriptions of the aquatic environment, fish communities and aquatic fish habitat by reservoir and river reach follow. Known fish spawning sites are provided in Figure 3.3. Appendix F1 provides a summary of habitat information for several of the important game fish species found in the watershed.

Table 3.6
Main Fish Species of
Mississagi River Reservoirs

Lake	Surface Area (ha)	Mean Depth (m)	Maximum Depth (m)	Major Fish Species	Data Sources	Additional Comments
Rocky Island	5416	10	80	Northern Pike Walleye Lake Whitefish Lake Trout Yellow Perch Common White Sucker Burbot	• MNR FWIN Survey (1999) • MNR Lake Survey (1976) • Walleye Spawning Survey (2003) • MNR NRVIS Mapping (2003)	P-G-T Trout Lake exists (see text)
Aubrey	2050	8	26	Northern Pike Walleye Lake Whitefish Common White Sucker Yellow Perch	• MNR Lake Survey (1976) • Walleye Spawning Survey (2003) • MNR NRVIS Mapping (2003)	Walleye eggs are collected at one of the spawning sites for this lake's walleye population, for use in a fish hatchery program
Tunnel	1575	9.7	51.8	Walleye Northern Pike Smallmouth Bass Lake Whitefish Yellow Perch Common White Sucker Burbot	• MNR DLUG (1983) • Walleye Spawning Survey (2003) • MNR NRVIS Mapping (2003)	A minimum lake elevation during the walleye spawning period is part of the existing WMP
Red Rock	444	11.5	26	Walleye Northern Pike Common White Sucker Lake Whitefish Yellow Perch Smallmouth Bass Burbot	• Fiset (1990) • Northern Pike Spawning Survey (2003) • MNR NRVIS Mapping (2003)	

Rocky Island Lake Reservoir

The fish community of Rocky Island Lake is a complex mix of cold and cool water species. The predominant game fish species in the lake include lake trout, northern pike and walleye, with other large species present including lake whitefish, yellow perch, burbot, white sucker and longnose sucker. Historically, the forage fish community of the reservoir has been comprised of Iowa darter, golden shiner, common shiner, trout perch, blacknose shiner, bluntnose minnow and northern redbelly dace (MNR, 1976a). Lake whitefish were the predominant species caught during a 1999 Fall Walleye Index Netting Survey (FWIN) conducted by MNR (1999a). MNR considers the reservoir to be of prime importance in terms of meeting the angling targets of the district because of its large size, variety of aquatic habitat and its significant contribution to the District's fish population (MNR, 1983). Mercury contamination has led to restrictions in consumption of large walleye caught from the lake (MOE, 2001).

Adult walleye were transferred to Rocky Island Lake from Biscotasi Lake in 1976 (165 adults) and from the North Channel of Lake Huron in 1981 (88 adults) (MNR, undated). The 1999 FWIN surveys captured a total of 24 walleye: composed of 19 immature and 5 mature fish (MNR, 1999a). Walleye spawning surveys conducted during the spring of 2003 identified a number of high potential spawning sites for the Rocky Island Lake walleye population, including the Seven Mile Bay outlet channel, the Cyprus River mouth and Crazyhorse Rapids at the inflow of the Mississagi River.

Rocky Island Lake fisheries management is based on put-grow-take (P-G-T) stocking (MNR, 2006), since the water body is a major storage reservoir for downstream hydroelectric generation. A 1976 MNR Lake Survey indicated that, although excellent lake trout waters exist [approximately 2833 ha (7000 acres) of suitable habitat], lake trout reproduction is limited due to the water level drawdown that occurs prior to hatching of lake trout eggs, resulting in egg desiccation and mortality. MNR (Blind River) reported that spring littoral index netting (SLIN) for lake trout in 2003 resulted in a catch of only four lake trout.

Wetland fish habitat is generally limited to several small areas at the back of sheltered bays scattered throughout the lake and to the wetland where the Mississagi River enters the lake (MNR, 1999c).

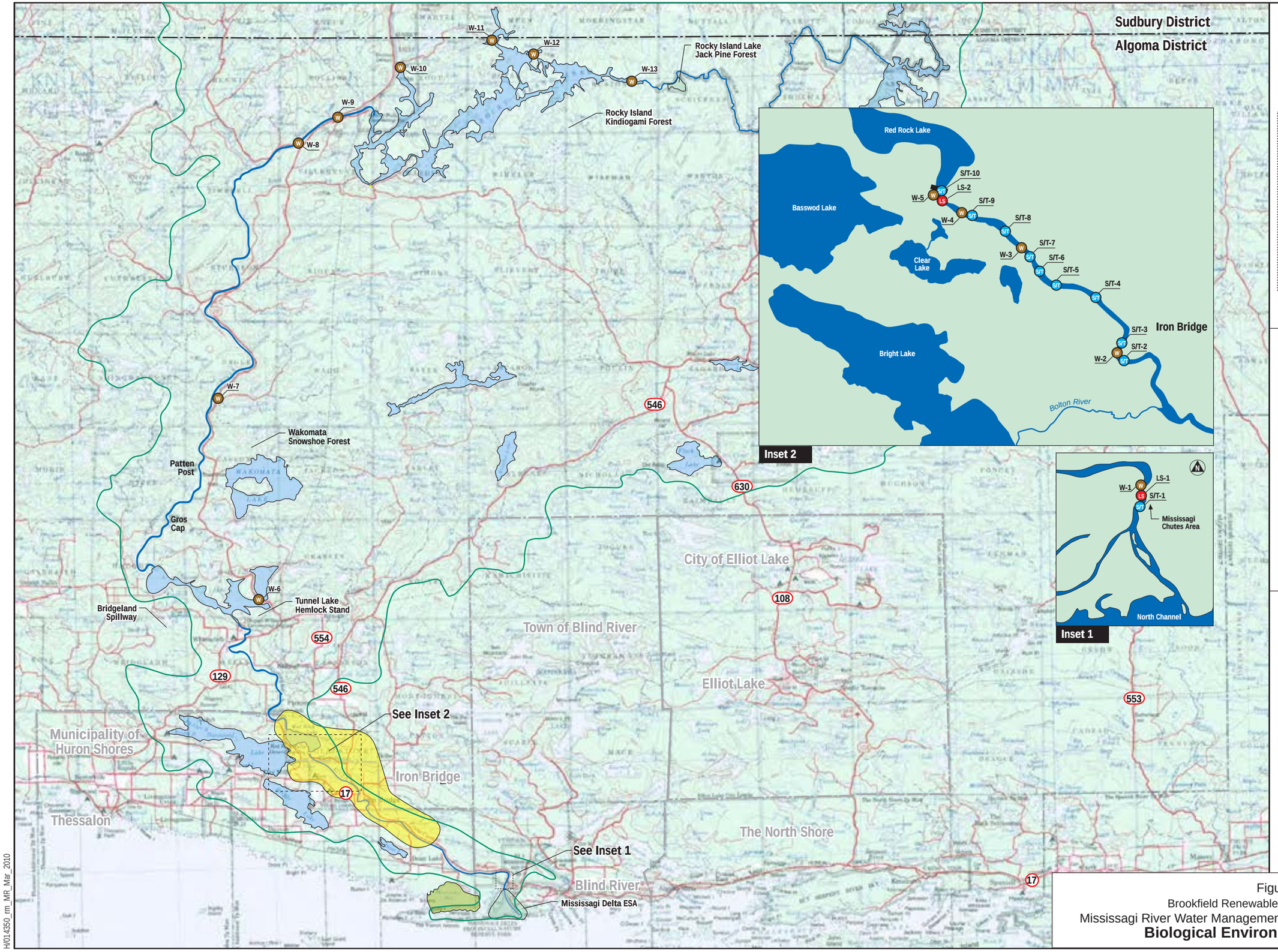

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Figure 3.3
Brookfield Renewable Power
Mississagi River Water Management Plan
Biological Environment

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Back of figure

Aubrey Lake Reservoir

A complex cool/cold water fish community resides in the reservoir, with large fish species including northern pike, walleye, whitefish, common white sucker, burbot and yellow perch. The forage fish community includes trout perch, Iowa darter, golden shiner, ninespine stickleback, common shiner, blacknose shiner, finescale dace, creek chub, pearl dace and brook stickleback. Walleye and northern pike are the primary fish species caught during the open water fishing season, although lake whitefish are caught as well.

MNR considers the reservoir to be of prime importance in terms of meeting the angling targets of the district because of its large size, variety of aquatic habitat and its significant contribution to the District's fish population (MNR, 1983). Mercury contamination has led to restrictions in consumption of large northern pike caught from the reservoir (MOE, 2001).

Significant areas of open wetland habitat appear to be limited to small isolated bays and along the banks of several small tributary streams located on the large island in the center of the lake (MNR, 2001). However, areas of emergent vegetation (e.g., bulrush and cattail) were noted as being common during the 1976 MNR Lake Survey. Rapids are located at the base of Rocky Island Lake Dam, at the upstream end of Aubrey Lake at the Wenebegon River inflow, in Peshu Creek at the outlet of Peshu Lake (which drains into the Wenebegon River), and at the Bierce Creek inflow to Aubrey Lake. MNR has identified these areas as spawning sites that provide spawning habitat for spring spawning species such as walleye and white sucker. Walleye spawning surveys conducted during the spring of 2003 confirmed the presence of both male and female walleye at the Peshu Lake Road bridge during the spawning season.

Walleye eggs are collected by a local citizens group for use in local hatcheries and walleye stocking programs. Each spring, adult walleye are captured from Aubrey Lake at the Wenebegon River inflow by trap netting, with roe and milt collected for use in hatchery programs. Walleye have been stocked in Aubrey Lake in the past, in an attempt to improve the sport fishery (Paterson, 1981).

MNR (Blind River) reported that SLIN for lake trout in 2003 resulted in a catch of only one lake trout.

Mississagi River from Aubrey Falls to Tunnel Lake

The predominant landform in this river stretch (approximately 80 km) is the Mississagi Gorge, with the steep banks of the river rising over 100 m above water elevation. The river drops approximately 68 m over its length through this reach, with numerous rapids.

Detailed fish and fish habitat information for this section of the Mississagi River is generally lacking. Major fish species known to be present include walleye, northern pike, smallmouth bass and lake whitefish (Paterson, 1981). Rainbow trout and brook trout can also be found throughout this section of the river. Brook trout are also present in many of the small cold water tributary streams throughout this reach (Paterson, 1981). MNR (Blind River District) discussions with local fishermen indicate that lake sturgeon are also present.

The Blind River District Fisheries Management Plan (MNR, 1989) states that management of this section of the river would be directed at maintaining the high quality brook trout fishery in the tributaries along the Mississagi Gorge, while trying to develop the trout fishery in the main river (MNR, 1989). In an effort to support this management goal, MNR stocked rainbow trout in 1997 and 1999 at four locations along the main stem of the river between Aubrey and Tunnel Lakes (although one location was not stocked in 1999) (MNR, 1999b).

The Tunnel Lake walleye population is suspected of migrating as far as 15 to 20 km upstream to Pig Pen Chutes during their spring spawning run (Paterson, 1981). Walleye spawning surveys were conducted during the spring of 2003 to identify potential walleye spawning sites within this section of the Mississagi River. Potential sites identified include the Aubrey Falls GS tailrace, the base of the Highway 129 bridge, the base of the Highway 554 bridge and several sites along the shoreline of the main river channel. Wetland habitat is generally limited through this stretch of river, although small stands of lowland hardwood swamp and shrub thicket are scattered along the low gradient floodplain areas (MNR, 1999c). More detailed habitat investigations have been conducted at two locations in this reach that were being considered for future hydroelectric development, i.e., Patten Post, located approximately 60 km downstream from Aubrey Falls GS, and Gros Cap, located 9.6 km downstream from Patten Post (Paterson, 1981). At the Patten Post site, the river is fairly shallow with several exposed gravel and

boulder bars. Substrate generally consists of coarse granular material, with some sandy outwash deposits located in the floodplain. Talus slopes are evident at the site, with the terraces of the gorge rising sharply to over 65 m above the river water level. The river is approximately 44 m wide at this point.

At the Gros Cap site, the river is wider (approximately 100 m) with both banks rising sharply, although the west bank is distinctly higher, being a rather large hill of granite extending approximately 150 m above river level (Paterson, 1981). Substrate is generally coarse granular material, with no signs of excessive erosion present (Paterson, 1981).

A minimum flow of one unit hour per day (approximately 5.8 m^3/s) is released through the Aubrey Falls reach to ensure the river below the falls is kept fresh daily, as part of present operational guidelines. The Aubinadong River, which supports a cold water trout fishery, constitutes the major tributary to this section of the river, entering the watercourse approximately 15 km downstream from Aubrey Lake. Wakomata Lake has been designated by MNR as a "natural" lake trout lake meaning that it is managed for naturally reproducing populations (MNR, 2006). It also is one of the larger lakes in the watershed. Jobamageeshig Lake is also designated as a natural lake trout lake by MNR. Both the latter lakes empty into the Mississagi River through Snowshoe Creek, approximately 10 km upstream from Tunnel Lake. Other inflowing tributaries include Sharpsand River, Rapid River, Grindstone Creek, Stoney Creek, Black Creek, and Lafoe Creek.

Tunnel Lake Reservoir

The fish community of the Tunnel Lake reservoir consists of a complex warm/cool water fish community with walleye, northern pike, smallmouth bass, lake whitefish, white sucker, burbot and yellow perch being the dominant large species in the waterbody. The outlet channel from Cumming Lake, a short riverine reach entering the northeast corner of Tunnel Lake, is considered a major spawning area for the Tunnel Lake walleye population (J. Trottier, personal communication). The Crown Land Use Policy Atlas (MNR, 2004) states that Tunnel Lake will be managed as a warm water fishery. Mercury contamination has led to restrictions in consumption of walleye, northern pike and common white sucker caught from the lake (MOE, 2001).

Significant inflows to the lake (apart from the Mississagi River) include Cumming Lake (a natural lake trout lake), through Cumming Creek, and Axe Lake (a natural lake trout lake). However, water level management on Tunnel Lake does not have the potential to affect water levels on these lakes.

Significant areas of wetland habitat are generally limited to several small tributaries draining into the northeastern basin of the lake. However, during the 1966 MNR Lake survey, floating, emergent and submergent vegetation occurred in varying degrees along the shoreline, with species such as spike rush, blue flag iris, arrowhead and grasses dominating the flora.

In order to enhance survival of walleye eggs and fry at a spawning site downstream of Cumming Lake, a weir has been installed immediately upstream of Tunnel Lake to maintain water levels within this spawning site prior to fry dispersal.

Mississagi River from Tunnel Lake to Red Rock Lake

From Tunnel Lake, the Mississagi River flows approximately 20 km downstream to Red Rock Lake reservoir. The Little White River flows into the Mississagi approximately 9 km upstream from Red Rock Lake. Detailed fish community and fish habitat information for this stretch of river is generally lacking, although walleye, northern pike, smallmouth bass, and rainbow trout are known to inhabit this section of the river (recreation map). MNR has identified this river reach as a fish travel corridor in recognition of the importance of this stretch for spawning of migratory fish communities from downstream areas (MNR, 2003).

Detailed habitat investigations have been conducted on the Little White River, upstream of Bells Falls, which is located approximately 4 km upstream from the river's mouth at the Mississagi (Fiset, 1990). The river through this reach is wide, slow and relatively deep. MNR stocked rainbow trout in the Little White River near its mouth on the Mississagi River in 1995 and 2000 (400 fish) (MNR, 1999b; MNR, 2000a). Studies concluded that the Little White River appeared unsuitable for brook trout and rainbow trout (which have both been stocked into the Little White River) primarily because of the high summer water temperatures and a lack of instream cover (Fiset, 1990). Other fish species found in lower reaches of the Little White River include

smallmouth bass, walleye, longnose and white suckers, shorthead redhorse and a variety of chub, shiners, dace and other small forage species (Fiset, 1990).

Red Rock Lake Reservoir

The reservoir at Red Rock Lake has a complex warm/cool water fish community with walleye, rock bass, northern pike, whitefish, longnose sucker, burbot, yellow perch and white sucker the predominant large species in the waterbody (MNR, 1978). Aquatic vegetation was noted as being sparse during the 1978 MNR Lake Survey. However, investigations in the spring of 2003 determined that an area with high potential for pike spawning exists in the Goldenburg Wetland located at the north end of Red Rock Lake where the river widens to form the head pond. Mercury contamination has led to restrictions in consumption of walleye, northern pike and common white sucker caught from the lake (MOE, 2001).

Mississagi River from Red Rock GS to Lake Huron (North Channel)

From the base of Red Rock Falls, the Mississagi River travels approximately 33 km before entering the North Channel of Lake Huron at the Mississagi Delta. This section of river is generally characterized by a low gradient, with two large meanders occurring between the GS and Mississagi Chutes, located immediately upstream of the river mouth. Substrate through this reach is composed primarily of sands and silty sands, with exposed bedrock outcrops evident at several locations (Ontario Hydro, 1982). Coarse gravel and cobble can also be found along the river bottom (Ontario Hydro, 1982).

This stretch of river supports both a resident fish community and a migratory fish community composed of fish species from the North Channel of Lake Huron (including lake sturgeon). MNR has identified this entire river reach as a fish travel corridor in recognition of the importance of this stretch for spawning of migratory fish communities from downstream areas (MNR, 2003). The predominant fish species found in the river during electrofishing surveys conducted in August of 1983, 1985 and 1987 (in support of the monitoring program initiated to determine the impacts of erosion protection and control measures) included yellow perch (adults and juveniles), rock bass and mottled sculpin (Sheehan, R.W., 1988). Other large species present included smallmouth bass (adults and young of the year), walleye (adults and

juveniles), northern pike, common white sucker (adults and juveniles), and redhorse sucker. Muskellunge are also known to inhabit this section of the river. Small fish species present included bluntnose minnow, mimic shiner, emerald shiner, spottail shiner, log perch, Johnny darter and rosyface shiner. Historically, rainbow smelt migrated upstream from the North Channel during their spring spawning run (Goodyear et al., 1982) and still do migrate according to MNR (Blind River).

Lake sturgeon have been studied extensively in the lower Mississagi River as noted previously in Section 3.2.1. The Mississagi River is considered to be the most significant population for the North Channel lake sturgeon population. As of July 1, 2008, recreational fishing for lake sturgeon is not permitted on the Mississagi River. Recreational anglers inadvertently catching lake sturgeon are not allowed to keep them. However, traditional use of lake sturgeon by aboriginal peoples for subsistence and ceremonial purposes will not be affected (MNR, 2008).

This reach of the Mississagi River is designated as a fish sanctuary from the second Saturday in March to the third Friday in May to protect spring spawning fish populations. The Mississagi River watershed is within MNR's Fisheries Management Zone 10, and contains the majority of the local area's walleye and smallmouth bass fisheries.

Anadromous species of salmon and trout, which have been introduced to the Great Lakes and are known to migrate up the Mississagi River include chinook, pink and coho salmon, and rainbow and brown trout (KGS and North/South Consultants, 1990). In the past, pink salmon, the smallest of the salmon species present in the river, have been the most abundant species, while coho salmon have been the least abundant salmonid using the river (KGS and North/South Consultants, 1990). Spawning sites for pink salmon were investigated during the fall of 2002 (NRSI, 2004) and are shown in Figure 3.3.

Brown trout occur only rarely in the river, always in low abundance, and no established spawning run of this species is known to exist (KGS and North/South Consultants, 1990).

The Mississagi River is one of the largest producers of sea lamprey (KGS and North/South Consultants, 1990). In 1999, an estimated 133,171 spawning phase sea lamprey entered the Mississagi River from Lake Huron, representing nearly 56% of the estimated Lake Huron population total (Schleen and Klar, 2000). Surveys in 1999 estimated the larval sea lamprey population in the river to be 8 million (Schleen and Klar, 2000). Sea lamprey, a non-native species in the Great Lakes, are known to be a major cause of the collapse of Great Lakes' lake trout populations and have been the focus of major research and control efforts for the past 60 years (Hebert, 2000). DFO has treated the river with lampricide every 4 years, beginning in 1961, in an effort to control and minimize the numbers of lamprey produced in the river.

The tailrace area below Red Rock Falls dam is a known spawning location for salmonids (i.e., chinook, coho and pink salmon, rainbow and brown trout), walleye and sea lamprey (KGS and North/South Consultants, 1990). Detailed habitat investigations carried out below the dam have identified that approximately 410 m^2 of suitable rainbow trout spawning habitat (i.e., gravel substrate 0.5 to 2.0 cm diameter) and approximately 2266 m^2 of chinook salmon spawning habitat (i.e., gravel substrate 0.5 to 4.5 cm diameter) exist (Fiset, 1990).

Walleye spawning has been documented as generally occurring between April 20 and May 15 (Goodyear et al., 1982). Approximately 200 m^2 of angular rock rubble, suitable for walleye spawning, exists on a shoal in the tailrace area, and walleye have been observed at this site during the spawning season (Ontario Hydro, 1982).

MNR reports that lake sturgeon spawn in the lower Mississagi River when the lake level is high and the river flow is low. Recent estimates of the size of the Mississagi River lake sturgeon spawning run population size have placed it around 200 to 350 fish (AOFRC 2003). Ontario Hydro (1982) concluded that, due to the lack of other clean rubble areas in fast moving water, potential spawning sites for walleye, lake sturgeon and chinook salmon are probably limited to the Red Rock Falls tailrace and the Mississagi Chutes.

Other known or potential spawning sites in this section of river have been identified for several fish species. Shino Rapids, located approximately 1.5 km downstream from the Red Rock Falls GS, is comprised of almost 1 km

of rocky, predominantly boulder strewn, banks that may provide potential, although marginal, spawning habitat for walleye and/or chinook salmon (Ontario Hydro, 1982).

A walleye spawning assessment was conducted by the Mississauga First Nation and the Anishinabek/Ontario Fisheries Resource Centre below the Mississagi Chutes in 1999 and 2000. The project was conducted to determine the size and duration of the walleye spawning run, determine the dynamics of the walleye population and track the movement of walleye (Mcleod, 2002). A total of 11 fish species were captured in 1999 (netting from April 19 to May 5), while 10 species were captured in 2000 (April 13 to May 3). Common white sucker was the most frequently captured species (maximum of 772 fish in 2000), with walleye being the second most frequently captured species (95 and 68 walleye in 1999 and 2000, respectively). Northern pike and smallmouth bass were also captured in lower numbers. Based on aging of captured walleye, the 1997 year class, resulting in the 2-yr old fish captured in 1999 and the 3 year olds in 2000, appeared to be the dominant year class of spawning walleye. The mean age of females in 2000 was 5.8, while for males it was 3.8. The ratios of male to female walleye were 1:2 in 1999 and 1:0.9 in 2000. Based on mean length and weight information for the captured walleye, the authors of the study concluded that walleye in this area of the Mississagi were growing at a rapid rate. However, the study indicated that the relatively young age of the spawning run may be cause for concern, and indicated that further study was warranted. Spawning conditions at the site did not appear to change due to upstream dam operations during the spawning season, and there are no year class gaps in the data to indicate complete year class failure. However, spring flows during the study did fluctuate greatly, and the authors suggest that “significant changes in flow rates and water depths caused by dams located upstream…may be affecting walleye reproductive success” (Mcleod, 2002). The study indicated that the Mississagi Chutes do not provide optimal spawning habitat, and advocated further study on the walleye population farther upstream on the river.

Four small, gravel shoals, located between Shino Rapids and Iron Bridge, may provide some spawning habitat for pink salmon, coho salmon and rainbow trout, although they are not considered to be optimum spawning areas (Ontario Hydro, 1982). One in stream bar, composed of approximately 50% pebble/gravel (2 to 31.5 mm diameter), located 50 m downstream from the

west side of the center span of Highway 17 bridge in Iron Bridge, is a known salmon and trout spawning site (Chubbuck and Fung, 1985).

A deep pool, located approximately 2 km downstream from Iron Bridge and known locally as Sturgeon Hole, is a popular fishing spot for lake sturgeon (Ontario Hydro, 1982). Aquatic vegetation is common along the banks of the Mississagi River in the low gradient portion downstream from Iron Bridge. This may represent important juvenile nursery habitat for species that spawn in the river, and important foraging and cover habitat for many other species (both resident and migratory).

The Mississagi River delta is comprised of an extensive sandy area with several islands separated by active river channels, and a network of former channels that now flood on a seasonal basis to support wetland vegetation communities (Noble, 1991b). Wetland habitats include deep and shallow emergent marsh and floodplain meadow marsh (Noble, 1991b). This area provides important fisheries functions, including spawning, nursery, foraging and staging for species preparing to migrate up the Mississagi River. Inundation of these riparian channels during the spring freshet is important as nursery habitat for young of year (yoy) sturgeon. The North Channel of Lake Huron is characterized by a complex community of cold and warm water species, with lake whitefish, northern pike, smallmouth bass, walleye, yellow perch and pacific salmon being the dominant game species (MNR, 1989). Management of this area's fisheries resources lies within the context of the Lake Huron Fisheries Management Plan (MNR, 1989).

3.2.3 Riparian and Terrestrial Vegetation

The Mississagi River shoreline lies predominantly within the Great Lakes-St. Lawrence Forest Region of Ontario, although the northern portion of the study area (i.e., Rocky Island Lake area) grades into the Boreal Forest zone to the north. Typical forest assemblages in the Great Lakes-St. Lawrence Forest Region, which generally forms a belt of mixed hardwood-coniferous forest around the Great Lakes, include red pine, white pine, eastern hemlock, yellow birch, sugar and red maple and red oak (Farrar, 1995). Typical tree species associated with the boreal region to the north include conifers such as black and white spruce, balsam fir, and jack pine, as well as hardwoods such as white birch and trembling aspen (Farrar, 1995).

Vegetation regions identified by Rowe (1972) divide the Great Lakes-St. Lawrence forest area in the Mississagi River watershed into two distinct sections: the Temagami Forest Section found around Rocky Island Lake and the Algoma Forest Section found in more southerly portions of the watershed.

Rowe (1972) describes the Temagami Forest Section as follows:

> "Eastern white pine with scattered white birch and white spruce; although the spruce frequently rivals the pine in abundance. Both red pine and jack pine are present, the former often prominent in bluffs along ridges and the latter generally restricted to the driest sandy or rocky sites. The tolerant hardwoods, yellow birch and sugar maple have only a scattered occurrence. The prevalent forest cover on the uplands is clearly a reflection of periodic past fires…on the lowlands, in poorly drained depressions and in swamps, black spruce with tamarack or eastern white cedar form well marked communities."

The additions to Mississagi River Provincial Park (see also Section 4.8 and Table 4.3) contain extensive representations (i.e., >1000 ha) of 11 ecosite types, being

- open wetlands
- white pine-red pine forests
- mixed pine uplands
- white pine mixed woods
- sugar maple forests
- jack pine forests
- black spruce-jack pine
- intolerant hardwoods
- intolerant hardwoods-coniferous forests
- nutrient poor coniferous forests
- moderately rich coniferous forests,

and major representations (i.e., 100 to 1000 ha) of six ecosite types, being

- rock barrens, cliffs or talus slopes
- tall shrub thicket
- red pine forest
- red maple-red oak uplands

- yellow birch-hemlock forests
- nutrient rich coniferous forest (MNR, 2002a).

Rocky Island Lake shorelines and upland areas are predominantly coniferous ecotypes, with mixed pine uplands, white pine-red pine stands, intolerant hardwood-pine, moderate coniferous and black spruce lowlands. Thicket swamp, dominated by speckled alder tall shrubs with some presence of willow, can be found on alluvial sand levees and mineral soil areas along the shoreline of the lake. Forest communities present within the boundaries of Mississagi River Provincial Park include jack pine and white pine complexes with extensive stands of white birch (MNR, 2002b).

The riparian and upland areas along the Mississagi River corridor below Aubrey Falls are dominated by red pine-white pine forest, with scattered stands of intolerant hardwoods and coniferous mixed forest. Sugar maple, lowland hardwoods, pure jack pine stands, tall shrub thicket and poor coniferous stands are also found throughout this area.

Farther to the south, throughout the Tunnel Lake-Wakomata Lake area of the Mississagi River corridor, shorelines and adjacent upland areas are dominated by sugar maple forest assemblages with smaller patches of white pine-red pine mixed stands, lowland hardwoods, intolerant hardwood-coniferous forest, tall shrub thicket and rich coniferous-lowland hardwoods.

A forest resource inventory for three areas along the shoreline of the Mississagi River from Red Rock Falls GS to Mississagi Chutes was conducted in support of the Environmental Assessment for bank stabilization measures (Ontario Hydro, 1982). Generally the shoreline around Iron Bridge is interspersed with deciduous dominated mixed forest stands and open clearings. Predominant tree species found along the banks include red maple, white ash, white and yellow birch. Spruce, silver maple, willow, white pine and cedar, among others are the dominant species found in upland areas along the river corridor (MNR, 2004). Severely eroding slopes along this section of the river are not conducive to large tree growth. Shrubs (red-osier dogwood, speckled alder, willow) and grasses/sedges are common.

Several significant forest stands have been identified in the Mississagi River watershed, within the study area of the water management plan. These

include the Rocky Island – Kindiogami Forest, the Rocky Island Lake Jack Pine Forest, the Wakomata-Snowshoe forest area and the Tunnel Lake Hemlock Stand.

The Rocky Island – Kindiogami Forest is a natural heritage area (Crins, 1996) and is included in the Mississagi River Provincial Park (additions) Policy Report (MNR, 2002b). It is partially located on the large island in the center of Rocky Island Lake, as well as on the mainland farther south to Kindiogami Lake. This forest is a provincially significant forest and a Life Science Site (NHIC, 1998a). Much of the forest is situated within the lands burned in the large Mississagi fire of 1948 and is consequently mainly composed of young, early successional stands of white birch, trembling aspen and jack pine. However, pockets of old growth red and white pine dominated forests, generally over 140 years old are found on the large island in Rocky Island Lake (NHIC, 1998a). Representative areas of old growth pine forest are rare throughout the province, and significant given their high susceptibility to fire and the intensive logging operations of the early part of this century (MNR, 2000b).

The Rocky Island Lake Jack Pine Forest, located on a large island, which splits the flow of the Mississagi River where it enters the eastern end of Rocky Island Lake, has been identified as an excellent representation of this forest type in the Mississagi River Provincial Park (Noble, 1991a). The large island supports an extensive jack pine forest, which, although not significant in a distributional sense, is an excellent example of contiguous jack pine, dominated intolerant boreal forest that develops following fire (Noble, 1991a).

The Wakomata-Snowshoe forest area, located around the north and western shores of Wakomata Lake, has been identified as a natural heritage area in the Mississagi River Provincial Park (additions) Policy Report (MNR, 2002b). This area includes significant stands of white pine (along with some red pine), as well as mixed stands of pine, white birch, maple and red oak, present on top of low hills and sandy plains (MNR, 2002b). Scattered swamps and bogs are also found throughout this area.

The Tunnel Lake Hemlock forest stand, located on a high ridge below the southeast end of Tunnel Lake, has been identified as a Candidate Life Science ANSI (Noble, 1991b). Pure hemlock stands and mixed hemlock-dominated

stands occur on this 270-ha site, which is highly representative of a forest community and tree species that is near the northern limit of its range (NHIC, 1998b).

3.2.4 Wetlands

Numerous small wetlands exist throughout the Mississagi River watershed. However, significant wetland communities are generally lacking along the shorelines of the main reservoir lakes and along the northern section of the main stem of the river (i.e., Aubrey Falls to Tunnel Lake). The lower gradient shorelines of the river downstream from Iron Bridge support wetland species, although no extensive wetland areas have been documented. No provincially significant wetlands have been identified in the study area, although two sites (i.e., where the Mississagi River enters Rocky Island Lake, and the Mississagi River Delta) do have relatively extensive wetland vegetation assemblages.

The Mississagi Delta, designated as a Provincial Park, is comprised of a large sand delta, divided into a number of islands by several active flow channels (Noble, 1991b). A network of former channels that now flood on a seasonal basis support a variety of wetland vegetation communities, including graminoid rich fen, low shrub fen, deep emergent marsh, meadow marsh (dominated by grasses and sedges), shallow emergent marsh (dominated by bulrush), and a variety of swamp assemblages (dominated by speckled alder, sweet gale, meadowsweet, willow and red ash (Noble, 1991b). MNR identifies this area as an Environmentally Sensitive Area (ESA) and a Wildlife Feeding Area (MNR, 2003).

The Bridgeland Spillway, designated as a Candidate Life Science ANSI, is located south of the west end of Tunnel Lake, and represents a former route of the Mississagi River channel. The area supports a rich assemblage of wetland communities, dominated by swamp and bog wetland types. The bog communities are highly representative of regional bog environments (Noble, 1991b). However, this area does not have the potential to be affected by changes in the water level or flow regime of the Mississagi River.

The wetlands at the north end of Red Rock Lake have a high value associated with them. This area is used extensively by waterfowl as a nesting and

staging site. It is also an important spawning area for northern pike (MNR, 2004).

3.2.5 Wildlife (Mammals)

Wildlife known to be present in the Mississagi River watershed include beaver, muskrat, mink, otter, lynx, red fox, marten, raccoon, fisher, bobcat, weasel, timber wolf, coyote and black bear (MNR, 2004). Small mammals such as voles, mice, rats, squirrels, chipmunks, shrews and bats are also present. Habitat usage data, or information regarding significant habitat areas of furbearing mammals in the study area is relatively limited.

Moose are found throughout the study area, although the capacity of the Mississagi River to produce moose was rated as low to moderate (Paterson, 1981). No ranked moose aquatic feeding areas have been documented within the potential zone of influence of water level or flow changes in the Mississagi River study area. However, it is likely that many of the wetlands scattered throughout the lakes and along the main river provide some feeding habitat. Moose calving sites, (i.e., areas with suitable isolation, cover and escape routes to provide protection from predators) can also be found in close proximity to shorelines (MNR, 2000b).

White-tailed deer are located within the study area and are known to be locally abundant around the Iron Bridge area (Ontario Hydro, 1982). A significant deer wintering area is located in a 33,369-ha block of land centered around the Village of Iron Bridge and bisected by the Mississagi River (Figure 3.3) (MNR, 2002b). There are numerous scattered areas of varying size within this block of land that provide deer shelter, food sources and open areas for travel, grazing and sunning (MNR, 2002b). However, given their generally upland nature, no important deer areas are located within the zone of influence of potential water level or flow changes in the Mississagi River.

3.2.6 Wildlife (Birds)

Mississagi Bay, located immediately west of the Mississagi River mouth on the North Channel, is a known waterfowl staging site (Figure 3.3) (Ontario Hydro, 1982), and waterfowl nursery area (MNR, 2003), although the Mississagi River does not generally lie within a major migratory flyway

(Paterson, 1981). Waterfowl are also associated with the small bays and marsh areas along the length of the river (Noble, 1991b). Paterson (1981) indicated that the waterfowl capability of the Mississagi River watershed is generally low (Class 7) along the majority of the main river, although productivity levels generally increase slightly (Class 6) in the large hydro reservoirs (i.e., Rocky Island Lake, Aubrey Lake and Tunnel Lake). Appendix F2 provides a summary of general nesting times, habitat information and conservation status for waterfowl and shorebirds known to breed in the Algoma District.

Loons are relatively ubiquitous throughout the study area. Loon nesting and incubation generally occur in the late spring and summer, with nests constructed close to the water's edge.

One sandhill crane nesting site, located approximately 3 km northeast of Iron Bridge, was identified in the early 1980's (Ontario Hydro, 1982). Additional sandhill crane nesting sites have been confirmed along the Mississagi River and lower Little White River (MNR 2004). Sandhill crane nesting sites were also located in the North Channel area near the mouth of the Mississagi, but the current status of such sites is unknown (Ontario Hydro, 1982). Sandhill cranes typically nest in tall vegetation in shallow wetlands and along the margins of lake or ponds (Herbert, 2000).

Colonial nesting birds such as great blue herons, generally nest in trees in swamps along large bodies of water (MNR, 2000b). The entire local population of these birds may depend on the health of one colony site, as these birds generally return to the same site year after year (MNR, 2000b).

Raptors, such as bald eagle and osprey, are also known to nest in the Mississagi River watershed. The Ontario Breeding Bird Atlas (2001) has recorded bald eagles and osprey nesting in blocks in the Iron Bridge area. During field studies conducted in support of the Mississagi River Provincial Park additions (MNR, 1999c), approximately 18 resident and migratory bald eagles were observed in the Rocky Lake–Kindiogami area. MNR has also identified various raptor nesting sites in the Rocky Island and Aubrey Lakes area (MNR, 2003). Bald eagles have also been sighted at the base of the Red Rock Falls GS in the wintertime (Ontario Hydro, 1982). They are also

frequently sighted in the lower Mississagi River below Red Rock GS in the fall, when spawning salmon are present in the river (MNR, 2004).

3.2.7 Wildlife (Reptiles and Amphibians)

Reptile and amphibian data for the Mississagi River watershed is generally lacking. Appendix F3 provides a listing of amphibians and reptiles, and their associated habitats, whose territorial range includes the Mississagi River watershed. As noted previously, wood turtles are known to be present within MNR's Sault Ste. Marie District and are classified as endangered on Ontario's SARO list and of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Field investigations were conducted to determine species presence and/or potentially suitable habitat in the planning area. The results of these investigations are confidential to MNR but were taken into consideration during the water management planning process.

4 Socioeconomic Environment (Including Resource Values)

4 Socioeconomic Environment (Including Resource Values)

4.1 Community Profile and Infrastructure

The upper part of the watershed lies within Sudbury District and the remainder is located in the District of Algoma (Figure 4.1). There are three municipalities (City of Elliot Lake, Town of Blind River and the Municipality of Huron Shores), and two First Nation reserves (Mississauga and Thessalon) within or adjacent to the southern part of the watershed (Figure 4.1). The majority of the watershed is Crown land. Only in the southern area below Wakomata Lake is there private ownership.

The Town of Blind River's boundaries were increased in 2001, through the Ontario government municipal restructuring process, to incorporate a number of unorganized geographical townships. The Municipality of Huron Shores, lying on the southwest boundary of the watershed, was created January 1, 1999 and involved the amalgamation of the townships of Thessalon, Thompson, Day, Bright Additional, and the Village of Iron Bridge, plus annexation of some unorganized townships.

Population data for district and local municipalities is provided in Table 4.1. Between 1996 and 2001, there has been a decline in the population throughout the area.

The major east-west transportation routes are in the south, near Lake Huron and include the Trans Canada Highway (Highway 17) and the Canadian Pacific Railway. Highway 129 links Thessalon with Chapleau and provides the major north-south route for the whole region. This highway generally follows the east side of the Mississagi River valley from Wakomata Lake to Aubrey Falls and then continues north just west of the Wenebegon River. Highway 546 (The Deer Trail) follows the Little White River valley and then continues northeast along the southern section of Mississagi River Provincial Park. Highway 556 connects Sault Ste Marie to Highway 129 at Aubrey Falls (Figure 4.1).

Table 4.1
Population Statistics
(Statistics Canada)[1]

Location	Population (2006)	Population (2001)	Change (%)	Largest Employer	Total Private Households (2006)
Algoma District	117, 461	118,567	-0.9	Essar Steel Algoma Inc.[2]	50,010
Blind River	3,780	3,969	-4.8	Cameco Refinery[3]	1,615
Huron Shores	1,696	1,794	-5.5	Midway Lumber[4]	690
Elliot Lake	11,549	11,956	-3.4	St. Josephs Hospital[5]	5,645
Thessalon	1,312	1,386	-5.3	Algoma Manor[6]	525

1 Statistics Canada. 2007. *2006 Community Profiles*. 2006 Census. Available online at: http://www12.statcan.ca/census-recensement/2006/dp-pd/prof/92-591/index.cfm?Lang=E Accessed January 20, 2009.

2 Sault Ste. Marie Economic Development Corp. 2008. Sault Ste. Marie Stats and Facts: 08/09. Available online at: http://www.sault-canada.com/UserFiles/Stats-Facts%202008-2009-1.pdf Accessed January 20, 2009.

3 Ontario Investment and Trade Centre. 2008. Community Profiles: Blind River. Available online at: http://www.2ontario.com/communities/majoremployers.asp?mun_name=3557038&topic=1 Accessed January 20, 2009.

4 Municipality of Huron Shores. 2008. Demographic Profile. Available online at: http://www.huronshores.ca/community/demographic.html Accessed January 20, 2009.

5 City of Elliot Lake. 2008. Key Statistics. Available online at: http://www.cityofelliotlake.com/en/cityhall/keystatistics.asp Accessed January 21, 2009.

6 Ontario Investment and Trade Centre. 2008. Community Profiles: Thessalon. Available online at: http://www.2ontario.com/communities/majoremployers.asp?mun_name=3557028&topic=1 Accessed January 21, 2009.

A 230-kV electrical transmission line runs along the Mississagi River valley connecting Aubrey Falls GS to the Mississagi Transformer Station (TS). A 230-kV line also connects Wells GS to the Mississagi TS. There are also 2 x 230-kV lines from Mississagi TS to Algoma TS. A 230-kV line also connects Aubrey Falls to Wawa and another 230 kV connects Mississagi TS and Wells to Sault Ste Marie. In addition, a 230-kV line connects Mississagi TS to Hanmer (see Figure 4.1) and a 115-kV line runs from Rayner GS to Red Rock GS and then over to Algoma TS.

To Wawa
Aubrey Falls GS
Rocky Island Lake
Aubrey Lake
Rocky Island Lake Control Dam
Sudbury District
Algoma District
129
Mount Lake Dam
546
Mississagi River
630
Wakomata Lake Dam
To Sault Ste. Marie
Mississagi TS
Cumming's Lake Dam
Little White River
City of Elliot Lake
Tunnel Lake
Wells GS
George W. Rayner GS
554
Town of Blind River
129
546
Elliot Lake
To Hanmer
553
Red Rock Lake
Red Rock Falls GS
Municipality of Huron Shores
17
Iron Bridge
To Algoma
Thessalon
The North Shore
Thessalon FN
Blind River
Mississauga FN
Thessalon
Blind River
Area of Watershed Shown
Legend
Watershed Boundary
Mississagi River
Provincial Highway
Rail Lines
230 kV Transmission Line
115 kV Transmission Line
Municipality/Township Boundaries
First Nation Land
Waste Disposal Site
N
0
10 km
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Figure 4.1
Brookfield Renewable Power
Mississagi River Water Management Plan
Major Infrastructure
HATCH

Back of figure

The Mississagi River is not used as a major water supply source. MOE (Garside, pers comm. February 2003) indicated that there are only two industrial/ commercial water users apart from BRP. These users are both near the mouth of the river and are

- Cameco Corporation uranium refinery located approximately 1 km from Lake Huron and approximately 100 m from the river. This plant has groundwater wells for process water, and wells immediately adjacent to the river for fire pumps.

- Huron Pines Golf Club, located just north of the Cameco refinery. The club has a Permit to Take Water from the river for irrigation purposes.

Iron Bridge has no communal water supply, relying mainly on a number of private deep-drilled wells. Residences along the Highway 17 corridor west of Blind River are also served by groundwater wells. There are a few lodges and outfitters farther upstream from Iron Bridge, which might have water lines from the river.

Garside (2003) also indicated that there are no direct dischargers into the river. The Mississauga First Nation does not have a municipal sewage facility; individual buildings have their own septic systems. There are no treated or untreated sewage discharges directly into the Mississagi River.

4.2 First Nation Communities

The Mississagi River system and associated watershed is an important traditional area of the First Nations (also see Section 4.11). They have used this waterway for generations as a primary means of travel. Camping sites along the river and, in some cases, homesteads and ceremonial/burial grounds have been identified to signify the importance of the river. Fishing, hunting and trapping along the river was, and still is, an important lifestyle for the local First Nation community (Mississauga First Nation, Personal Comm., 2004).

The Mississauga First Nation is the only First Nation community located within the Mississagi River watershed (Figure 4.1). Their reserve is located between the Mississagi River delta in the west and Blind River. The main settlement/ community area is 3 km west of the town of Blind River. The Mississauga First Nation has a population of 1031 with 352 living on the reserve (INAC website –

data for 2007). The current reserve land base is listed at approximately 2000 ha (INAC, 2003 website) but this will increase to 17,900 ha with the impending Final Transfer of a 1995 Land Claim Settlement (Mississauga First Nation, 2002)[1]. The band has two outstanding specific claims registered with Indian and Northern Affairs Canada. One specific claim relates to flooding of their land by the construction of dams on the Penwabecong River in 1852 and the other claim relates to the southern boundary of the reserve. Two other claims regarding the northern boundary and the lack of compensation for construction of the TransCanada highway through the reserve have been settled.

The Mississauga First Nation has an active community that has developed significantly in the last 20 years. Their community members still rely on the Mississagi River system for hunting, trapping, fishing, travel, drinking, cleaning, and other traditional uses. There have been considerable additions to the Mississauga First Nation local infrastructure including a new water treatment plant. The main source of water is a well near the center of the community. No water is drawn directly from the Mississagi River.

A Draft Community Plan was prepared in 2002 which outlines cultural, economic and social initiatives that will be followed in the short, medium and long term. Among a number of proposals, the community is interested in developing a commercial fishery and a fish processing plant, as well as developing the forestry and tourism potential of the area.

The Thessalon First Nation reserve is located on the shores of Lake Huron 10 km east of Thessalon and just south of the Mississagi River watershed (Figure 4.1). The registered population of the Thessalon First Nation is 590 with 90 living on the reserve (INAC 2008 website). Similar to the Mississauga FN, Thessalon FN members use the Mississagi River system for hunting, trapping, fishing, travel, cleaning and other traditional uses. The main source of water is two wells located in the public works yard. Sewage facilities consist of individual septic tanks at each residence (OCWA, 2001). There is currently a specific claim being investigated regarding the reserve boundaries. The claim alleges that they did not receive the proper amount of land to which they were entitled under the Robinson-Huron Treaty.

[1] The Mississauga FN reserve shown in Figure 4.1 includes the enlarged land base.

4.3 Hydroelectric Power Generation

A comprehensive evaluation of alternative power development schemes was undertaken in 1945 to 1946 by Ontario Hydro. From this review, the Rayner and Red Rock Falls GS were developed in 1950 and 1961 respectively, as well as storage dams/control structures on Rocky Island Lake. After these first developments, two additional stations were constructed by Ontario Hydro. These included Aubrey Falls GS in 1969 and Wells GS in 1970 (Paterson, 1981) (Figure 3.1). The Wells station shares the Rayner reservoir (Tunnel Lake) and the Rayner plant is now only used for reserve generating capacity and in occasional years when the spring freshet exceeds the capacity of the Wells plant. Four reservoirs have been created by these developments: Rocky Island Lake, Aubrey Lake, Tunnel Lake and Red Rock Lake. The salient features of the generating facilities are provided in Section 5.

There are also four remote private lodge micro hydro sites (all off-grid) in the Mississagi River watershed. These are located on tributaries to the Little White River, at the outlets of Flack and Mikel Lakes (Raimbault Twp) on the Boland River, and at the outlets of Rottier Lake (Viel Twp) and Mount Lake (Sagard Twp) on the Sister River. Laurentian Lodge owns Mikel Creek GS (30 kW) and Wilkie Falls GS (150 kW) on Boland River. Frontier Lodge owns Rottier GS (80 kW) on Sister River, and Wilderness Lodge owns Mount Lake GS (34 kW), also on Sister River. All of these micro hydro sites generate power to reduce the use of diesel generators. None of these facilities would be affected by any changes to operations on the Mississagi River system. However, they could be subject to simplified WMPs if deemed warranted by the MNR Minister (Section 2.3.1 of LRIA).

4.4 Hunting and Trapping Activities

Approximately 18 trapline areas are located between Rocky Island Lake and Lake Huron along the Mississagi River (Appendix G). Beaver, muskrat, mink and red fox are the predominant animals caught with beaver, lynx, otter and fox bringing the highest return. The productivity of a trapline varies from year to year, depending on weather conditions, prices and intensity of trapping (Paterson, 1981). Most trapping in the area is for supplementary income, not relying on it as their primary income source (MNR, 1983). There are eight trappers' cabins adjacent to the Mississagi River.

Hunting and trapping are popular activities in the area, both for local residents and First Nations. Waterfowl hunted include Canada goose, snow goose, Brant goose, mallard duck, American black duck, green-winged teal, blue-winged teal, wood duck, gadwall, American widgeon, northern shoveler, northern pintail, canvasback, red head, ring-necked duck, greater scaup, lesser scaup, harlequin duck, bufflehead, common goldeneye, hooded merganser, common merganser and red-breasted merganser.

Small game species hunted in the area are primarily ruffed grouse and rabbit. Large game hunted includes white-tailed deer, black bear and moose. Deer are common in the southern half of the watershed, with several important deer yards in the Iron Bridge – Red Rock areas. There are 16 bear management areas along the Mississagi River from the mouth to Rocky Island Lake (Appendix G).

4.5 Forestry Industry

Northshore Forest Incorporated operates the sustainable forest license (SFL) for the Northshore Forest management unit that includes most of the Mississagi River watershed. Northshore Forest Inc. is managed by a Board of Directors with company shareholders including St. Mary's Paper Ltd., Domtar Inc., Midway Lumber Mills Ltd., and North Shore Independent Forestry Association. Domtar Forest Resources updated the forest management plan recently. Forest management plans direct the planning, harvesting, renewal and tending for the management unit. Forest management plans provide set-back cutting distances from watercourses (e.g., to prevent sedimentation/protect fish habitat/provide aesthetic screens along canoe routes, etc).

Most of the timber cut in the watershed is processed at mills located outside the area (e.g., Domtar's pulp and paper mill in Espanola). Some lumber is processed locally at mills in Thessalon and Sault Ste. Marie.

4.6 Mining/Aggregate Industry

There are no active mines present in the watershed. Historically, there were a number of copper mines in the lower part of the watershed but these are no longer active. Aggregate resources are relatively abundant especially where there are relatively thick glacial deposits and lacustrine deposits, such as the Mississagi

River valley (Paterson, 1981). However, future development of any mines or pits will be restricted to areas outside existing provincial parks and conservation areas.

4.7 Recreation/Tourism

The primary recreation and tourism activities in the study area of the Mississagi River watershed focus on water-based recreation (i.e., canoeing, kayaking, white-water paddling), sport fishing, hunting, hiking, snowmobiling and use of provincial parks and conservation reserves. These activities are described in more detail in the subsections that follow. In addition, ecotourism is developing as a new form of recreation in the Mississagi River watershed.

Water-Based Recreation

The Mississagi River, from its headwaters near White Owl Lake/Lebel Lake to its mouth at Lake Huron, is a provincially significant canoe route (Figure 4.2). The route encompasses a total distance of approximately 322 km, although several access points (i.e., Aubrey Falls, Pig Pen Chute, Tunnel Lake, Iron Bridge) allow users to enter or exit the river at different locations. Mississagi Provincial Park (including 2003 additions) is a popular backcountry canoeing area, primarily because of its relatively isolated nature and high scenic quality (MNR, 2004). MNR states "the intent of waterway parks is to incorporate outstanding recreational water routes with representative natural features and historic resources to provide high quality recreational and educational opportunities for park visitors" (MNR, 2004). The Mississagi River offers both white water and flat water canoeing opportunities. The Wenebegon, Aubinadong and Little White Rivers, which are also provincial parks, also provide canoeing opportunities.

During daylight hours from the Saturday before Victoria Day to the Saturday after Thanksgiving, a flow of 8.5 m^3/s is released through the Aubrey Falls GS control dam to provide tourists with a scenic view of the falls area. Site visits to view Aubrey Falls GS control dam are summarized in Table 4.2 for the years 1999 to 2007.

Camps/Tourist Lodges

There are three commercial lodges and one remote outpost on or near Tunnel Lake. There are also several private cottages on Tunnel Lake.

There is one commercial lodge located on Highway 129 close to Aubrey Falls and three licensed commercial outpost camps on Rocky Island Lake. A few private cabins are situated along the banks of the Mississagi River between Aubrey Falls and Tunnel Lake. The main cottage/cabin area in the watershed is around Wakomata Lake and this area is not affected by water levels/flows on the Mississagi River. However, the summer residents in this area and lodge guests on nearby lakes in the Chub and Cumming's Lakes area use Tunnel Lake and the Mississagi River extensively (see Appendix I – Resort Owners' Survey).

Snowmobiling

Snowmobile trails crisscross the watershed (Figure 4.2). A primary trail follows the Mississagi River from the Highway 556 bridge to where Highway 129 crosses the river near Aubrey Falls. A secondary trail also follows the river for about 5 km just downstream of the junction with the Sharpsand River. There is another short stretch of trail paralleling the river just below Iron Bridge.

4.8 Provincial Parks, Conservation Reserves and Enhanced Management Areas

There are several provincial parks, and one provincial nature reserve, within the Mississagi River WMP area as listed in Table 4.3. The additions to the Mississagi River Provincial Park were regulated in 2003 and include the Mississagi River upstream of Tunnel Lake to Aubrey Falls. Provincial parks, conservation reserves and enhanced management areas within the Mississagi River watershed are shown in Figure 4.3.

Sudbury District

Algoma District

Rocky Island Lake

Aubrey Lake

Mississagi River

Tunnel Lake

Red Rock Lake

Municipality of Huron Shores

Thessalon

Thessalon FN

Iron Bridge

Town of Blind River

City of Elliot Lake

Elliot Lake

The North Shore

Blind River

Mississauga FN

546

630

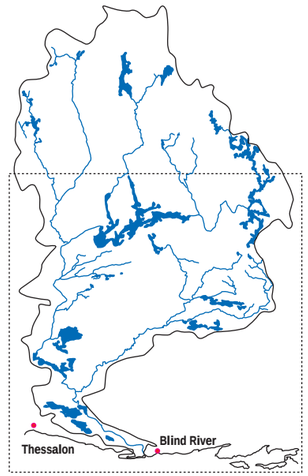
554

129

108

553

17



Area of Watershed Shown

Legend

- Watershed Boundary
- PS Primary Snowmobile Trail
- SS Secondary Snowmobile Trail
- C Canoe Route
- P Portage
- Public Access Points
- Boat Launch

N

0 10 km

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Figure 4.2

Brookfield Renewable Power

Mississagi River Water Management Plan

Canoe and Snowmobile Routes

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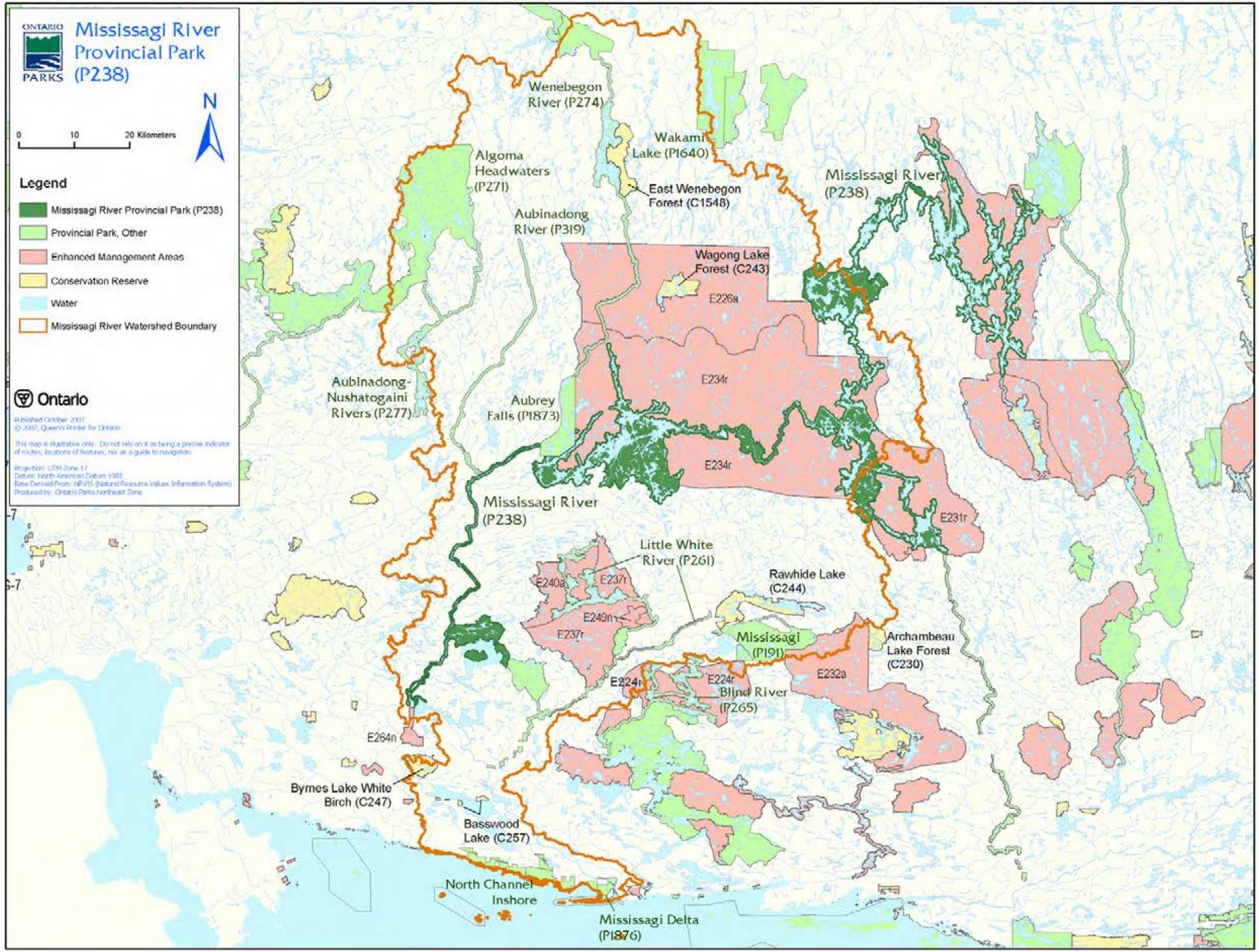

Figure 4.3
Brookfield Renewable Power
Mississagi River Water Management Plan
Parks, Conservation Reserves and Enhanced Management Areas

HATCH™

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Table 4.2 Aubrey Falls Visitation Statistics 1999-2007

1999	May	June	July	August	Sept.	October
Sunday	84	98	133	259.5	126	70
Monday	24.5	80.5	84	223.5	80.5	52.5
Tuesday	24.5	98	87.5	161	140	45.5
Wednesday	10.5	66.5	228	115.5	98	7
Thursday	31.5	38.5	59.5	189	108.5	24.5
Friday	56	49	80.5	115.5	105	35
Saturday	52.5	84	196	143.5	129.5	38.5
Totals	*264*	*515*	*868*	*1214.5*	*789*	*273*
					Total	*3941*

2000	May	June	July	August	Sept.	October
Sunday	151	130	260	105	136.5	73.5
Monday	35	49	178.5	129.5	87.5	42
Tuesday	21	154	98	182	101.5	35
Wednesday	42	116	241.5	220.5	49	14
Thursday	10.5	130	129.5	154	87.5	28
Friday	10.5	73.5	143.5	154	73.5	35
Saturday	70	73.5	109.5	185.5	122.5	7
Totals	*340*	*725*	*1179.5*	*1130.5*	*656*	*234.5*
					Total	*4266.5*

2001	May	June	July	August	Sept.	October
Sunday	38.5	66.5	238	185.5	143.5	21
Monday	17.5	36.5	154	105	84	21
Tuesday	3	66.5	192.5	136.5	115.5	35
Wednesday	10.5	66.5	178.5	126	56	45.5
Thursday	7	31.5	234.5	150.5	66.5	17.5
Friday	14	52.5	206.5	136.5	91	28
Saturday	52.5	42	154	182	217	28
Totals	*143*	*364*	*1358*	*994*	*774*	*196*
					Total	*3828.5*

2002	May	June	July	August	Sept.	October
Sunday	14	21	17.5	70	304.5	N/A
Monday	7	31.5	14	70	119	N/A
Tuesday	3.5	24.5	42	94.5	119	N/A
Wednesday	21	24.5	28	91	175	N/A
Thursday	21	31.5	42	115.5	94.5	N/A
Friday	38.5	0	14	122.5	171.5	N/A
Saturday	56	7	17.5	133	178.5	N/A
Totals	*161*	*140*	*175*	*695.5*	*1152*	*0*
					Total	*2334.5*

2003	May	June	July	August	Sept.	October
Sunday	21	14	66.5	84	45.5	0
Monday	17.5	31.5	73.5	59.5	56	7
Tuesday	3.5	7	119	119	24.5	0
Wednesday	3.5	10.5	105	87.5	56	0
Thursday	17.5	7	66.5	94.5	35	10.5
Friday	14	3.5	38.5	42	24.5	0
Saturday	38.5	35	42	108.5	70	14
Totals	*116*	*109*	*511*	*595*	*312*	*31.5*
					Total	*1673*

2004	May	June	July	August	Sept.	October
Sunday	31.5	31.5	63	161	49	31.5
Monday	10.5	24.5	77	87.5	45.5	31.5
Tuesday	10.5	21	24.5	49	38.5	7
Wednesday	31.5	56.5	80.5	84	56	24.5
Thursday	0	0	108.5	84	49	21
Friday	0	7	80.5	87.5	14	3.5
Saturday	0	35	129.5	56	59.5	28
Totals	*84*	*186*	*564*	*609*	*312*	*147*
					Total	*1900.5*

Most Popular

Day	Rank	Avg
Sunday	1	99.80
Monday	6	65.76
Tuesday	4	71.47
Wednesday	3	77.42
Thursday	5	67.45
Friday	7	62.89
Saturday	2	85.06

Month	Rank	Avg
May	5	187.25
June	4	339.50
July	2	775.83
August	1	873.25
September	3	736.50
October	6	183.75

2004 Times	Rank	Avg
7:00 -10:59	4	109.5
11:00 - 12:59	2	309
1:00-3:59	1	485.5
4:00 -6:59	3	252
7:00 - 9:00	5	42

* Statistics based on information gathered from the vistor registry book at Aubrey Falls Provincial Park and an average of 3.5 occupants per vehicle taken from the Parks Statistics Program

2005	May	June	July	August	Sept.	October
Sunday	17.5	59.5	109	56	42	66.5
Monday	14	14	66.5	227	87.5	17.5
Tuesday	7	28	87.5	59.5	38.5	10.5
Wednesday	10.5	21	73.5	112	42	17.5
Thursday	7	35	132	101.5	24.5	17.5
Friday	31.5	24.5	98	73.5	28	45.5
Saturday	35	45.5	77	87.5	63	28
Totals	*123*	*228*	*513*	*747*	*326*	*203*
					Total	*2208*

2006	May	June	July	August	Sept.	October
	17.5	10.5	59.5	49	56	38.5
	21	10.5	119	70	35	24.5
	3.5	17.5	73.5	80.5	21	17.5
	10.5	14	80.5	87.5	24.5	14
	7	38.5	59.5	122.5	38.5	7
	28	73.5	70	28	52.5	21
	35	63	91	115.5	49	24.5
	123	*228*	*553*	*553*	*277*	*147*
					Total	*1860*

2007	May	June	July	August	Sept.	October
	21	10.5	52.5	94.5	87.5	21
	7	10.5	91	73.5	14	14
	0	17.5	105	52.5	42	17.5
	14	14	49	59.5	24.5	7
	17.5	31.5	42	105	24.5	21
	31.5	73.5	66.5	52.5	17.5	7
	38.5	70	84	66.5	52.5	21
	130	*228*	*490*	*504*	*263*	*109.5*
					Total	*1722*

Table 4.3
Provincial Parks in the
Mississagi River Water Management Area

Name	Size (ha)	Category	Year Regulated	Description
Mississagi River and Mississagi River additions	91,247	Waterway Provincial Park	2003	Park extends east from Rocky Island Lake, includes the Mississagi River and crosses into the Spanish River watershed down to Biscotasing (at the CPR line). The park's main feature is a canoe route offering hunting and angling opportunities. Park boundary extends 200 m from the maximum controlled elevation of the river. Additions to the park in 2003 fall into two categories: Category A – natural heritage areas, including: Rocky Island-Kindiogami forest (containing some young successional growth and old growth forest); north shore of Wakomata Lake and White Owl-Red Pine Lake complex. Category B – recreational values/ecological boundaries including extension from Aubrey Falls to Tunnel Lake.
Aubrey Falls	4,860	Natural Environment Provincial Park	1985	The Wenebegon River flows through the park. Park provides boating, canoeing, hiking and angling opportunities.
Aubinadong River (P319)	2,289	Waterway Provincial Park	2002	The river flows through a diverse landscape, rugged in the north to more gentle near its confluence with the Mississagi River. The river offers both slow moving and narrow fast stretches of water.

Table 4.3
Provincial Parks in the
Mississagi River Water Management Area

Name	Size (ha)	Category	Year Regulated	Description
Little White River (P261)	12,782	Waterway Provincial Park	2002	Includes approximately 100 km of the Little White River from the Blue Lake headwater area to the Mississagi River. The Raven Lake natural heritage area included in the park contains bedrock cliffs, deep gorges, wetlands and significant stands of white pine.
Mississagi Delta	2,395	Provincial Nature Reserve Park	1985	The nature reserve protects an extensive sandy bird's foot delta at the mouth of the Mississagi Delta. The park also includes a chain of off-shore islands. A number of vegetation communities are found in the park, as well as cultural/ heritage values.

4.9 Fishing

Commercial baitfish harvesting and recreational fishing are important activities on the Mississagi River system. Commercial baitfish harvest areas along the Mississagi River between Rocky Island Lake and the North Channel of Lake Huron are shown on a map included in Appendix G. Fishing also plays an important role in the lifestyle of local First Nations. In this regard, there is a traditional fishery for subsistence and ceremonial purposes practiced by the Mississagi FN on the Mississagi River at the "chutes" (see Figure 3.3).

Walleye is a primary sought after species in the Mississagi River from Red Rock Falls GS to Lake Huron. Approximately 3000 walleye were taken on an annual basis from 1970 to 1973 (Ontario Hydro, 1982), however, there is no current information available regarding fishing values. Yellow perch, pink salmon, chinook salmon, rainbow trout and lake sturgeon have been traditionally the targets of the recreational fishery in this section of the river which has easier access, and is the most popular reach used for fishing. However, as of July 1, 2008 recreational anglers are no longer allowed to keep any lake sturgeon they catch. This restriction does not apply to aboriginal peoples who use lake sturgeon for subsistence and ceremonial purposes (MNR, 2008).

Fishing is also a popular activity for those visiting the lodges and outpost camps on or near Tunnel and Rocky Island lakes. Walleye is the target catch in this area.

4.10 Agricultural Resources

There is relatively little farming carried out in the watershed. The only agricultural areas are south of Tunnel Lake, located around Wharncliffe, Kynoch, Bellingham, Parkinson and Iron Bridge. Predominantly hay and pasture are grown for cattle fodder.

4.11 Heritage Resources

There is evidence of human occupation dating from soon after the retreat of the last ice sheet approximately 9000 years ago (Adams and Errington, 1992). The early inhabitants of the area were probably ancestors of the Algonkan speaking Ojibwa groups. Adams and Errington (1992) identified 44 separate prehistoric sites during an inventory of cultural resources within the Mississagi River

Provincial Park. Further sites might have been discovered if time had permitted. This information is indicative that the entire river valley has high cultural potential.

The first evidence of Europeans in the area occurred in the early 17th Century, at which time explorers described the local inhabitants as nomadic. By 1650, missionaries identified a number of seasonal settlements along the north shore of Lake Huron with the Mississauga band occupying the Mississagi River delta area. While some crops were cultivated they were also dependent on fishing and hunting. They moved on a seasonal cycle to a series of sites where there was abundant fishing. The Mississagi River valley is within their traditional hunting/fishing areas (Adams and Errington, 1992).

The north shore of Lake Huron was an important area during the fur trade era. There was an outpost of the North West Company on Green Lake (now submerged under Rocky Island Lake) that was subsequently operated by the Hudson Bay Company until the 1880's. The Hudson Bay main trading post was located at the mouth of the Mississagi River (Adams and Errington, 1992).

In the 19th Century, settlement was encouraged through Ontario government grants and was mainly concentrated in the Iron Bridge/Thessalon area where better soils enabled agricultural crops to be grown. Local mining and forestry activities gave other employment opportunities.

The Mississagi Forest Reserve was established in 1903 to protect red and white pine stands, although salvage cutting was allowed. The principle of reserves was to manage the forests within the watershed and enable a sustained yield of wood. However, by the 1930's the supply of pine was diminishing. The river was used as an important route for log drives up to this time and there are still remnants of these operations (Paterson, 1981). The Blind River sawmill was the largest pine sawmill east of the Rockies (MNR, 1983). An extensive forest fire in 1948 all but finished the pine industry and the Blind River operation was much reduced, finally closing in the late 1960's.

5 Waterpower Facilities and Current Water Management Strategies

5 Waterpower Facilities and Current Water Management Strategies

5.1 Existing Water Power Facilities and Control Structures

Brookfield Renewable Power owns four hydroelectric generating stations on the Mississagi River and four control structures on Rocky Island Lake reservoir as described below. The key features of each of these generating stations are provided in Table 5.1.

Table 5.1
Key Features of Generating Stations on the Mississagi River

Generating Station	Year Commissioned	Capacity (MW)	Head (m)	Design Flow (m^3/s)	Annual Capacity Factor	30-Yr Average Energy (GWh)
Aubrey Falls	1969	162	55	353	0.12	170
Rayner	1950	46	65	82	0.08	32
Wells	1970	239	65	433	0.17	355
Red Rock Falls	1961	41	28	180	0.53	192
Totals		**488**				**749**

Rocky Island Lake Control Dam and Side Dams

The dams impounding Rocky Island Lake reservoir are located upstream of the Aubrey Falls GS. Originally constructed in 1949 to provide storage capacity for the Rayner GS, Rocky Island Lake now provides storage for all downstream hydroelectric facilities. There are four structures associated with Rocky Island Lake reservoir (Figure 5.1): the main control dam, Side Dam No. 1, Side Dam No. 2 and Round Lake Dam. The Rocky Island Lake main control dam is a 20-m high concrete structure consisting of five sluiceways and extending a total length of 128 m. The two side dams are both impervious earth-fill embankments located approximately 1.5 km upstream from the main control dam. These side dams have no discharge facilities and are designed to contain the reservoir. The Round Lake Dam is also an impervious structure located approximately 16 km upstream of the main control dam.

Aubrey Falls Generating Station

The Aubrey Falls GS is the northernmost hydroelectric facility on the Mississagi River, located approximately 75 km northeast of Thessalon (Figure 5.1). This generating station was commissioned in 1969, and consists of two units with a total generating capacity of 162 MW. The dam facilities associated with the generating station include the main concrete dam, the Aubrey Falls Control Dam and the Trolling Lake Block Dam (Figure 5.1). The powerhouse is located downstream from the main concrete dam, with power flow conveyed by two steel penstocks. The main dam has a total length of 335 m, including the headworks/intake structure and a sealed log chute, which are flanked on either side by concrete gravity sections. The Aubrey Falls Control Dam is located adjacent to the main dam and consists of a concrete sluiceway and adjacent earth-fill embankment, with the structure extending a total distance of 207 m. The Trolling Lake Block Dam is located southwest of the generating station and consists of a 520-m long earth-fill embankment designed to contain the reservoir.

Rayner Generating Station

The Rayner GS, commissioned in 1950, is located approximately 25 km northeast of Thessalon on the Mississagi River (Figure 5.2). The Rayner facility, with a maximum capacity of 46 MW, consists of a main concrete dam, 198 m long and 72 m high, a two-unit powerhouse, one earth-fill side dam (located 3.7 km upstream) and one concrete side dam. Water from the intake structure on the main Rayner Dam is conveyed to the powerhouse via two 46-m long concrete penstocks. The Rayner GS can be operated in unison with the Wells GS to maximize power production at the site, although over the last 30 years the Rayner facility is generally only operated for reserve generating capacity and when excess water is available that cannot be used at the Wells GS.

Wells Generating Station

The Wells GS, commissioned in 1970, is located adjacent to the Rayner GS and uses the same reservoir (Tunnel Lake) and part of the original Rayner Side Dam (Figure 5.2). The Wells GS consists of two units with a total rated capacity of 239 MW. This generating station is the largest on the Mississagi and, on a 5-yr average basis, produces nearly 50% of the total energy production on the river.

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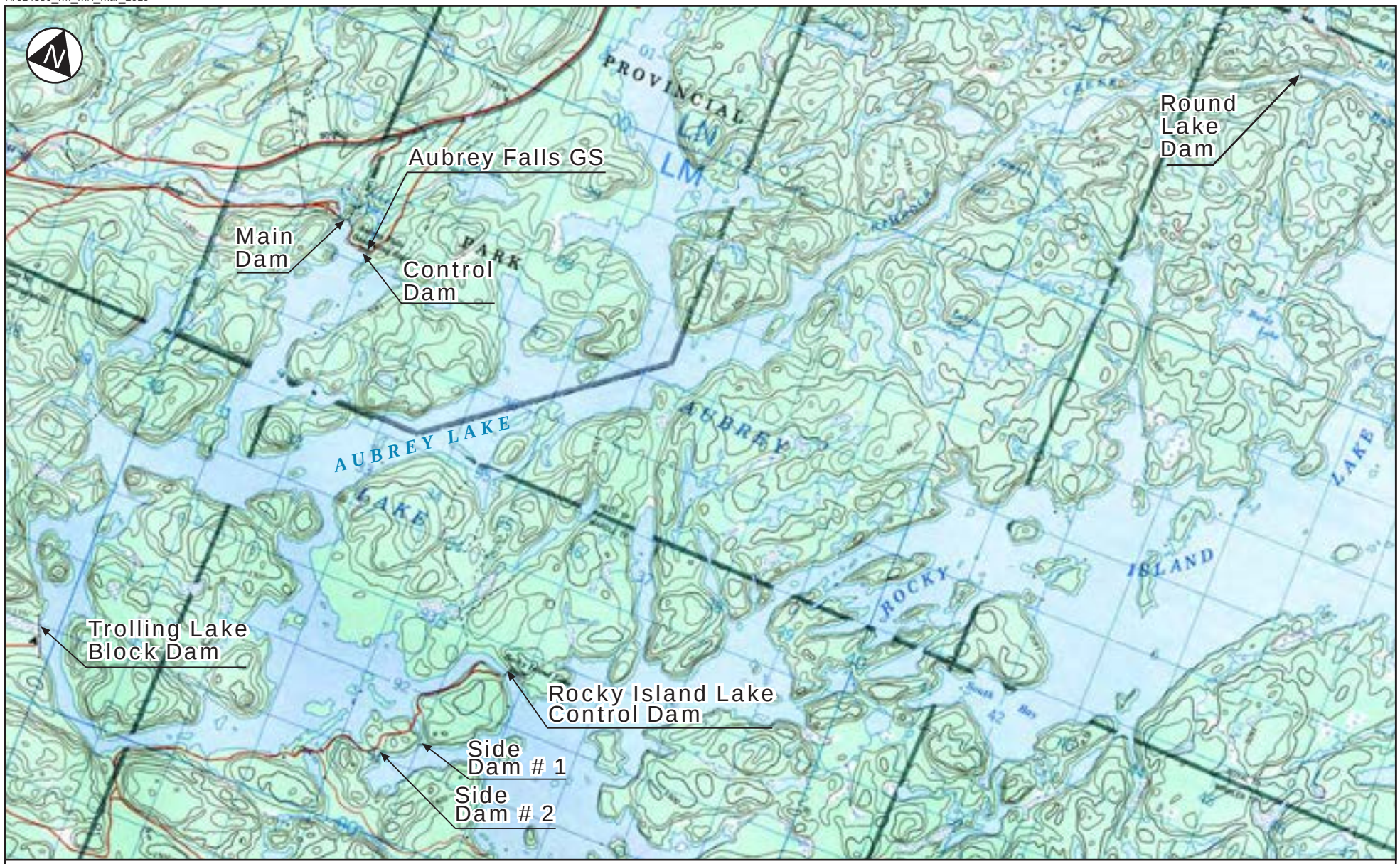

Figure 5.1
Brookfield Renewable Power
Mississagi River Water Management Plan
Location of Aubrey Lake and Rocky Island Lake Control Facilities

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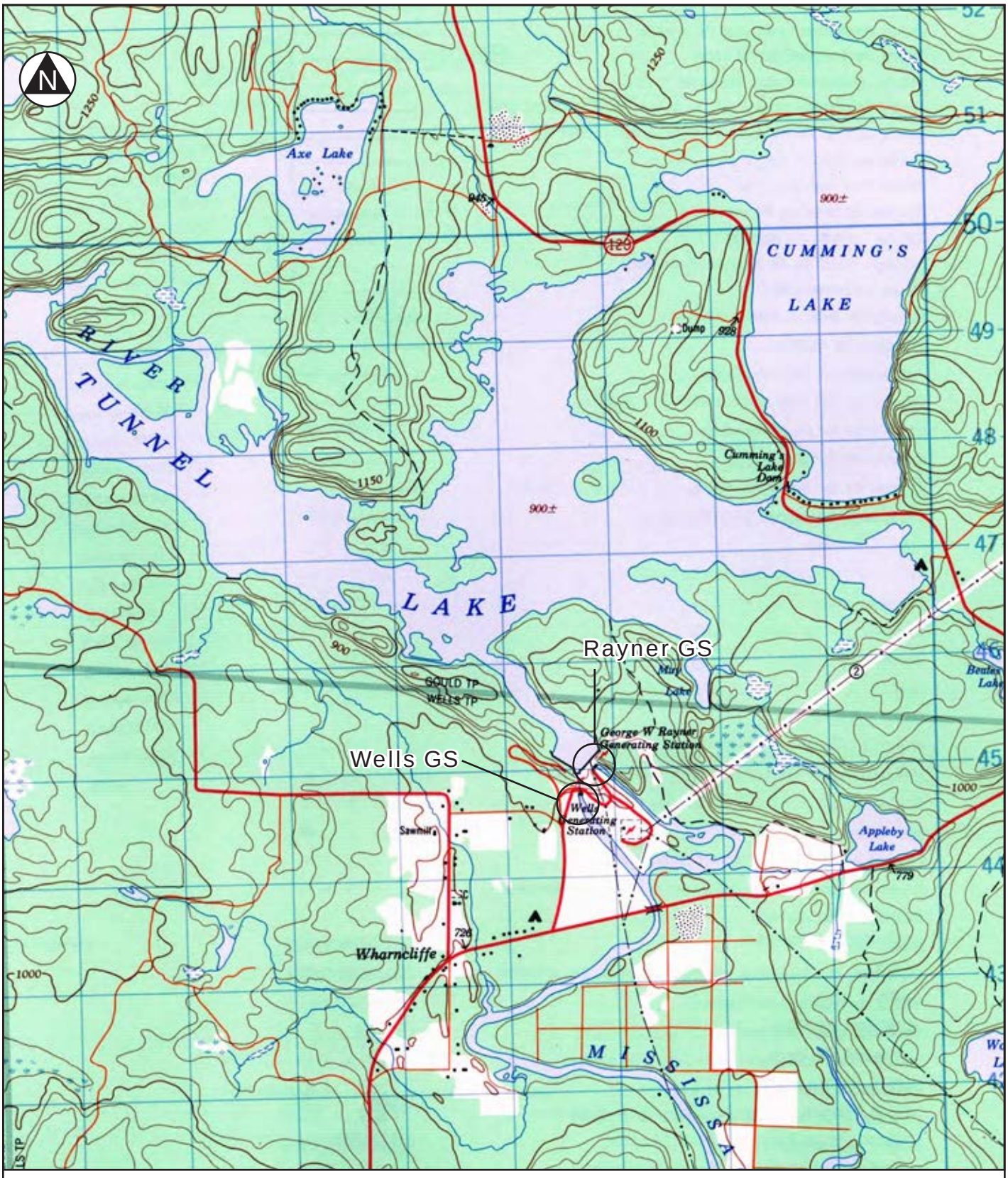

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Metres

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Figure 5.2

Brookfield Renewable Power

Mississagi River Water Management Plan

Location of Wells and Rayner GS

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Red Rock Falls Generating Station

The Red Rock Falls GS is located approximately 15 km downstream from the Wells and Rayner facilities, and approximately 6.4 km north of the Town of Iron Bridge (Figure 5.3). This facility was commissioned in 1961 and has a total rated capacity of 41.2 MW. The facility consists of a main concrete dam, approximately 290 m long with east, west and central gravity sections, a headworks/intake section and a sluiceway. Water is conveyed to the downstream powerhouse by two concrete penstocks. There is also an auxiliary block dam located in the northeast corner of Red Rock Lake reservoir.

Other Water Control Structures

MNR owns and operates two rock-fill earth core overflow dams in the Mississagi River watershed, one at the outlet of Wakomata Lake and the other at the outlet of Cumming's Lake (Figure 5.2). These dams are not located on the Mississagi River. However, Wakomata Lake flows into the Mississagi River via Snowshoe Creek. The Cumming's Lake structure controls flow into Tunnel Lake on the Mississagi River system.

5.2 Existing Water Management Plan

5.2.1 Overview

A water management plan for the Mississagi River was developed by the former owner (OPG) of the generating facilities on the river. The plan is comprised of a set of operating constraints and guidelines that relate to a portion of the Mississagi River on which water control structures and associated facilities are located for the purposes of either storage or electrical power generation, or both.

The water management plan consists of three types of constraints:

- Operational – developed due to the electrical, structural or legal requirements of the storage/generating facility. Each location has a normal operating range. Some have additional storage available for flood protection or energy reserve during critical periods.

- Social constraints – voluntary constraints developed primarily to address social uses of the water and are subject to watershed conditions. An example is summer water levels to enhance recreational activities (fishermen's water). A reasonable effort is made to fulfill these constraints.

- Environmental constraints – constraints developed to protect or enhance the natural environment.

The guidelines for adherence to the above constraints conform to two categories:

- Mandatory Constraints – those requirements established by operational factors such as maximum and minimum reservoir levels, as defined by either legal or structural or equipment limitations and ecological requirements, such as fisheries flows and levels, that must not be violated.

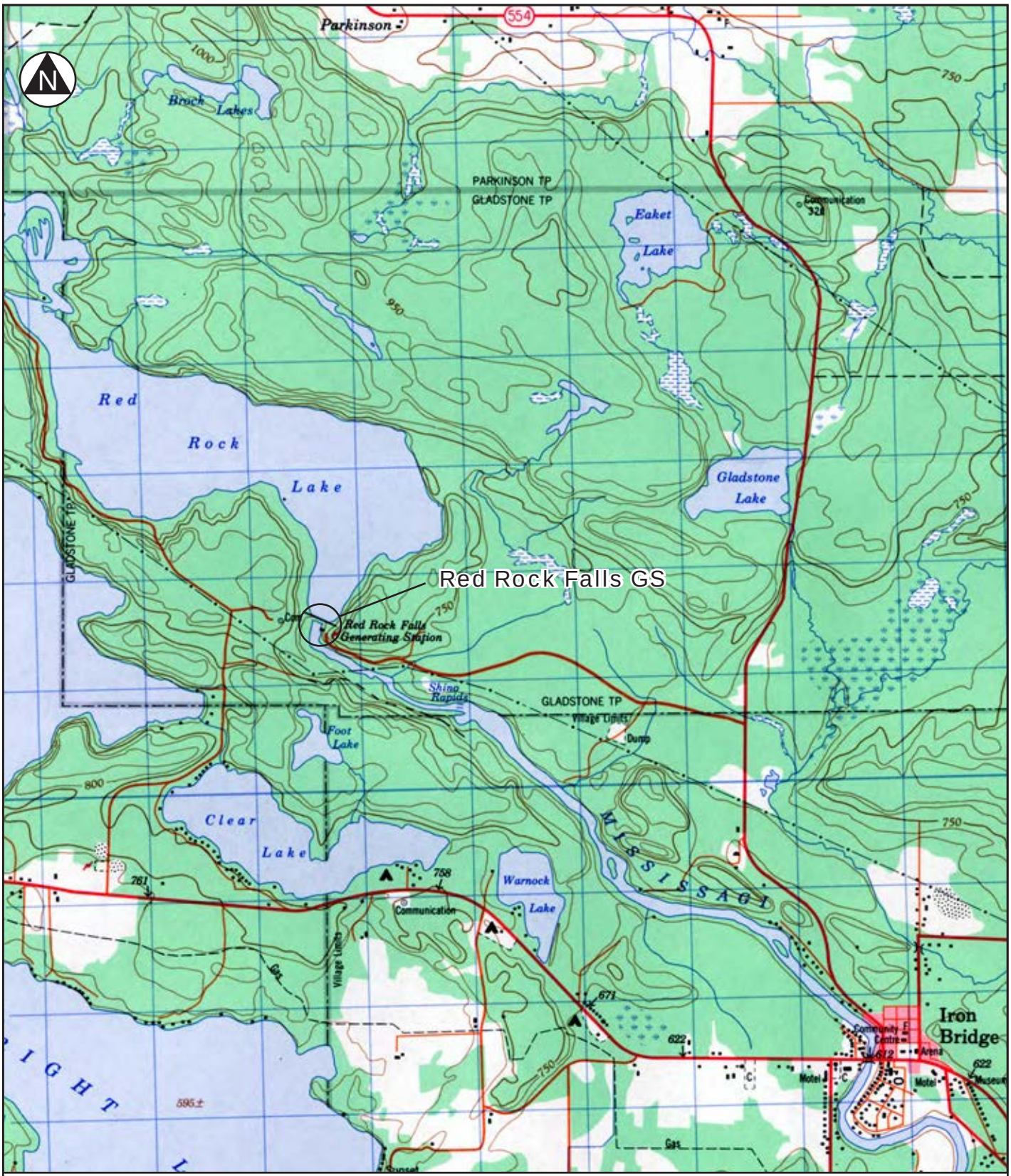
- Voluntary Social Constraints – examples are summer reservoir levels and Fishermen's Water flows. They are adhered to on a reasonable effort basis and can be relaxed during an electrical system energy demand emergency.

5.2.2 Existing Site Specific Constraints

Rocky Island Lake Reservoir

Water Level Constraints				
Constraint	**Elevation Limits (mCGD)**	**Fluctuation Range (m)**	**Duration**	**Type**
Absolute Range	396.76 to 408.95	12.19	Annual	Operational Constraint
Flood Allowance	None	-		
Normal Operating Range	396.76 to 408.95	12.19	Annual	Operational Constraint
Summer Normal Range*	406.00 to 408.95	2.95	June 1 to September 30	Voluntary Citizenship
Summer Energy Reserve*	406.00 to 405.00	1.00	June 1 to September 30	Voluntary Citizenship

*New in October 2002. The energy reserve allows BRP to respond to spot market opportunities.



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Metres

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Figure 5.3

Brookfield Renewable Power

Mississagi River Water Management Plan

Location of Red Rock Falls GS

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Guideline Notes re Rocky Island Lake Water Levels:

1. Maximum elevation of 408.95 mCGD is defined by Licence of Occupation No. 7198. There is no legal minimum operating level. The operating minimum is the lowest sluice sill elevation.

2. Social considerations on Rocky Island Lake include three licensed commercial outpost camps to which Land Use Permits have been issued for seasonal recreational use.

Flow Constraints				
Constraint	**Flow Limits (m^3/s)**	**Flow Range (m)**	**Duration**	**Type**
Maximum Flow	0	-	Spring Freshet April to June	Voluntary Citizenship - Flood Management in lower river

Guideline Notes re Rocky Island Lake Main Control Dam:

1. Rocky Island Lake main control dam is kept open until early April after being drawn down and passes inflow.

2. Rocky Island Lake main control dam is usually closed at the beginning of the freshet (early April) as soon as total inflow to Red Rock Falls GS will support minimum salmon water release (also see Guideline Note 6 under Red Rock Falls GS). Under these conditions, flood management guidelines for the entire lower river system are implemented to reduce/control flooding in Iron Bridge and lower river.

Historical operating data for Rocky Island Lake are available for a 52-yr period from 1950 to 2001. Historical water levels are given in Figure 5.4 and historical flow releases from the main control dam in Figure 5.5 at the end of this section. These figures depict the long-term variation in daily average flow, which has occurred during each of the 52 weekly periods of the year. This time period was chosen as it corresponds to the normal flow decision period that the MPT Production Centre uses for water allocations and flow releases from Rocky Island Lake.

The data are presented in the form of "Box and Whisker" plots, which provide the following statistical information on flows, for each week:

- maximum historical water level/flow for the period (top dash)
- calculated average water level/flow for the period (diamond)
- minimum historical water level/flow for the period (bottom dash)
- 90th percentile water level/flow (upper whisker)
- 75th percentile water level/flow (top of box)
- 25th percentile water level/flow (bottom of box)
- 10th percentile water level/flow (bottom whisker).

The percentile values reflect a threshold flow magnitude below which the historical flows have occurred over the respective 52-yr operating period. An illustrative example follows, with reference to Figure 5.5. If the 90th percentile flow for Week 1 is 70.5 m^3/s, flow releases have been at or below this flow for 90% of the time for all days in Week 1 (viz January 1 to 7). The 75th percentile flow value for Week 1 is 52.7 m^3/s and the 25th percentile flow value is 24.7 m^3/s. This means that flow releases from Rocky Island Lake Reservoir for the first week of the year over the long term fall between 52.7 and 24.7 m^3/s, 50% of the time (viz 75% to 25%). It is also evident the flow releases for Week 1 exceed the 90th percentile level of 70.5 m^3/s only 10% of the time, with the maximum recorded flow in Week 1 for the 52-yr period equal to 118 m^3/s. The 10% flow for Week 1 is 10.8 m^3/s and minimum recorded flow of 0 m^3/s, representing the lowest range of flow releases that have occurred 10% of the time, historically. Similar statistical analyses of flows can be made for other weeks of the year and may also be applied for historical water levels given in Figure 5.4.

Aubrey Falls Generating Station and Reservoir

Aubrey Lake Water Level Constraints				
Constraint	**Elevation Limits (mCGD)**	**Fluctuation Range (m)**	**Duration**	**Type**
Absolute Range	391.58 to 394.63	3.05	Annual	Operational Constraint
Flood Allowance	None	-		
Normal Operating Range	391.58 to 394.63	3.05	Annual	Operational Constraint

Aubrey Lake Water Level Constraints				
Constraint	**Elevation Limits (mCGD)**	**Reservoir Status**	**Duration**	**Type**
Maximum Level-Flood Management Guideline	393.19	Reservoir half-full storage level	Spring freshet-April to June	Voluntary Social Constraint - Flood Management in lower river

Guideline Notes:

1. There are no legal maximum or minimum operating levels as defined by Water Power Lease Agreement No. 94 (November 18, 1975). Maximum operating level is determined by the dam design and operating minimum by generating equipment constraints.

Flow Constraints				
Constraint	**Flow Limits (m^3/s)**	**Hours**	**Duration**	**Type**
Minimum Flow - Scenic falls flow discharged through spillway	8.50	During specified daylight hours (see Note 1 below)	Saturday before Victoria Day to Saturday after Thanksgiving.	Legal Social Constraint - As per WPLA No. 94
Minimum Flow - Lower river refresh flow	Generating unit operated at efficiency	1 h each day	Annual	Legal Environmental Constraint - As per WPLA No. 94
Maximum Flow - Flood and Ice Management	Generating unit operated at capacity (floods) or efficiency (ice management)	Reduced hours of operation	For lower river ice management and to reduce risk of Highway 129 flooding	Operational Constraint / Social Constraint - Flood Management in lower river

Guideline Notes:

1. In accordance with Water Power Lease Agreement No. 94, (Supplemental Letter of Agreement, dated May 27th, 1998); discharges of about 8.5 m^3/s are required to spill for scenic water during daylight hours of the tourist season (from the Saturday before Victoria Day in May to the Saturday after Thanksgiving Day in October). The schedule for the discharge is as

follows and the minimum rate of flow of 8.5 m^3/s shall be maintained by BRP by keeping the spillway control gate open each and every day between:

(a) 0830 hours to 1600 hours, Eastern Standard Time, at which time it will close, for the months of May and September
(b) 0830 hours to 1700 hours, Eastern Standard Time, at which time it will close, for the months of June and August
(c) 0830 hours to 1800 hours, Eastern Standard Time, at which time it will close, for the month of July
(d) 0830 hours to 1500 hours, Eastern Standard Time, at which time it will close, the month of October.

The total daily spill average is about 3 m^3/s, with the release controlled from the Ontario System Control Centre (OSCC) located in Sault Ste. Marie.

Historical operating data for Aubrey Falls GS are available for a 32-yr period from 1970 to 2001. Box and Whisker plots of historical water levels in the Aubrey Falls Reservoir are given in Figure 5.6 and historical combined flow releases from the generating station and the control dam spillway in Figure 5.7.

Tunnel Lake Reservoir

Tunnel Lake Water Level Constraints				
Constraint	**Elevation Limits (mCGD)**	**Fluctuation Range (m)**	**Duration**	**Type**
Absolute Range	269.56 to 275.00	5.44	Annual	Operational Constraint
Flood Allowance	274.44 to 275.00	0.56	Spring freshet-April to June	Operational Constraint
Normal Operating Range	269.80 to 274.44	4.64	Annual	Operational Constraint
Maximum Level-Flood Management Guideline	272.35 (reservoir half-full storage level)		Spring freshet-April to June	Voluntary Social Constraint - Flood Management in lower river
Summer Normal Range*	273.2 to 274.2	1.00	June 1 to September 30	Voluntary Social Constraint

Tunnel Lake Water Level Constraints				
Constraint	**Elevation Limits (mCGD)**	**Fluctuation Range (m)**	**Duration**	**Type**
Summer Energy Reserve*	273.2 to 272.7	0.50	June 1 to September 30	Voluntary Social Constraint
Minimum Level-Spring Walleye spawn Guideline	272.35		21 Days as determined by local MNR office	Operational/ Ecological Constraint
Critical Energy Reserve	269.80 to 269.56	0.24	For use only during critical energy demands	Operational Constraint

*New in October 2002.

Guideline Notes:

1. Maximum operating level is defined by Water Power Lease Agreement No. 35 (Schedule C, dated April 4, 1955) is 275.84 mCGD. The limit of the leased land is generally defined at 275.84 mCGD but in some locations it is at 275.23 mCGD. In such locations flooding rights, between 275.23 mCGD and 275.84 mCGD, have been reserved to BRP's Mississagi Power Trust.

2. The absolute upper limit of the forebay of the Wells/Rayner GS's has been established at 275.00 mCGD. This is to prevent water from spilling through relief vents at the concrete headworks at the Rayner GS and other dam design constraints.

3. Since 1986, (beginning with the former owner Ontario Power Generation - then Ontario Hydro) and presently BRP, has agreed to assist pickerel spawning in the Wells/Rayner forebay. On a reasonable effort basis, upon notification of the timing of walleye spawning by the MNR, BRP will attempt to maintain, as a minimum, the water level on the day contacted by MNR. The level of 272.35 mCGD at the start of walleye spawning is the level MNR would like to see. However, MNR has agreed that flooding concerns override this restriction (as per December 4, 1992 Minutes of Meeting). The spawning duration is approximately 21 days in Tunnel Lake and at the forebay of Wells/Rayner GS's. This is to allow the walleye access to spawning beds located along the shore of the lake.

Once the level of 272.35 mCGD is achieved, Tunnel Lake reservoir should be operated in a stable or rising mode, gradually filling to allow a gentle increase in water level on the lake.

Wells/GW Rayner Generating Stations - Flow Constraints				
Constraint	**Flow Limits (m^3/s)**	**Hours**	**Duration**	**Type**
Maximum Flow-Flood Management Guideline	Generating units operated at capacity	Reduced hours of operation	Spring Freshet-April to June	Social Constraint - Flood Management Guidelines for lower river

Historical operating data for Wells/Rayner GS's are available for a 52-yr period from 1950 to 2001. Box and Whisker plots of historical water levels in Tunnel Lake are given in Figure 5.8 and historical combined flow releases from the two generating stations and control dam spillway are given in Figure 5.9.

Red Rock Lake Reservoir

Red Rock Lake Water Level Constraints				
Constraint	**Elevation Limits (mCGD)**	**Fluctuation Range (m)**	**Duration**	**Type**
Absolute Range	207.00 to 209.80	2.80	Annual	Operational Constraint
Flood Allowance	208.90 to 209.80	0.90	Spring freshet – April to June	Operational Constraint
Normal Operating Range	207.30 to 208.90	1.60	Annual	Operational Constraint
Critical Energy Reserve	207.00 to 207.30	0.30	For use only during critical energy demands	Operational Constraint

Guideline Notes:

1. Maximum flooding level right as defined by Water Power Lease Agreement No. 63 (Schedule C, dated September 14, 1962) is 210.30 m CGD. This elevation is equal to the elevation of the top of the main dam.

Red Rock Lower River Water Level Constraints				
Constraint	**Elevation Limits (mCGD)**	**Fluctuation Range (m)**	**Duration**	**Type**
Daily Fluctuation Range in Lower River	Varies	0.61	Annual	Operational Constraint

Guideline Notes:

1. Daily fluctuations at Iron Bridge, resulting from Red Rock Falls GS operation, should not exceed 0.61 m. This constraint has been imposed for two reasons: to minimize water level fluctuations in general, and to minimize shoreline erosion in susceptible areas.

Red Rock Falls GS – Flow Constraints				
Constraint	**Flow (m^3/s)**	**Other Details**	**Duration**	**Type**
Maximum Flow - Flood Management	500	Flooding in Town of Iron Bridge	Spring Freshet - April to June	Social Constraint - Flood Management Guideline for lower river to mitigate potential flood damage
Uniform Flow Release	50 to 56	-	3-day period once every 3 years (approx.)	Environmental Constraint/ Lampricide Treatment
Minimum Flow - GS	75 (24 h/d)	Continuous release	First 5 days of walleye spawn*	Environmental Constraint/ walleye spawn
Minimum Flow - GS	75 (18 h/d)	Station shutdown: 4 hours daylight, 2 hours overnight	Remainder of walleye spawn period*	Environmental Constraint/ walleye spawn
Minimum Flow - GS	Not less than 38 average for the day	Flow release period from 04:00 to 20:00 h EST (16 h/d)	May 1 to October 31	Voluntary Social Constraint - Fishermen's Water
Minimum Flow - GS	Not less than 35 average for the day	Flow release cycled such that unit not shutdown more than 8 h/d	November 1 to April (beginning of Freshet)	Environmental Constraint/ Salmon Spawn

*Spawn period

Guideline Notes:

1. BRP has agreed to assist with the Lampricide Treatment in the tailrace of Red Rock GS over a 3-day period. A constant discharge of 50 to 56 m^3/s (50% gate) from Red Rock GS is provided for approximately 60 hours.

Sea Lamprey Control Centre will advise the General Manager of Mississagi Operations, of the start date for the year's treatment. This constraint occurs approximately once every 3 years.

2. BRP has agreed to advise MNR Blind River of planned periods of "No Flow" greater than 24 hours. Extended periods of "no flow" may have a detrimental effect on the fishery downstream of Red Rock Falls GS.

3. BRP will provide the Iron Bridge Mississagi River Monitoring Committee with timely updates whenever flood management procedures are in force, particularly when 500 m^3/s maximum flow out of Red Rock GS is reached. The membership includes representatives from BRP, Iron Bridge, the Ontario Ministry of Natural Resources, the Ontario Provincial Police and the First Nations. BRP participates on a voluntary basis as a good corporate citizen. The Committee meets in Iron Bridge annually, usually in early April, to update committee membership listings, review flood emergency plans, discuss watershed conditions and freshet operating strategies. BRP provides hydrologic data, such as snow pack, river flows and reservoir levels, to the Committee until any flood potential subsides.

4. BRP has agreed to assist walleye spawning in the tailrace of Red Rock GS for a 21 to 28 day period in the spring. The assistance is in the form of regulated discharge from Red Rock GS, as specified in the above table. MNR will advise both the BRP's General Manager of Mississagi Operations and Sault Ste. Marie System Control Centre of the start and end dates of the walleye spawn in accordance with the following general guidelines:

   – April to May/June – walleye spawning starts shortly after freshet, generally around April 20 to 30, and lasts for about 28 days. The Resource Coordinator, Sault Ste. Marie System Control Centre, will contact the Ministry of Natural Resources, Blind River office, to confirm the start and completion dates. BRP's General Manager of Mississagi Operations will then ensure that these dates are documented in the most recent revision of Hydroelectric Utilization Guideline (HUG) MP061.
   – For the first 5 days of the spawn, BRP is to discharge a minimum of 75 m^3/s continuous daily flow. For the remainder of the spawn period, there is a requirement to maintain a minimum flow of 75 m^3/s for 18 hours each day. To meet this minimum flow requirement, the

station should be shut off for 4 hours during the day and 2 hours at night.

5. Fishermen's Water – May 1 to October 31
   Starting May 1 and ending October 31 each year, the operation of Red Rock Falls GS must also satisfy the long-standing commitment to supply Fishermen's Water. Fishermen's Water is defined as the water released to provide sufficient channel depth and water movement for recreational fishing and boating.

   The original agreement with MNR stipulated that Fishermen's Water would be passed starting May 1 each year. Over the years, the implementation date has been shifted to the Victoria Day weekend. In most years the requirement to provide either the walleye spawn water or the necessity of passing freshet inflows has more than met the less stringent flow requirements of Fishermen's Water. In the unusual case of both freshet and walleye spawn being completed before the Victoria Day weekend, BRP is required to pass Fishermen's Water any time on or after May 1. This likely also improves conditions for sturgeon spawning in the lower Mississagi River.

   Inflow is defined as the total calculated inflow into the Red Rock Lake reservoir.

   – Inflow Up To 76.0 m^3/s
     Minimum operation is one unit at 50% gate (56.6 m^3/s) from 04:00 to 20:00 or the times given in the current revision of HUG 531. If the inflows are less than 37.8 m^3/s, support from Rocky Island Lake will be required.

     Two unit operation will not be scheduled to run (except briefly for system operating contingencies) for these inflow conditions.

     In the past, during dry periods, the scheduled discharge time period periodically had to be shortened due to unavailability of water. If this is expected to be the case, alternate times and flows must be negotiated with MNR.

   – Inflow Above 76.0 m^3/s
     Operate one unit continuously and the second unit as required.

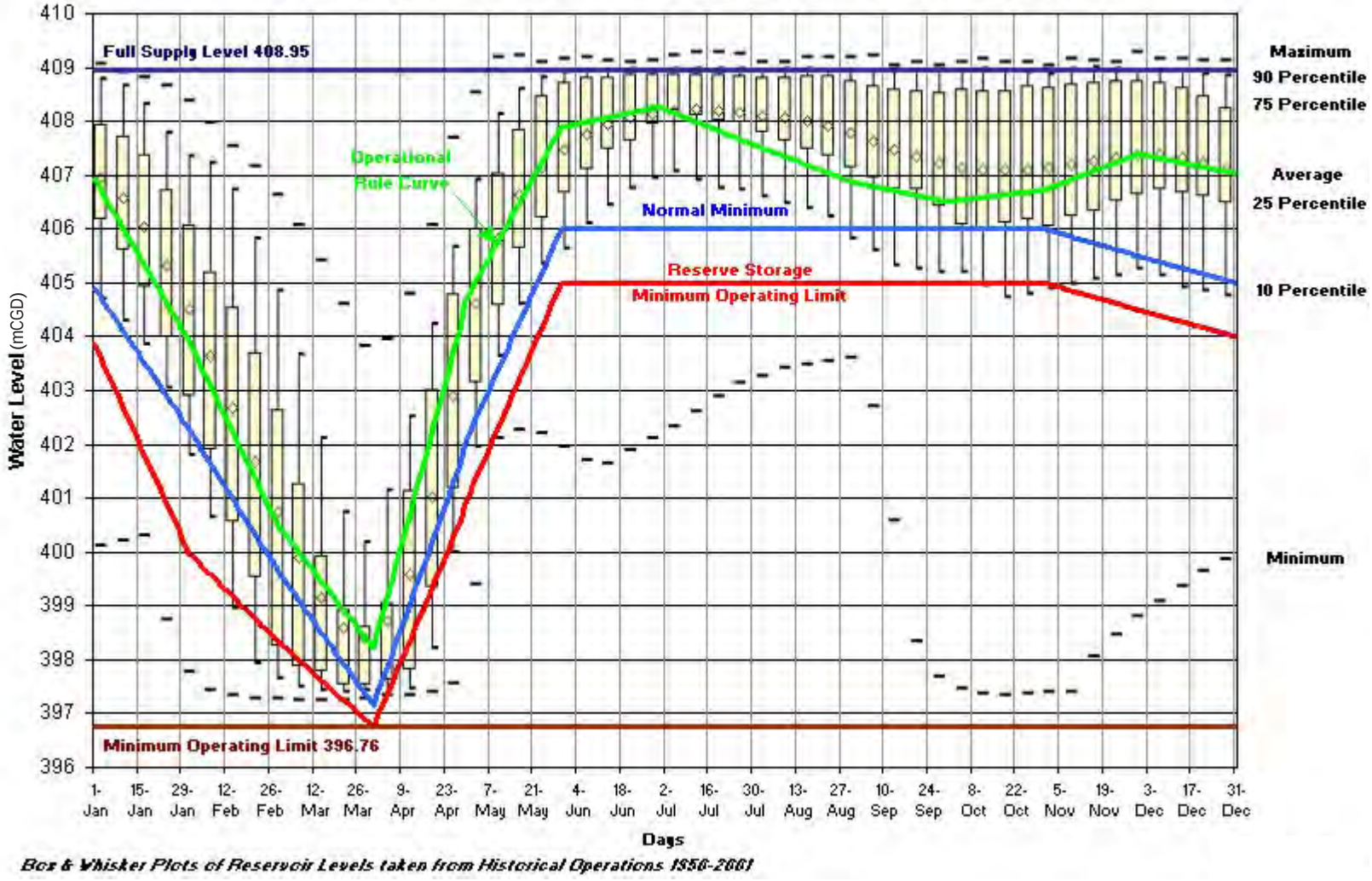
6. Salmon Spawn – November to beginning of spring freshet
   BRP has agreed to assist salmon spawning downstream of Red Rock Falls GS. During the late fall, a minimum daily average flow of 35 m^3/s will be released from Red Rock Falls GS. In addition to the minimum daily average flow, the GS is not to be shut down for any one period longer than 8 hours. This minimum daily average flow of 35 m^3/s will continue until April when passage of spring freshet flows exceed this minimum flow value.

Historical operating data for Red Rock Falls GS are available for a 41-yr period from 1961 to 2001. Box and Whisker plots of historical water levels in Red Rock Lake are given in Figure 5.10 and historical combined flow releases from the generating station and the main dam spillway are provided in Figure 5.11.

Lower Mississagi River

The lower Mississagi River comprises a 27 km long main river reach extending from the tailrace of the Red Rock Falls GS through the Village of Iron Bridge and continuing to the mouth of the river where it discharges into Lake Huron.

Discharge in the lower portion of the Mississagi River is monitored at a Water Survey of Canada hydrometric station (Station 02CC008) located at Mississagi Chutes. This is a natural exposed bedrock control in the river approximately 17 km downstream of Iron Bridge and 2 km upstream of the river mouth. A Box and Whisker plot of historical discharge taken from recorded water levels at the station for a 41-yr period is given in Figure 5.12.



Box & Whisker Plots of Reservoir Levels taken from Historical Operations 1956-2001

Figure 5.4
Brookfield Renewable Power
Mississagi River Water Management Plan
Rocky Island Lake - Rule Curves & Historic Operating Levels

HATCH™

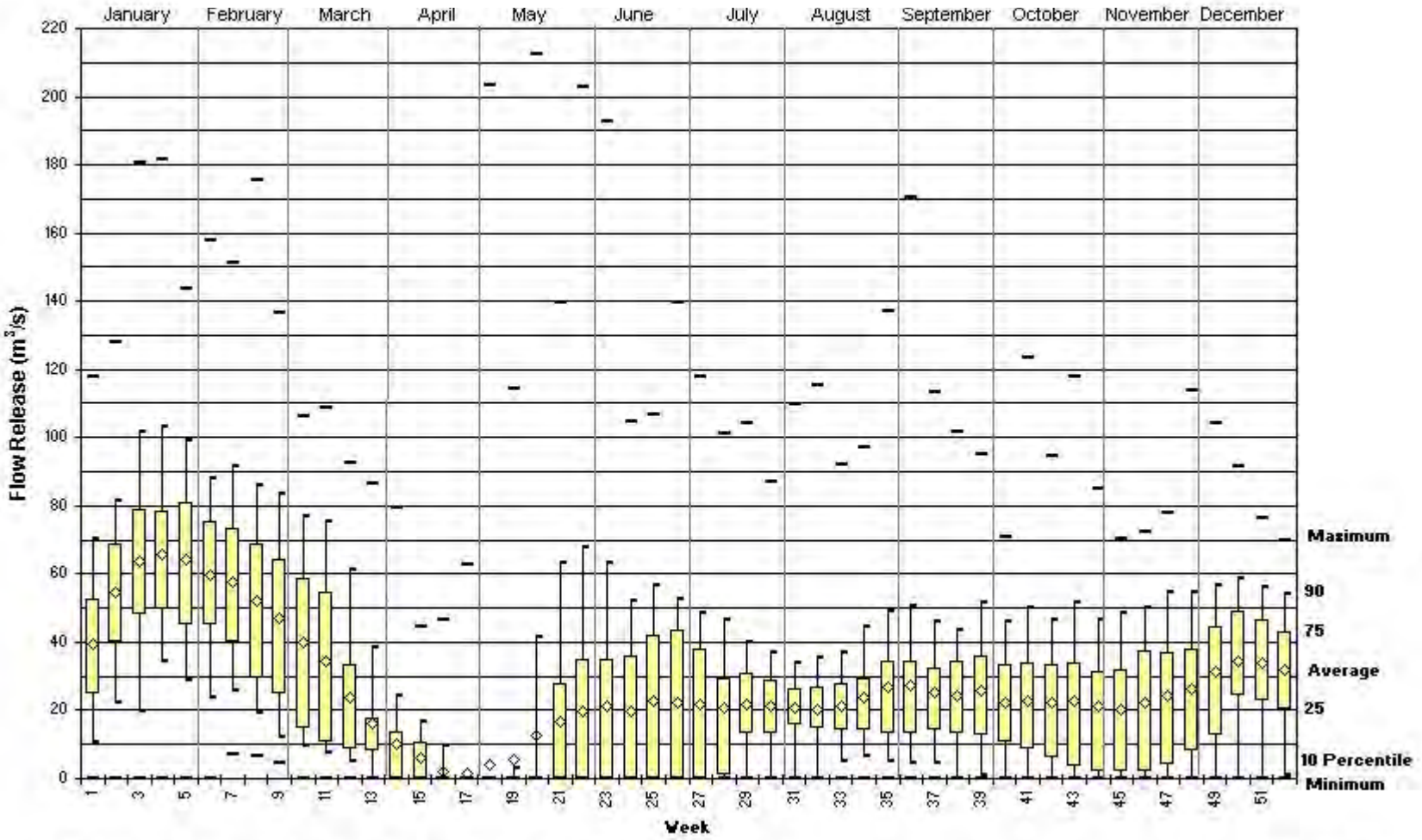


Figure 5.5
Brookfield Renewable Power
Mississagi River Water Management Plan
Rocky Island Lake - Historical Flow Releases

HATCH™

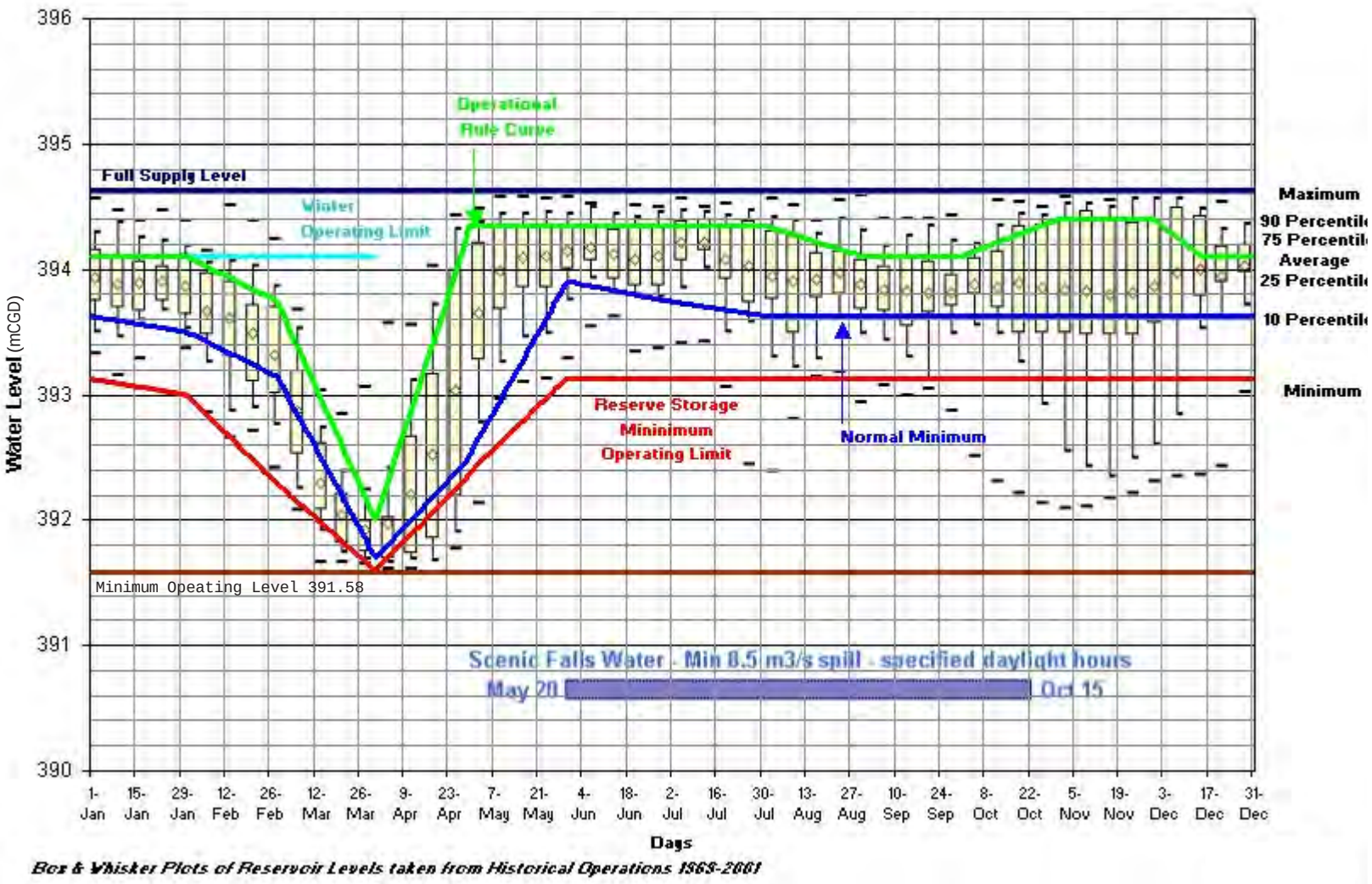
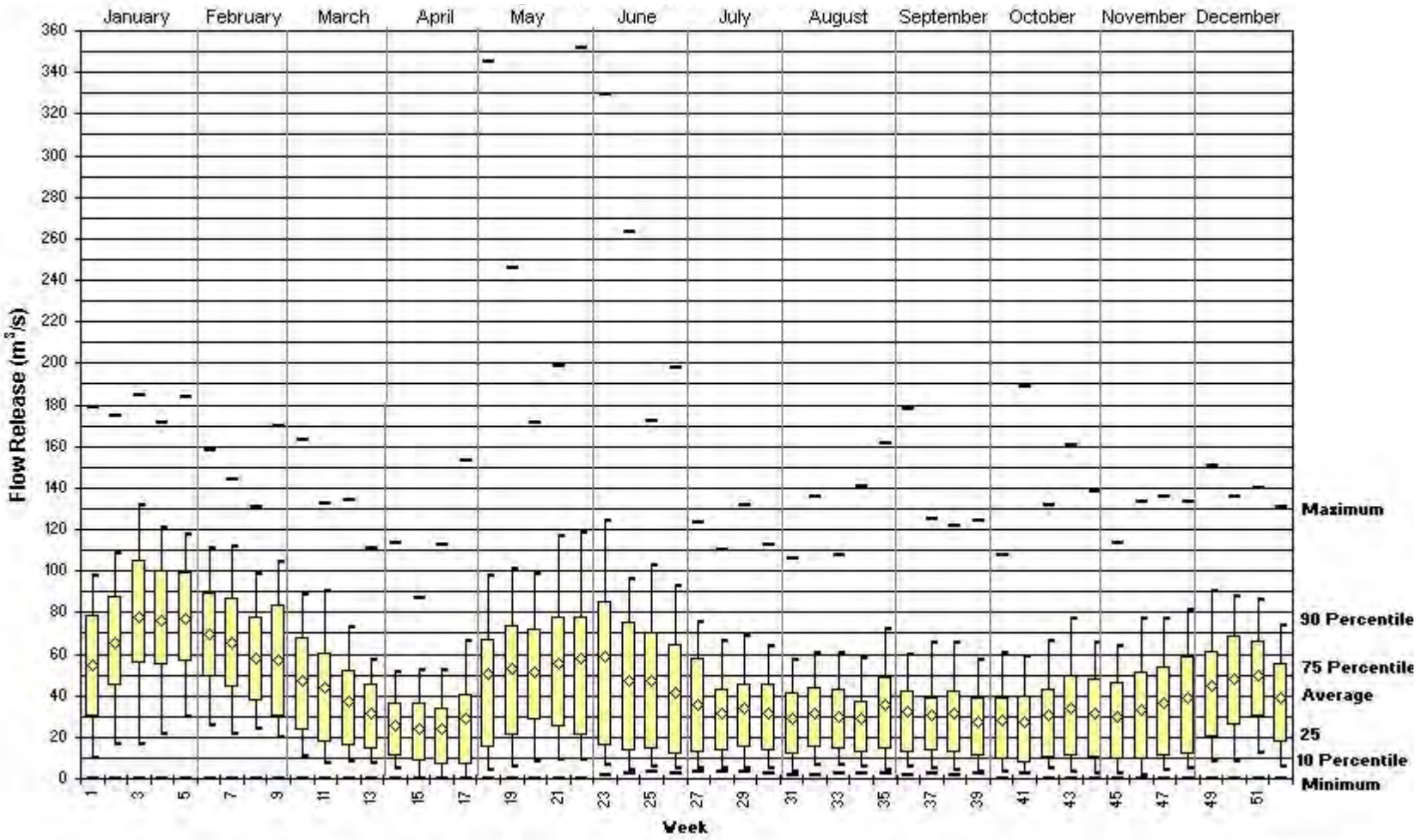
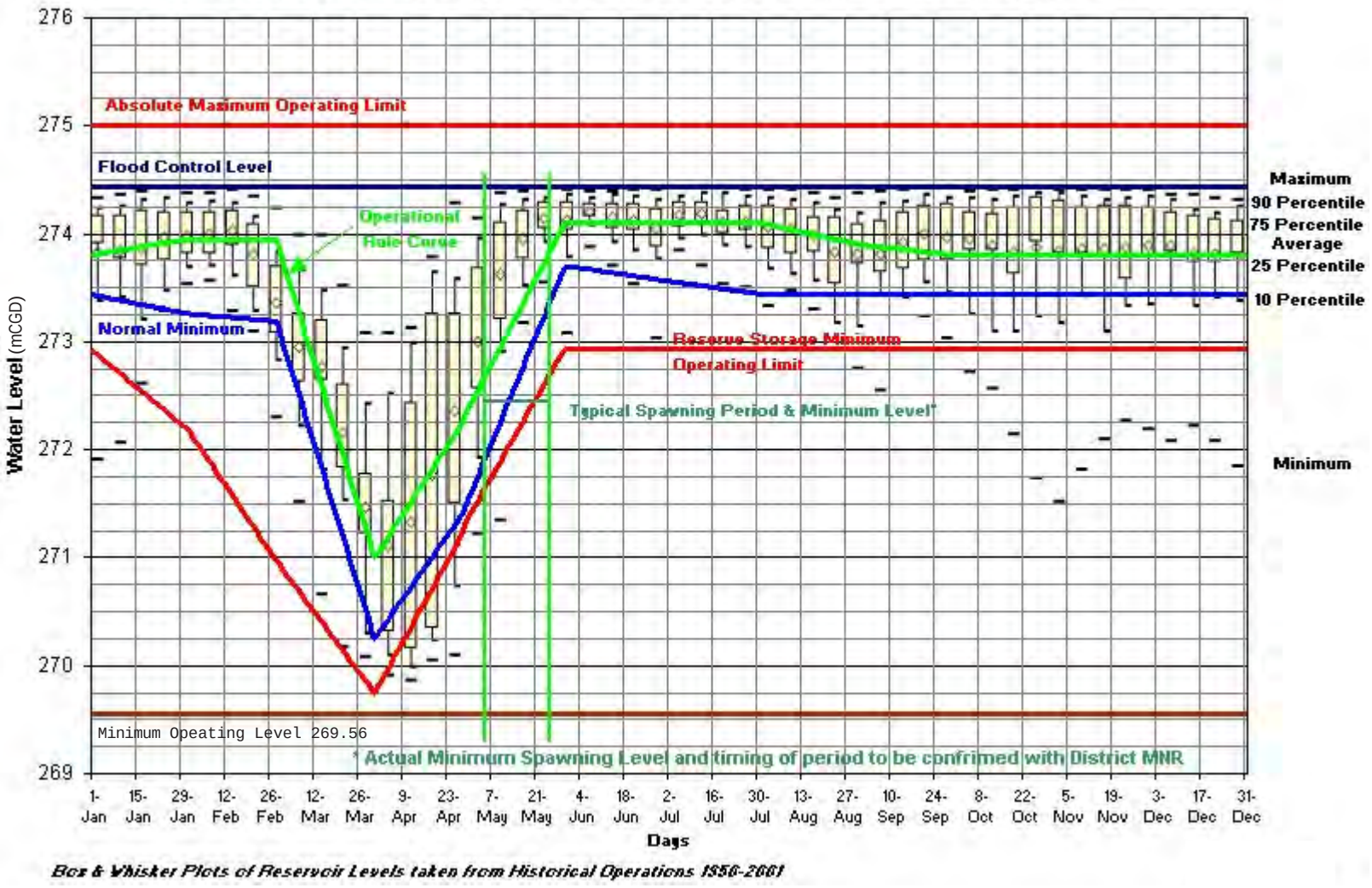


Figure 5.6
Brookfield Renewable Power
Mississagi River Water Management Plan
Aubrey Lake - Rule Curves & Historic Operating Levels



Box & Whisker Plots of Flow Releases taken from Historical Operations 1970-2001

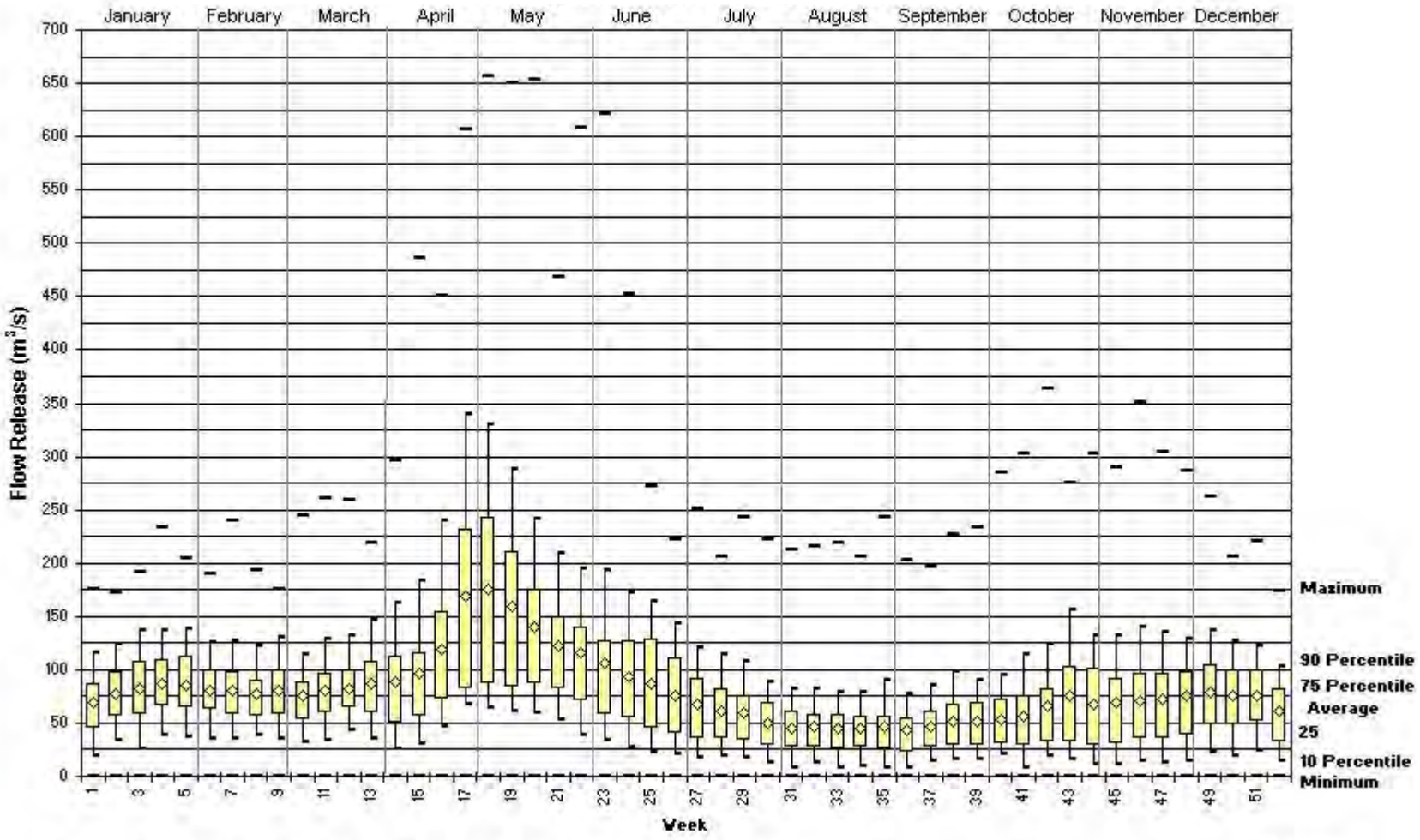
Figure 5.7
Brookfield Renewable Power
Mississagi River Water Management Plan
Aubrey Falls GS - Historical Flow Releases



Box & Whisker Plots of Reservoir Levels taken from Historical Operations 1956-2001

Figure 5.8
Brookfield Renewable Power
Mississagi River Water Management Plan
Tunnel Lake (Wells GS / Rayner GS) - Rule Curves & Historic Operating Levels

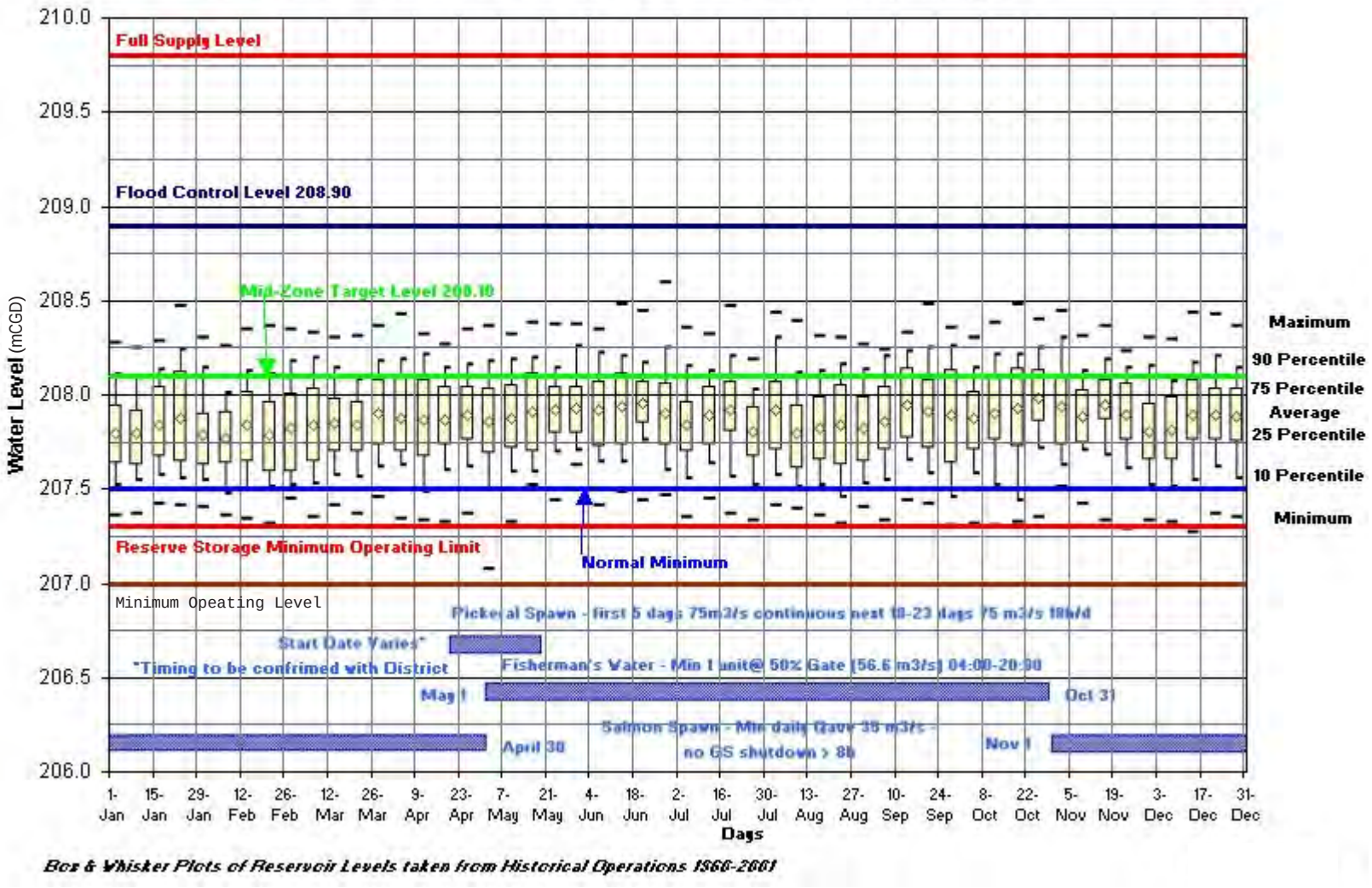
HATCH™



Box & Whisker Plots of Flow Releases taken from Historical Operations 1950-2001

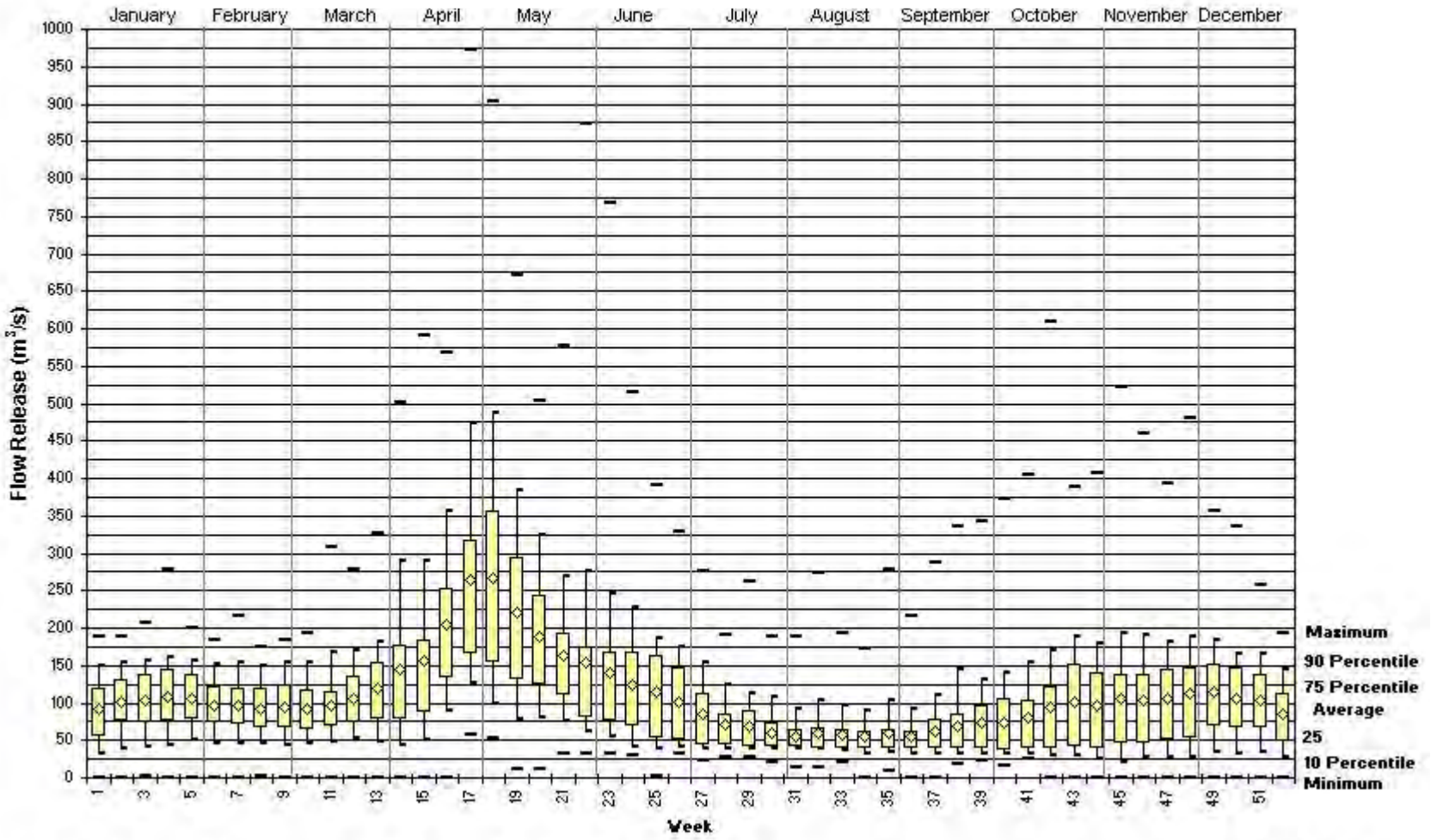
Figure 5.9
Brookfield Renewable Power
Mississagi River Water Management Plan
Wells / Rayner GS - Historic Flow Releases

HATCH™



Box & Whisker Plots of Reservoir Levels taken from Historical Operations 1960-2001

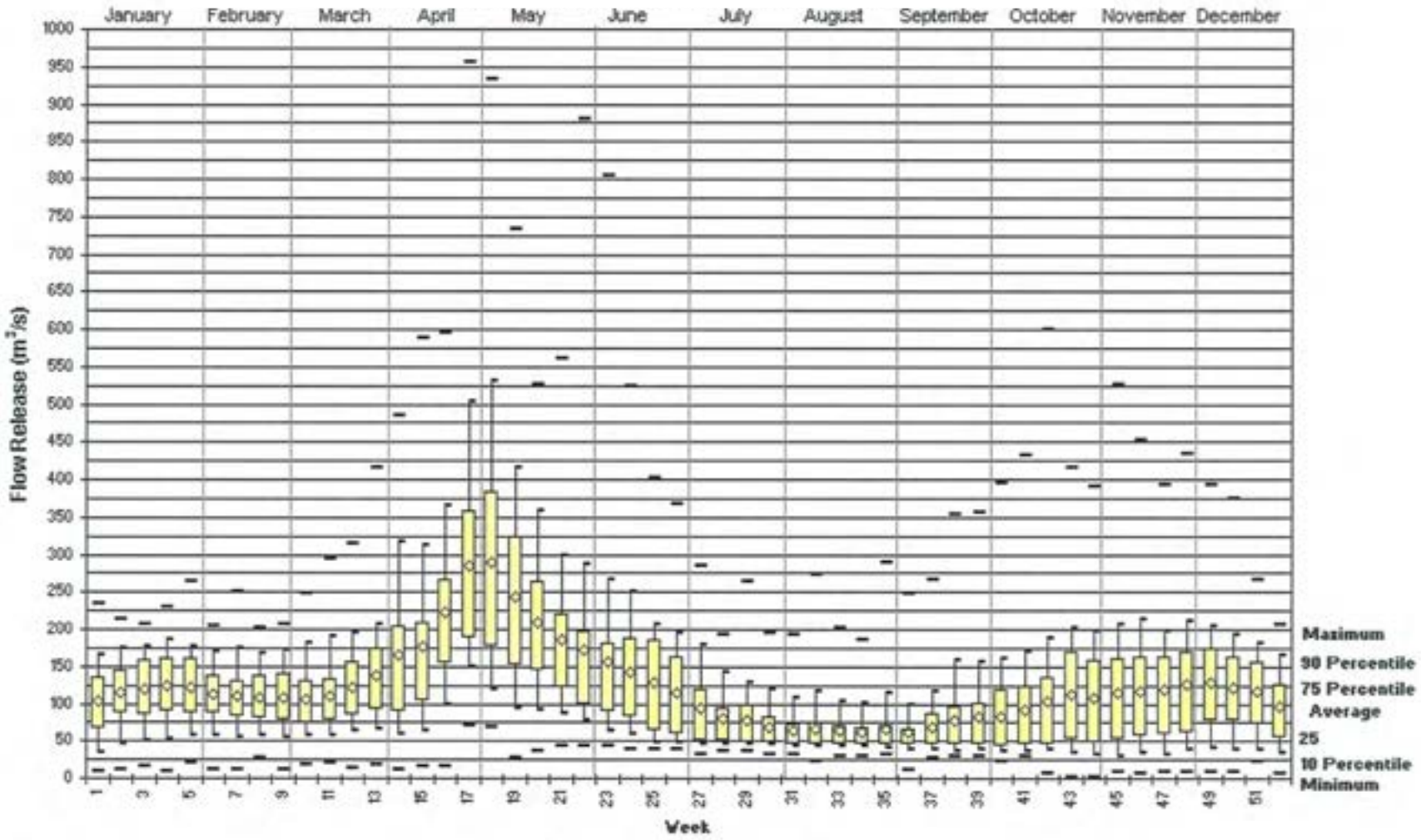
Figure 5.10
Brookfield Renewable Power
Mississagi River Water Management Plan
Red Rock Lake and Red Rock Falls GS - Rule Curves & Historic Operating Levels



Box & Whisker Plots of Flow Releases taken from Historical Operations 1961-2001

Figure 5.11
Brookfield Renewable Power
Mississagi River Water Management Plan
Red Rock Falls GS - Historic Flow Releases

HATCH™



Box & Whisker Plots of Flows taken from Hydrometric Records for Water Survey of Canada Station 02CC008 1961-2001

Figure 5.12
Brookfield Renewable Power
Mississagi River Water Management Plan
Mississagi Chute WSC Hydrometric Station - Historic Flow Releases

HATCH™

6 Issues and Concerns

6 Issues and Concerns

Economic, environmental and social issues related to water management of the Mississagi River (water levels and flows) were identified based on

- BRP's economic considerations
- Flood management considerations
- Public consultation at Information Centres
- Public Advisory Committee (PAC) input
- MNR's mandate of preserving and enhancing the aquatic ecology, aquatic habitat and recreation/tourism opportunities while encouraging/supporting multiple uses of the water resource
- First Nation input.

6.1 Brookfield Renewable Power Issues

Table 6.1 presents a summary of BRP's Issues on the Mississagi River system. These were prioritized by BRP and their high priority issues focused on the following:

- preservation and enhancement, where possible, of the existing operating regime on the Mississagi River to maximize renewable energy benefits, while meeting flood management, environmental and recreation/tourism commitments

- determining the effectiveness, costs and alternatives to address river ice management downstream of Aubrey Falls

- determining the validity and benefit of environmental and scenic flow constraints and whether they could be reduced.

MNR's Water Management Planning Guidelines (MNR, 2002) indicate that "operating regimes that reduce or eliminate adverse effects and increase net benefits without diminishing the waterpower facilities' financial performance, are preferred over those that would require revenues to be foregone". BRP considers this to be a very important guiding principle in addressing issues related to existing operations on the Mississagi River.

6.2 Public Issues

Table 6.2 presents a summary of issues on the Mississagi River system that was developed through discussions with the PAC and through comments provided on questionnaires received during and after the Open Houses in June 2003.

The PAC then prioritized the issues (high, medium or low), as recommended in MNR's Water Management Planning Guidelines (MNR, 2002) since it is not anticipated that all the issues can be addressed in this planning cycle. MNR's Water Management Planning Guidelines acknowledge "that there are practical limits to the changes than can be made within a planning cycle".

6.3 First Nation Issues

First Nation issues are included in Table 6.3. The primary concern of local First Nations was that First Nation values (e.g., medicinal plant areas, heritage sites, etc) be considered as part of water management planning. MNR has agreed to work with local First Nations to verify and update these values, and to assist them in developing protection strategies. Other First Nation concerns are also listed in Table 6.3.

6.4 MNR Issues and Review Items

MNR listed and prioritized their issues (Table 6.4), with a particular view to examining the potential for incremental improvements in the ecological health of the river system. MNR recognizes that the operation of the Mississagi River system has been continually improved upon over many years and acknowledges that, in some cases, a review of existing practices may indicate no changes are required.

6.5 Prioritization of Issues

The previously mentioned lists of BRP, MNR and Public/First Nation issues were consolidated into one list of high priority issues by consensus of the planning team (Table 6.5), for the following reasons:

- It was acknowledged by the Planning Team that it was not realistic to try and address all the issues identified in this water management planning cycle.

- Many of the issues relating to water levels and flows that were raised by MNR, the water power operator, the public and First Nations were similar in terms of whether the levels and flows were appropriate at various locations. Table 6.5 indicates whether the issues were raised by BRP, MNR, the PAC and/or First Nations.

Determination of the level of issue priority for the final list (Table 6.5) considered the priorities assigned by each of the key WMP participants for their own issues (see Tables 6.1 to 6.4).

The results of the issues consolidation exercise served to focus the planning team on high priority issues and data gaps to be addressed prior to selection of a preferred option for water management on the Mississagi River system.

Table 6.1 BRP Issues and Review Items		
Area	**Issues**	**Priority (High, Medium, Low)**
General	**Existing Operating Regime** Preserve and enhance, where possible, the existing operating regime to maximize renewable energy benefits, particularly in view of critical provincial shortage predicted over short term.	H
	Water Power Development Opportunities Preserve future waterpower development opportunities on the Mississagi River system.	M
Aubrey Falls D/S	**River Refresh Water** Determine benefit of running one unit hour per day for ecology. Is it needed, and if so, could it be modified to enhance hydro operations and still provide benefit for ecology?	M
	Scenic Spill Flows Determine costs and benefits of these flows and assess aesthetic impact of reductions in flows.	H
	River Ice Management Assess effectiveness and costs of current practices and options for modifying peaking restrictions. Consider roadwork or other capital options to address this issue.	H
Red Rock D/S	**Salmon Spawning** Are present flow releases beneficial? Review timing, frequency, volume and spawning site use. Could flow volumes be modified to also benefit hydro operations?	H
	Fishermen's Water Is minimum operation of one unit at 50% gate (56.5 m^3/s) for 16 hours daily, or 37.8 m^3/s daily average, from May 1 to October 31 beneficial, or could it be modified to enhance hydro operations and still provide benefit to fishermen?	H

Table 6.1
BRP Issues and Review Items

Area	Issues	Priority (High, Medium, Low)
Red Rock D/S (cont'd)	**Water Level Fluctuation Restriction (0.61 m):** Reassess the limits on water level fluctuation in Iron Bridge in light of channel modifications made by OPG in 1990s. Evaluate options for relaxing this constraint and monitoring erosion prone areas.	H
	Walleye Spawning Is the present 75 m^3/s for a minimum of 18 h/d for the remainder of the spawn/incubation period beneficial? Review to see if it could be modified to enhance hydro operations and still provide benefit to walleye.	M

Table 6.2 Public Issues		
Location	**Issue**	**Priority (High, Medium, Low)**
Rocky Island Lake Reservoir	Ability to maintain flood management capability to prevent flooding downstream in Iron Bridge	H
	Low summer water levels (below 405.7 m) - impacting aquatic ecology resources and limiting boating, fishing, canoeing, access to the lake and the canoe portage upstream of the lake; access to Seven Mile Bay; also increases fishing pressure on Aubrey Lake	H
	Conditions for walleye and pike spawning	M
	Conditions for lake trout fishery	M
	Low water levels in late October and effects on beaver harvest/habitat	L
Aubrey Lake/Falls	Maintenance of scenic water flows over Aubrey Falls between May and Thanksgiving.	H
	High water levels for boat launch access	L
Aubrey Falls to Tunnel Lake	Ice jams on river causing potential impacts to economy and safety and access along Highway 129.	H
	Extreme water level and flow changes make planning of canoe trips difficult, canoeing safety a concern, and potential loss of canoe tourist business (July 1 to August 31).	H
	Declining brook trout and rainbow trout populations and flow conditions for spawning.	M
	Bank erosion, particularly mature white pines and sedimentation of potential brook trout and rainbow trout spawning and nursery areas.	M
	Low spring water levels affecting walleye spawning.	L
Tunnel Lake Reservoir	Low water levels during the summer, affecting tourism and recreation (including boat launch and access at Hooverville Landing), and access to fire water	H
	Loss of walleye spawning habitat due to low spring water levels and effects on fishing success	H
	Bass reproduction abilities during spawning/nesting period (mid-late June) and effects on fishing success	H
	Pike and perch reproduction abilities during spawning/nesting period and effects on fishing success	L-M
Wells GS to Red Rock Lake Reservoir	Effect of fluctuating water levels on spawning habitat	M
	Erosion concerns	M
Below Red Rock GS	Flooding concerns in the Iron Bridge area	H
	Fluctuating water levels and flows affecting boating, particularly access concerns due to low water levels.	M
	Well water supply to residences adjacent to river.	M
	Dewatering of salmon redds in the fall.	M

Table 6.2 Public Issues		
Location	**Issue**	**Priority (High, Medium, Low)**
General	Unpredictable water levels and effects on wood turtle habitat and aquatic invertebrates	H
	Low summer water level effects on wildlife and waterfowl habitat.	M
	Economic impacts on tourism	M

Table 6.3 First Nation Issues		
Location	**Issue**	**Priority (High, Medium, Low)**
General	Consider First Nation Values (e.g., medicinal plant areas, heritage sites, etc)	H
	Fluctuating (and low) water levels on the Mississagi River	Not rated
Rocky Island Lake	Fluctuating (and low) water levels	Not rated
Below Red Rock Lake	Historical flooding in Iron Bridge	Not rated
	Erosion near a cemetery containing both aboriginal and non-aboriginal graves (in vicinity of Mississagi River Delta).	Not rated

Table 6.4
MNR Issues and Review Items

Location	Issue	Priority (High, Medium, Low)
Rocky Island Lake Reservoir and d/s	**Summer Water Levels** Define exactly minimum elevation(s) and timing, for access, navigability, aquatic ecosystem, waterfowl, tourist operators, recreation, aesthetics, and any other identified needs	H
	Winter Drawdown Review hydrology of the river system to determine if there is a potential to reduce the extent of winter drawdown, with respect to flood mitigation and public safety.	M
	Lake Trout Review and investigate management options for enhancement of lake trout.	M
	Flood Management Ensure that flood management requirements are considered.	H
Aubrey Lake Reservoir and d/s	**Mega Ripple** Ensure unconsolidated coarse sand and gravel mega-ripples are identified and considered.	M
	Scenic Flows Review conditions associated with scenic viewing, and potential for improving viewing opportunities through timing and flow volumes.	M
	River Refresh Water Review the present practice of running one unit hour per day, as related minimum flow requirements for the river, as well as the variability within the natural flow regime.	H
	Lake Trout Review and investigate management options for enhancement of lake trout.	M
	Restrictions Due to Ice The present practice includes a maximum of 4 hours downtime, at ambient temperatures below -25°C, and maintenance of one day's storage volume in the forebay. This practice should be reviewed to verify it is the most effective strategy.	M
Tunnel Lake Reservoir and d/s	**Maximum Drawdown Level** Review the maximum drawdown level. Identify any benefits that may be associated with a reduced drawdown level.	M

Table 6.4 MNR Issues and Review Items		
Location	**Issue**	**Priority (High, Medium, Low)**
Tunnel Lake Reservoir and d/s (cont'd)	**Sturgeon** Assess the status of sturgeon within Tunnel Lake and the upstream reaches of the river	M
	Summer Water Levels Define exactly minimum elevation(s) and timing, for access, navigability, aquatic ecosystem, waterfowl, recreation, aesthetics, any other identified needs.	H
Red Rock GS and d/s	**Review and Re-evaluation of Walleye Spawning Period Practices** Presently there is a 75 m^3/s continuous minimum flow for the first 5 days of the spawn, followed by 75 m^3/s for a minimum of 18 h/d. Conditions associated with walleye spawning should be reviewed and adjusted if a benefit is identified.	H
	Review and Re-evaluation of "Fishermen's Water" This is a flow of 56 m^3/s for 16 hours daily, or 38 cm daily average, from May long weekend to November 1. The starting date has varied between May 1 to the Victoria Day weekend. It may be appropriate for this discharge volume to be weighted relative to the seasonal hydrological characteristics; i.e., above average, average, or below average precipitation, or assess other options.	H
	Review and Re-evaluation of Water Level Fluctuations below Red Rock GS Presently water level fluctuations are limited to 0.61 m vertical downstream of Red Rock. This practice should be reviewed and conditions associated with it (and variances) defined.	H
	Red Rock Falls GS Salmon Spawning Present guideline is minimum daily average flow at Red Rock GS of 28 to 35 cm (dependent on inflow), and no shut down more than 8 consecutive hours. Discharge timing, frequency, and volume should be reviewed. Results of salmon spawning studies fall 2002 should be reviewed and incorporated where appropriate.	H
	Sturgeon Achieve better understanding of spawning and juvenile (yoy) habitat below Red Rock GS	M

Table 6.4 MNR Issues and Review Items		
Location	**Issue**	**Priority (High, Medium, Low)**
Entire System	**Critical Habitats** Identify critical habitats and requirements for aquatic organisms (e.g., spawning sites, nursery habitat), as well as terrestrial users such as waterfowl.	H
	Erosion Concerns Identify/map document erosion problem areas; determine if mitigation is possible or warranted in any locations.	M
	Cultural Values Complete cultural values inventory for entire planning area.	H
	Aboriginal Values Update inventory of aboriginal values, and develop protection strategies.	H
	Species at Risk Identify any species at risk in planning area. Known SAR include lake sturgeon, wood turtle, bald eagle, possibly peregrine falcon. Map locations, critical habitats, develop protection strategies.	H
	Recreational Values and Impacts Identify recreational impacts of changes in levels and flows on motor boating, paddling, fishing, hunting, camping, portages.	H
	Provincially Significant Canoe Route Recognize importance of this canoe route in planning considerations.	H
	Natural Flow Regime Discharge of bankfull flows and riparian flows should be investigated. The extent to which these flows can be achieved without risks of washout or other concerns should be investigated. Other aspects of the natural flow regime should be assessed in each river section, to determine if any can be applied, and to what extent.	H

Table 6.5
List of High Priority Issues for this WMP*

Issue	BRP	MNR	PAC	FN
General				
Preservation and where possible enhancement of renewable energy benefits	X			
Critical habitat including species at risk (e.g., wood turtle habitat) and spawning/nursery habitat		X	X	
First Nation and other cultural values		X		X
Recreational values and impacts (including provincially significant canoe route)		X	X	
Rocky Island Lake Reservoir				
Flood management capability		X	X	
Effect of low summer water levels on aquatic ecology and recreation (navigation/boat access)		X	X	X
Aubrey Downstream to Tunnel Lake				
Potential to increase or decrease scenic flows	X	X	X	
Effectiveness of current river ice management (public safety)	X		X	
Flow fluctuations and effects on ability to canoe safely			X	
Adequacy of refresh flow for aquatic ecology (i.e., potential to move closer to the natural flow regime)		X		
Tunnel Lake Reservoir				
Low summer water levels and impact on recreation and fire water access (i.e., boat access during low water levels)		X	X	
Impact of water levels on walleye and bass spawning (spring)		X	X	
Confirm presence/absence of sturgeon		X		
Downstream of Red Rock GS				
Adequacy of present salmon and walleye spawning flow releases	X	X		
Adequacy of Fishermen's water flow releases	X	X		
Potential flooding concerns in Iron Bridge	X	X	X	X
Water level fluctuation constraint (erosion concerns)	X	X		
Mississagi River Delta				
Erosion concern at a cemetery near shoreline				X

*Finalized after a review of Tables 6.1 to 6.4.

7 Data Gaps/High Priority Issues

7 Data Gaps/High Priority Issues

7.1 Data Gaps

Several priority data gaps in the environmental knowledge of the Mississagi River system were identified by the planning team, most of which needed to be filled to assist in addressing the high priority issues listed in Table 6.5. These data gaps were as follows.

7.1.1 Physical Environment

- Lack of accurate bathymetric data for Rocky Island Lake reservoir to better understand the implications of various drawdown scenarios on the aquatic ecology.
- Need for a review of river ice management procedures below Aubrey GS to determine adequacy
- Need to review whether a water level fluctuation constraint below Red Rock GS is still needed for erosion protection.

7.1.2 Aquatic Ecology/Habitat

- Need for baseline information on salmon spawning below Red Rock GS including timing, locations, and amount of wetted habitat available with normal and reduced flows during spawning, to determine the adequacy of the flow regime during spawning.
- Need for baseline information on walleye/pike communities, spawning habitat locations and timing of spawning activities in reservoirs throughout the Mississagi River system.
- Need for baseline information on lake trout in Rocky Island Lake and Aubrey Lake reservoirs.
- Need for baseline information on bass spawning nest locations and timing of spawning activities (Tunnel Lake).
- Need to confirm sturgeon presence/absence in the Tunnel Lake reservoir area.
- Need to confirm presence/absence of wood turtles and/or habitat along the Mississagi River and tributaries near confluence with Mississagi River.

7.1.3 Social Environment

- Need to assess boat access and navigability conditions on Rocky Island Lake reservoir during low summer water levels.
- Need to assess boat access on Tunnel Lake during low summer water levels.
- Need to assess adequacy of Aubrey Falls scenic flows (i.e., whether more or less flow is better based on aesthetics).
- Need to review adequacy of fishermen's water for navigability.
- Lack of knowledge on importance of Mississagi River system to recreational users and resort owners.
- Lack of knowledge on traditional values along the Mississagi River system to local First Nations
- Need to assess erosion concern at a cemetery near shoreline of Mississagi River Delta.

7.2 Filling of Data Gaps for Priority Issues

The results of baseline data collection activities to fill the data gaps noted above are provided in Section 8.

8 Baseline Data Collection to Fill Data Gaps for High Priority Issues

8 Baseline Data Collection to Fill Data Gaps for High Priority Issues

As a result of the data gaps identified in Section 7, several baseline data collection programs were initiated cooperatively between BRP, MNR, the PAC and First Nations. Each of these programs is described in the subsections that follow. The results of these activities provided guidance to the planning team in determining physical habitat improvements and/or changes to water management operations on the river system.

8.1 Field Investigations and Other Data Collection Activities

8.1.1 Rocky Island Lake Reservoir – Boat Access and Navigation

Site visits were made by planning team and PAC members to Rocky Island Lake reservoir during August to October 2007 to view boat launch conditions and navigability through channels to Rouelle Bay and Seven Mile Bay at various water levels (406.2, 405.7, 405.2 and 405.0 mCGD). Boat launch conditions were assessed for two access points on Rocky Island Lake, i.e., the Peshu Road access point and the south access point (Figure 8.1). Of the two access points on the lake, the south access point is used more by the general public. This is mainly because it is closer to the population centers of Elliot Lake and Blind River, and the road access to this location is considerably better than the road access to the north access point. The north access point is the main access used by commercial tourist operators, largely because of the proximity to the existing outpost camps. This access is also used by the general public. The north access point is also closer to many of the areas considered more popular for fishing.

The results of the boat launch condition assessment and navigability assessment for various water levels through channels to Rouelle Bay and Seven Mile Bay are summarized in Table 8.1. It was concluded that

- boat launch conditions are acceptable at all water levels observed for the Seven Mile Bay access point off Peshu Lake Road, and also at the south

access point to Rouelle Bay, although there is the potential for vehicles to get stuck in the sand at the latter location during low summer water levels

- Rouelle Bay is navigable through the channel at the lowest water level considered (405 mCGD), though care is required to avoid stumps

- Seven Mile Bay is not navigable through the channel using boat power at 405.2 m, though it is possible by pulling the boat through with care. Inexperienced boaters may try to navigate the channel under power at water elevations between approximately 405.5 and 406.5 mCGD, but would likely damage the outboard motor. Navigability is not possible at 405 m with or without boat power, without the likelihood of damaging the boat and/or motor.

Boat access to Sisson's Bay (Figure 8.1), which also has a commercial outpost camp on it, becomes difficult below 404.5 mCGD. Rocky Island Lake is also part of a provincially significant canoe route. At increasingly lower water levels, the thalweg or minimum connecting channel to lakes and bays take on the form they had before the construction of the Rocky Island Lake dams, around 1950. Canoe navigation is possible at low levels, if the thalweg channel is followed. However, it is not uncommon for canoeists, when traveling the lake at low levels (approximately below 404.0 mCGD) to become disoriented and unable to find the thalweg channel. They have been known to drag their canoes through an exposed muddy lake bottom in search of the main body of the reservoir. This is because the bottom features do not match the shape and characteristics depicted in maps, when at low levels, and the shortest route across the reservoir does not follow the thalweg channel. Without the benefit of a bathymetric map, following the thalweg channel at low lake levels can be difficult.

The upper reach of the Mississagi River enters Rocky Island Lake from the eastern end of the reservoir. Overall navigability of this relatively steep river reach is quite variable due to the existence of various rapids sections, some of which become exposed as water levels decline in the reservoir. At reservoir levels within 1 m of maximum (408.0 to 409.0 mCGD) motorized boat travel is possible in this river reach to a point several kilometers upstream of Rocky Island Lake. However, the navigability of these rapids varies considerably with flow rate, level of Rocky Island Lake, and distance upstream. The Mississagi River upstream of the confluence with the Abinette River tributary

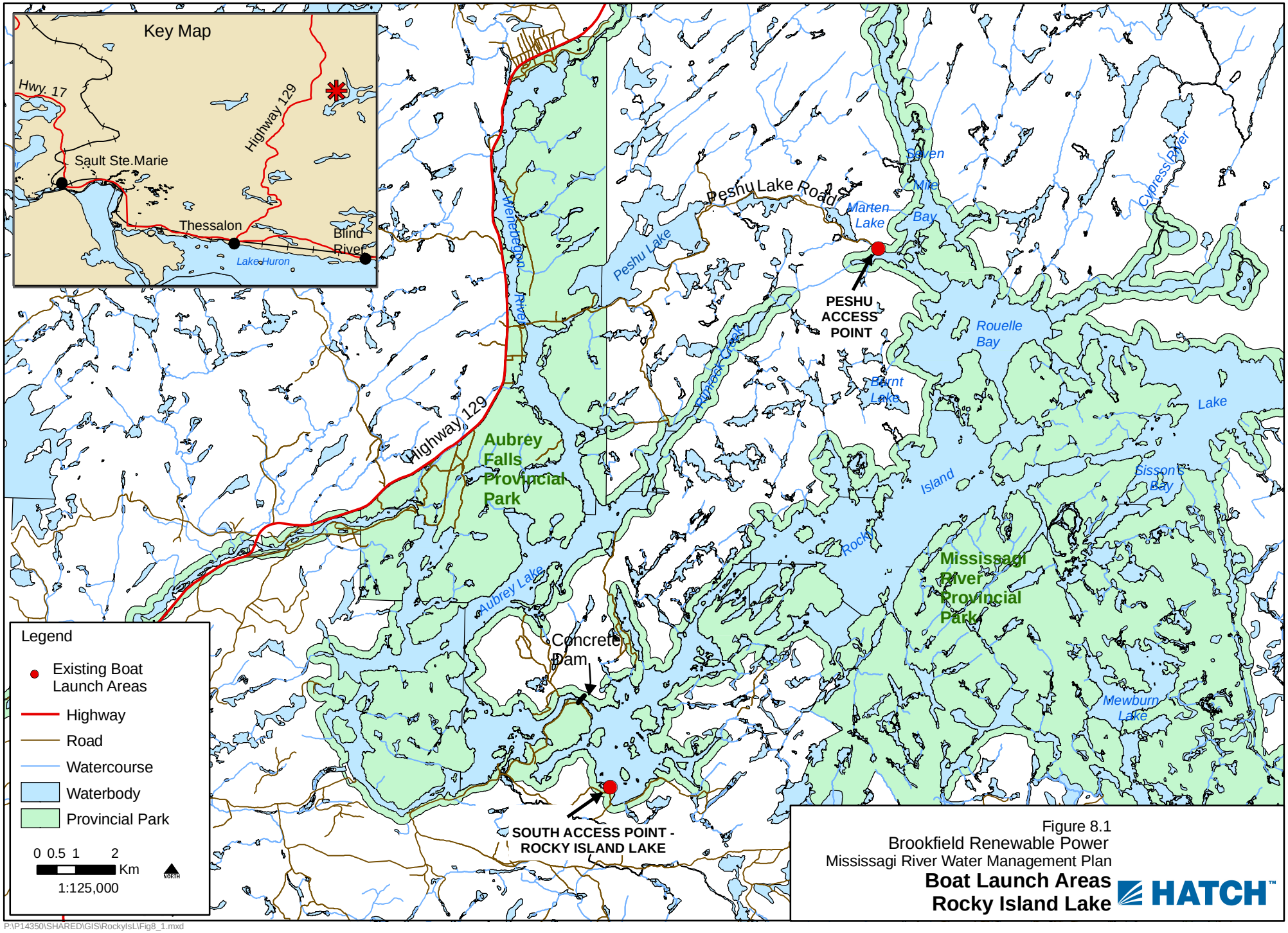


Figure 8.1
Brookfield Renewable Power
Mississagi River Water Management Plan
Boat Launch Areas
Rocky Island Lake

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Table 8.1 Rocky Island Lake – Boat Launch Conditions and Navigability Assessment through Channels to Seven Mile Bay and Rouelle Bay					
Water level (m)	**Date of Observation**	**Location**	**Boat Launch Conditions**	**Access and Navigability Conditions**	**Comments**
406.2	Aug. 24, 2007	Peshu Road Access Point	Good	Good with care to avoid stumps	Stumps just below surface
406.2	Aug. 24, 2007	Seven Mile Bay channel	Good	Good	
406.2	Aug. 24, 2007	Rouelle Bay channel	Good	Good with care to avoid stumps; minimum depth approx 1.5 m	Stumps just below surface
406.2	Aug 24, 2007	South Access Point	Good		Soft sand, a few stumps
405.7	Sept. 3, 2007	Peshu Access Point	Good	Good with care to avoid stumps	Stumps above and below surface
405.7	Sept. 3, 2007	Seven Mile Bay channel	Good	Passable navigability with care	
405.7	Sept. 3, 2007	Rouelle Bay channel	Good	Good with care to avoid stumps; minimum depth approx 1.1 m	Stumps above and below surface
405.7	Sept. 3, 2007	South Access Point	Good		Soft sand, a few stumps
405.2	Sept. 21, 2007	Seven Mile Bay channel	Good	Not possible under power; but possible by pulling boat through with care. Inexperienced boaters may try to navigate channel under power but would likely damage outboard motor.	Shallow, many stumps and boulders
405.2	Sept. 21, 2007	Rouelle Bay channel	Good	Good with caution, minimum depth of approximately 1 m	Need care to avoid stumps and rocks when navigating through channel
405.2	Sept. 21, 2007	South Access Point	Good		Soft sand, a few stumps
404.98	Oct. 2, 2007	Seven Mile Bay channel	Good	Not possible under power or without potential to damage boat by pulling it through channel due to need to drag over rocks in one or two sections	Very shallow, many stumps and boulders
404.98	Oct. 2, 2007	Rouelle Bay channel	Good	Fair, with more caution needed for 75 m stretch of channel to avoid stumps and rocks. Minimum water depth in channel is approximately 0.8 m with a lake level of 405 m	Stumps above and below surface and need more care to avoid rocks compared with higher water level
404.98	Oct. 2, 2007	South Access Point	Good		Soft sand, a few stumps

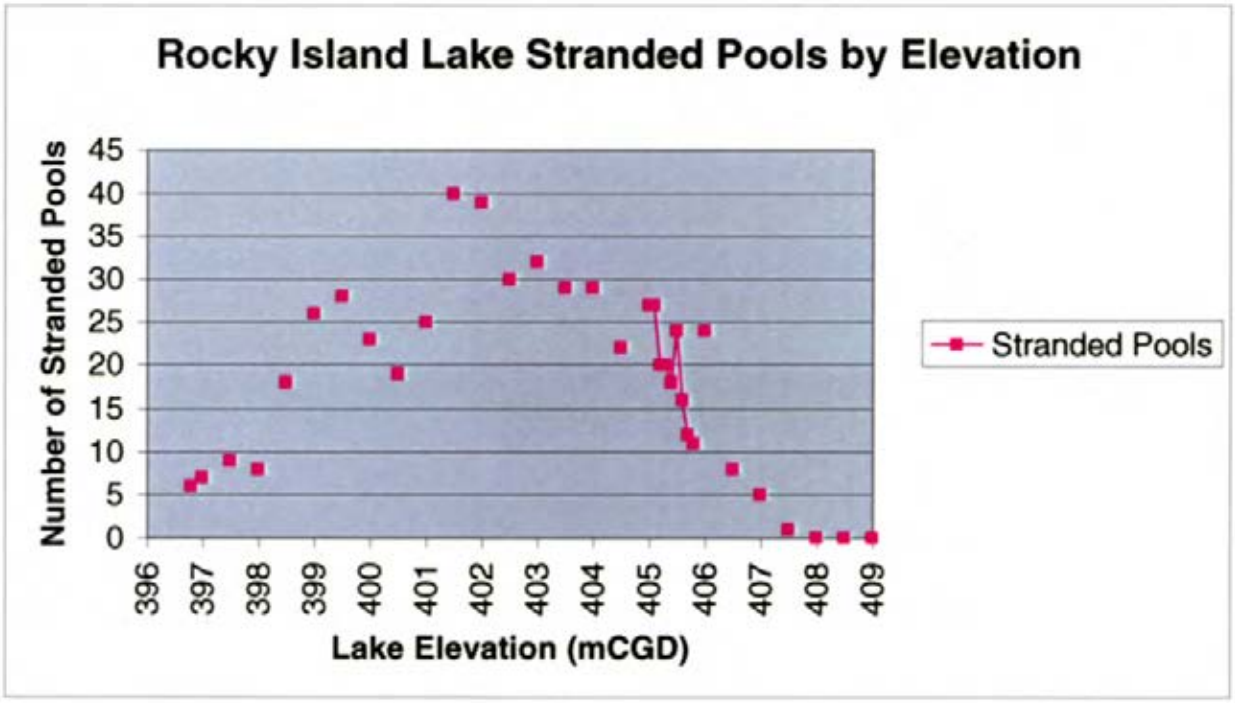
(Figure 2.1) is out of the zone of influence from levels of Rocky Island Lake reservoir. For both paddlers and motorized boaters, the development of rapids in the Mississagi River becomes more pronounced as the lake level falls below 407 mCGD. Below this lake level the inflow channel to the reservoir develops into a series of rapids, which makes upstream navigation increasingly difficult.

8.1.2 Rocky Island Lake – Effects of Summer Water Levels on the Aquatic Ecology

A bathymetric survey was conducted by MNR staff during the summer of 2003 on Rocky Island Lake reservoir and was used to evaluate the implications of summer water level changes on the aquatic ecology by defining stranded pools at various water level elevations.

A stranded pool is defined for this WMP as a disconnected pondage of water that has been isolated from the main body of the lake as a result of drawdown of water levels. Some pondages become discontinuous with the main body of the lake but may still be connected by a tributary stream or river channel. Such pondages are not considered to be stranded pools, because there is a potential for fish and other aquatic organisms to travel to or from these ponds, if water depth in the connecting channel is sufficient. The connectivity of these pondages in many cases is very difficult to determine. For the purpose of this WMP, pondages less than 0.05 ha were not considered to be stranded pools. The delineation of pondages smaller than this was not considered to be reasonable with the accuracy of the data available.

Two methodologies were used by MNR to evaluate stranded pools at each incremental lake elevation. The first was done manually, using large maps whereby stranded pools were counted only by total number, without area. First-hand knowledge was applied to eliminate some of the pondages delineated by the mapping, which were known to have connectivity to a river channel or a tributary stream, which was not evident on the mapping. Results of this evaluation are presented graphically in Figure 8.2. It is evident that the maximum number of stranded pools occurs around 401.5 mCGD, with the number of stranded pools at 40. There is some variability in the relationship between number of stranded pools and lake elevation, but the overall trend is an increase in number of stranded pools until approximately 401.5 mCGD,



Source: MNR, Blind River

Figure 8.2
Brookfield Renewable Power
Mississagi River Water Management Plan
Rocky Island Lake - Stranded Pools by Elevation

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followed by a drop. The drop in number of stranded pools with continued reduction in elevation is due to the dewatering of many of these pools because they are very shallow. It is evident from the data that to avoid any formation of stranded pools, the water level could not drop much below 408.0 m. From an ecological perspective, maintaining the water levels above this value would approximate a natural range of fluctuation, which could be considered ideal. However, the reality of this waterbody being a hydroelectric reservoir does not make this a practical solution. Additionally, the reservoir is drawn down each winter to (or near) the minimum level of 396.76 mCGD during the winter months. Therefore, the focus was on determining any significant ecological differences in stranded pools formed during the summer months. Field evaluations found very little in the way of aquatic organisms in these stranded pools. This is to be expected, because the cycle of annual dewatering has taken place for approximately 55 years. Any organisms that would be present would have to be capable of tolerating this dewatering, or would have been extirpated long ago. Natural selective forces have acted to shape the ecological community present in these areas prone to dewatering. Most of the stranded pools were very similar in many ways. Typically the substrate consisted of mud and woody debris. Some areas have increased amount of sand and gravel. Most of the pools were formed in relatively shallow flat basins. Only a few of these stranded pools had a depth greater that one meter. The larger basins were not stranded pools, because most of these have tributary (local drainage) inflow, and were connected to the main body of the lake by a wetted channel. The largest of these basins would have originally been lakes or ponds before dam construction and flooding.

During the summer of 2002 some of the stranded pools were sampled with gill nets to determine if any stranded fish were present. None were caught. However, sampling these ponds was difficult because access was difficult, and woody material in them made use of nets practically impossible. Visual examination of most of the stranded pools indicated almost no fish. The only exception was one severely stressed central mudminnow (*Umbra limi*). A few invertebrates were located and identified.

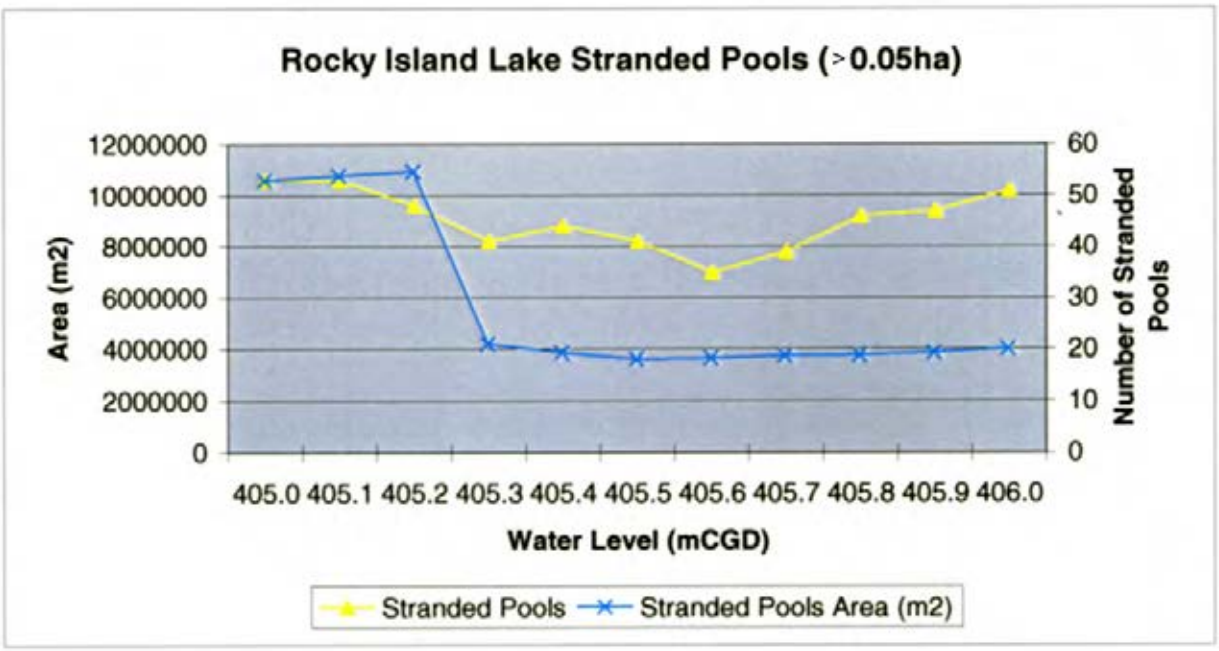
A second method was applied only to interpret mapping between 405.0 and 406.0 mCGD. This method used automated techniques to determine number and also surface area of stranded pools. Results of this evaluation are provided in Table 8.2 and are shown graphically in Figure 8.3. It is evident

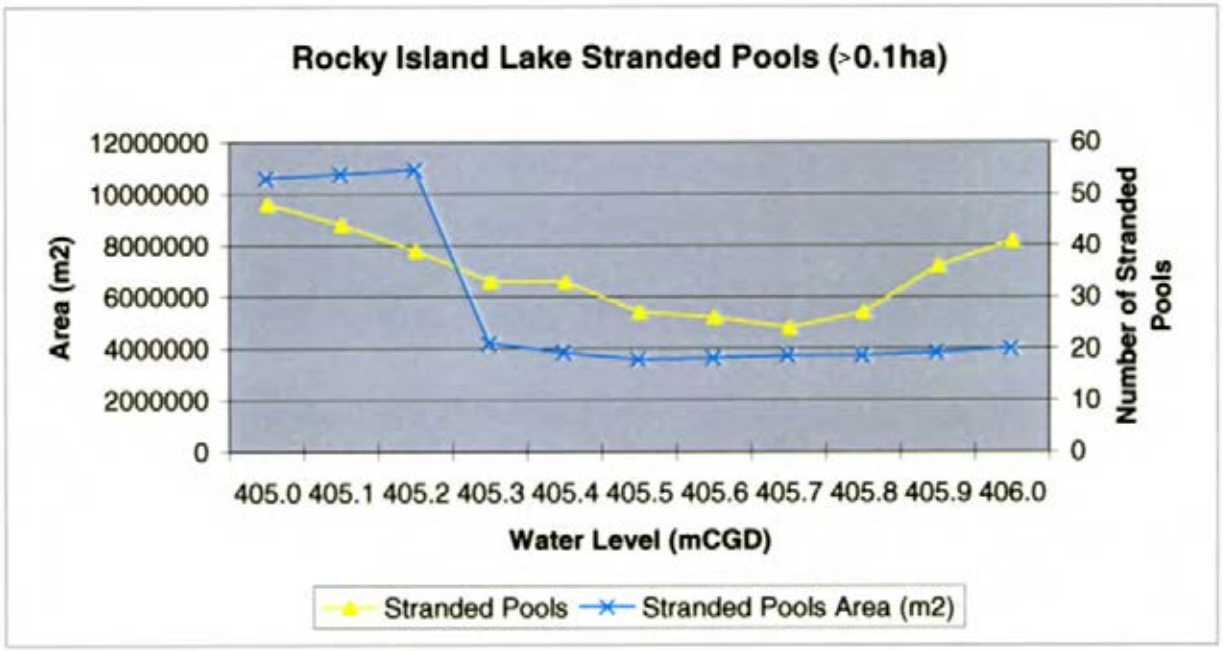
from Figure 8.3 that there is not a clear trend in number of stranded pools in this elevation range. However, there is a distinct step in total stranded pool surface area between 405.2 and 405.3 mCGD.

Table 8.2
Rocky Island Lake – Number and Area of Stranded Pools for Various Summer Water Levels*

Elevation (mCGD)	Depth (-) (m)	Surface Area (m^2)	Stranded Pools (No.)	Stranded Pools Area (m^2)
Surface Area (10 cm increments >0.05 ha)*				
406.0	3.0	39 687 700	51	3 999 270
405.9	3.1	38 463 710	47	3 857 590
405.8	3.2	37 393 940	46	3 756 310
405.7	3.3	36 400 610	39	3 738 030
405.6	3.4	35 425 990	35	3 642 920
405.5	3.5	34 420 440	41	3 599 950
405.4	3.6	33 441 050	44	3 858 570
405.3	3.7	32 547 240	41	4 184 790
405.2	3.8	31 680 080	48	10 933 260
405.1	3.9	30 829 490	53	10 770 080
405.0	4.0	30 032 200	53	70 587 450
*Methodology – Using a 3-m raster of grid of Rocky Island Lake – Used Raster Calculator ([outgrid4] >-3.9) to isolate water above 10 cm increments. Then converted raster to features. Then isolated water polys (>0.05 ha) no longer associated with main waterbodies queried.				
Surface Area (10 cm increments >0.1 ha)**				
406.0	3.0	39 687 700	41	3 992 070
405.9	3.1	38 463 710	36	3 849 320
405.8	3.2	37 393 940	27	3 742 750
405.7	3.3	36 400 610	24	3 727 320
405.6	3.4	35 425 990	26	3 636 580
405.5	3.5	34 420 440	27	3 590 050
405.4	3.6	33 441 050	33	3 850 760
405.3	3.7	32 547 240	33	4 178 670
405.2	3.8	31 680 080	39	10 927 290
405.1	3.9	30 829 490	44	10 764 090
405.0	4.0	30 032 200	48	10 583 580
** Methodology – Using a 3-m raster of grid of Rocky Island Lake – Used Raster Calculator ([outgrid4] >-3.9) to isolate water above 10 cm increments. Then converted raster to features. Then isolated water polys (>0.1 ha) no longer associated with main waterbodies queried.				

*Table produced by MNR, Blind River.





Source: MNR, Blind River

Figure 8.3
Brookfield Renewable Power
Mississagi River Water Management Plan
Rocky Island Lake - Stranded Pools Between 405m and 406m

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Figure 8.4 plots the change in lake area with each 10 cm increase in water level against lake elevation. It is apparent that the lake area increases in a nearly linear relationship between the minimum levels of 397 mCGD up to about 405.5 mCGD, although there is an increase in slope at about 401 mCGD. Several spikes in the incremental change in area are evident. One spike occurs at 400.45 mCGD (53.23 ha); another at 403.75 mCGD (65.7 ha); and another at 405.45 mCGD (64.8 ha). These spikes would be the result of flooding of one or more relatively large flat areas. At water levels greater than about 407.0 mCGD, small changes in lake area result with increased elevation. No significant trend is evident in the range being considered for a minimum summer level, between 405.0 and 406.0 mCGD.

Figure 8.4 also plots the change in lake area, with each 50 cm increase in water level plotted against lake elevation. The pattern is very similar to that resulting from 10 cm increments, but without any significant spikes. Again, no significant trend is evident in the range being considered for a minimum summer level, between 405.0 and 406.0 mCGD.

8.1.3 2003 Walleye Investigations on Rocky Island Lake, Aubrey Lake, Tunnel Lake and Red Rock Lake Reservoirs

The information in this section was provided by MNR (Blind River Area Office).

Rocky Island Lake Reservoir

Rocky Island Lake was sampled using the FWIN protocol from October 7 to 12, 2003. For a lake of Rocky Island's size (5416 ha), the FWIN manual recommends 36 sets. It was agreed, however, with water levels being low and thus rendering much of the lake too shallow to net or completely inaccessible, that 30 sets would be adequate. The recommended number of sets for lakes 3001 to 5000 ha is 28. Water temperatures ranged from 12^{o}C to 10^{o}C.

The Rocky Island Lake walleye population has an index catch rate above the Regional 25th percentile but well below the mean of 6.4 walleye/net (Morgan et al. 2003). MNR reports that both length at age L_{∞} and weight at age relationships appear to be much lower than the regional averages. Male and

female L_∞ are both slightly above the regional means. Early growth (ω) for males and females are both well below the regional means falling below the 5th percentile. The Brody growth coefficients (K) for both males and females are below the 5th percentile. Pre-maturation growth (h) is slightly above the 5th percentile.

There appears to be a trend in declining growth of young of year fish. This is supported by 5 years of below average growth with the two most recent being the lowest observed.

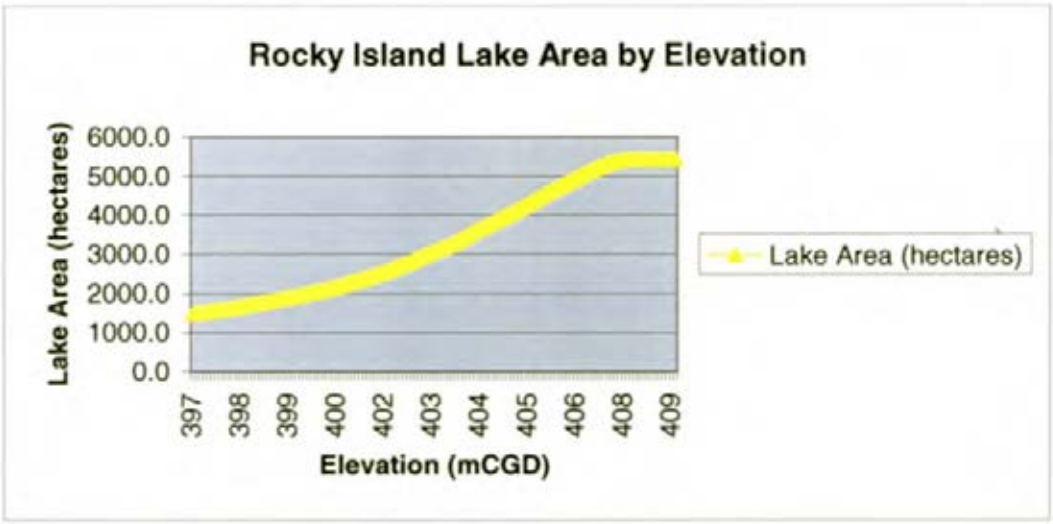
Aubrey Lake Reservoir

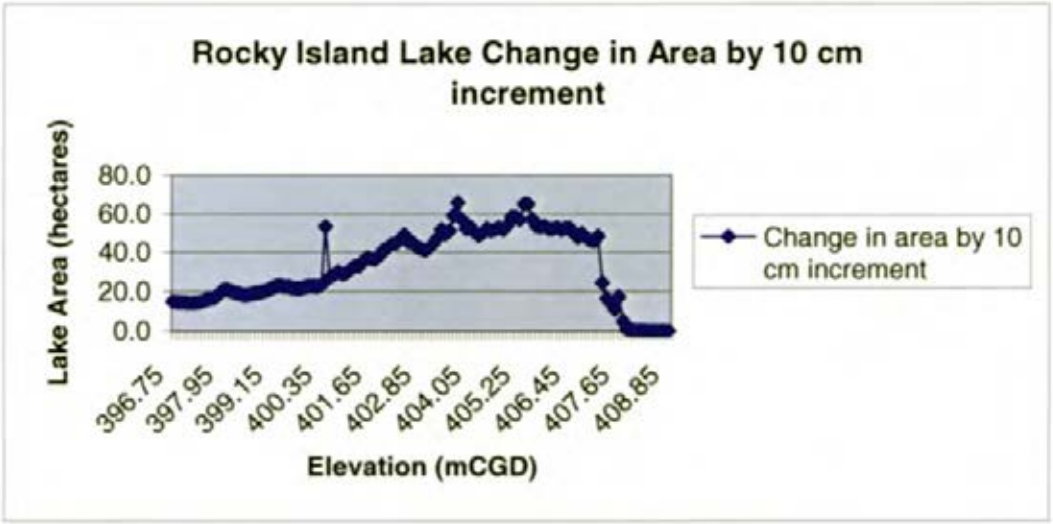
Aubrey Lake was sampled using the FWIN protocol from October 3 to 7, 2003. As per the protocol for a lake this size (ha), 22 nets were set. The water temperatures ranged from 13°C to 9°C.

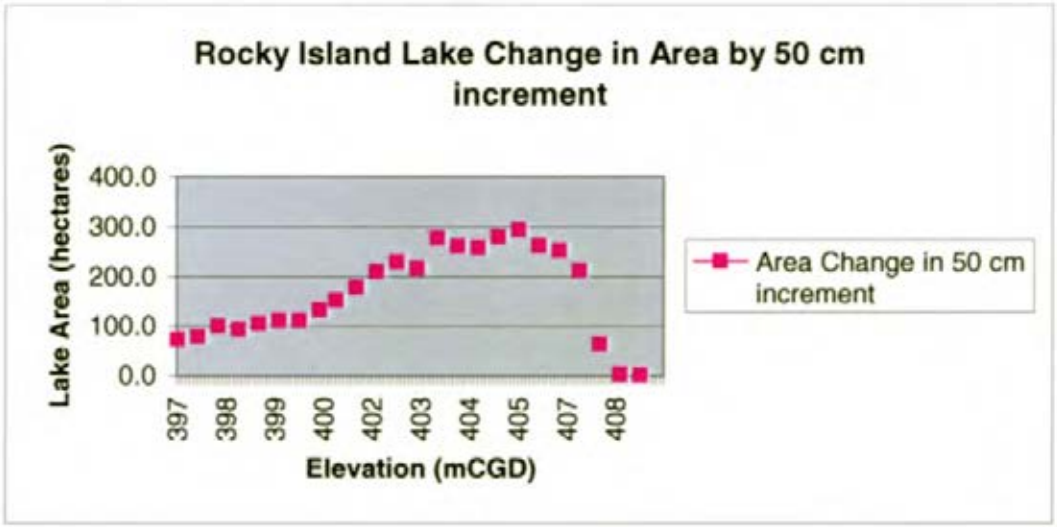
The Aubrey Lake walleye population has an index catch rate slightly below the 25th percentile of 2.2 walleye/net from the Northeast Region walleye abundance statistics from 1993 to 2001 (Morgan et al, 2003) and well below the regional mean of 6.4 walleye/net. The total length at age relationship for the population appears to be lower than the regional mean. Also, the weight at age relationship appears to be below the Regional means. L_∞ for the population is well below the female 5th percentile and only slightly above the 5th percentile for males. Early growth (ω) is between the male and female means. The Brody growth coefficient (k) is above the Regional 95th percentile for females and only slightly below the 95th percentile for males. Pre-maturation growth (h) is marginally below the 25th percentile for males.

Tunnel Lake Reservoir

Tunnel Lake was sampled using the FWIN protocol from September 27 to 30, 2003. As per the protocol for a lake this size (1575 ha), 18 nets were set. The water temperatures ranged from 15°C to 13°C.







Source: MNR, Blind River

Figure 8.4
Brookfield Renewable Power
Mississagi River Water Management Plan
Rocky Island Lake - Change in Area by Elevation

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The Tunnel Lake walleye population has an index catch rate slightly above the 25th percentile of 2.2 walleye/net from the Northeast Region walleye abundance statistics from 1993 to 2001 (Morgan et al, 2003) and well below the regional mean of 6.4 walleye/net. Walleye appear to be below the regional average for total length-at-age benchmarks with most values falling around the 25th percentile. The results are similar for the weight-at-age relationship, with males being around the 25th percentile and females being between the 25th percentile and the mean; the L_∞ for the combined sexes falls between the regional means for males and females. The Brody growth coefficient for the population (k) is between the regional mean and the 25th percentile. Early growth (ω) for the sample is slightly lower than the 25th percentile for females and males. Pre-maturation growth (h) is slightly greater than the regional 25th percentile.

Red Rock Lake Reservoir

Red Rock Lake was sampled using the FWIN protocol from September 9 to 10, 2003. As per the protocol for a lake this size (444 ha), 12 nets were set. The water temperatures ranged from 15°C to 14°C.

The Red Rock Lake walleye population has an index catch rate slightly above the 5th percentile of 0.2 walleye/net from the Northeast Region walleye abundance statistics from 1993 to 2001 (Morgan et al. 2003) and well below the regional mean of 6.4 walleye/net. Relative to regional data, the population has an average size at age distribution as well as an average weight at age distribution with the exception of the 5-yr old mature female weighing 1240 g, which is above the 75th percentile of 1052 g.

8.1.4 Additional Walleye and Pike Spawning Investigations (2004)

During the spring of 2004 additional walleye and pike spawning investigations were undertaken by BRP's environmental consultant and MNR to supplement and confirm field work initiated in 2003. The focus of this work was to confirm the extent and timing of the walleye spawn in the lower Mississagi, particularly in the vicinity of Red Rock and Tunnel Lakes. A limited amount of work was done to evaluate pike and walleye spawn in the lower Mississagi River.

Two new walleye spawning locations were confirmed by MNR (Blind River) at Tunnel Lake (Hooverville Creek inflow) and Aubrey Lake (Peshu Creek inflow). It is likely that the main spawning areas for Tunnel Lake walleye are in the river upstream of the lake. This was partially investigated during 2003, but more work is required to confirm this.

8.1.5 Lake Trout Investigations on Rocky Island Lake and Aubrey Lake Reservoirs

The information in this section was provided by MNR (Blind River Area Office).

Rocky Island Lake was sampled using the SLIN protocol over 2 days with sets occurring on May 9 and 10, 2003. As per the protocol, 30 nets were set. Four lake trout were sampled, with two having fin clips, having been stocked in 1994 and 1997. Due to a small sample size, L_∞ and initial growth rate (ω) could not be calculated. The average number of lake trout per net was 0.13.

Aubrey Lake was sampled using the SLIN protocol over 3 days with sets occurring May 8 to 12, 2003. As per the protocol, 30 nets were set. The original survey of Aubrey Lake done in 1976 did not indicate the presence of lake trout. The capture of one lake trout within this survey confirms that lake trout are now present within the lake. The presence of a fin clip would suggest that this is a hatchery-introduced lake trout (1992 stocking).

8.1.6 Sturgeon Assessment/Verification Tunnel Lake Area

Background

The information in this section was provided by MNR (Blind River Area Office).

Lake sturgeon are present in the Mississagi River below Red Rock Lake. Several studies have recently been done to document various attributes of this population.

The historical upstream natural extent and distribution of lake sturgeon in the Mississagi River before hydroelectric development is not documented.

Natural obstacles such as Red Rock Falls and Devils Slate Falls may have limited the upstream movement from Lake Huron of these fish, although this was never verified. Upstream migration of fish has not been possible past Red Rock dam since its completion in 1961. The Tunnel Lake dam/GS was completed around 1950.

MNR stocked 23 adult sturgeon (approximately 1.5 to 4 kg) into Tunnel Lake around 1986. These fish were captured in the North Channel of Lake Huron, and would have likely been between 10 and 20 years of age, based on the reported growth rates of sturgeon (Scott and Crossman, 1973). Sturgeon are very long lived, so it is quite possible that some of these stocked fish could still be alive. A lifespan of 50 years is an approximate average, but MNR reports that sturgeon of 154 years of age have been found in Ontario lakes. It is also possible that the originally stocked fish may have successfully reproduced. Any fish sampled in 2003 less than approximately 17 years of age would likely be the result of successful reproduction by the 1986 stocked fish. Sturgeon mature between 15 to 25 years of age. This slow growth and maturity would make it unlikely for large numbers to have been established by the initial stocking.

No studies have been done to determine the status of these fish. MNR indicates that there have been anecdotal reports of sturgeon seen in some sections of the Mississagi River above Tunnel Lake over the past 25 years.

MNR also indicates that it has two credible reports of sturgeon being caught by anglers in Tunnel Lake in recent years. These fish were reported to have been brought right up to boat side, and clearly viewed and identified. They were almost 2 m in length. Other anecdotal reports of large fish could not be verified as being sturgeon. This information was obtained during the August 2003 sturgeon assessment.

2003 Sturgeon Assessment Tunnel Lake

MNR and DFO have an interest in assessing the status of sturgeon in Tunnel Lake and the upstream reaches of the Mississagi River. It is important to understand the species present as part of a baseline monitoring program. A joint sampling program was conducted by MNR and DFO on August 19, 20, and 21, 2003. The intent of this program was to verify presence of sturgeon,

determine any population attributes, and determine further study requirements based on the results.

MNR indicates that there are a variety of techniques commonly used to sample or observe sturgeon. One of these methods involves targeting a summer shallow water basking behavior typical of juvenile sturgeon. These fish can often be found in shallow sand flats on warm sunny days. In some lakes where conditions allow, a visual assessment can be made to estimate sturgeon numbers and approximate size, simply by quietly and carefully watching. Tunnel Lake has some areas of this type in the northwest end. Because of time limitations and poor visibility, primarily due to waves, this method was not usable during this assessment period. Several small mesh gill nets (5 cm) were set in these areas of shallow sand flats (1.5 to 2.5 m depth). Some non-target fish were captured, but no sturgeon were sampled. For this method to have some probability of success, weather conditions must be favorable. The optimal conditions are warm, sunny, and relatively calm periods. However on the first day mechanical problems with an outboard prevented the crew from accessing these areas, at the only time when near optimal conditions were encountered. The first day began with good conditions, but deteriorated by mid-afternoon. Conditions on the second day were not favorable, and during the third day there were severe thundershowers. For these reasons, the basking behavior could not be observed. Unfortunately this 3-day period was the only one available for the purpose of this assessment, because of staff and equipment availability.

A second method commonly used for sampling sturgeon involves use of baited setlines. However, the gear required for this type of sampling was not available.

The third, and most commonly used method for sampling sturgeon is use of large mesh gill nets. However, during the summer months, sturgeon are known to not move about extensively, making capture by nets less likely. Typically sturgeon are sampled in the spring when they are moving toward spawning grounds, or in the fall when they may be staging in rivers. Several sets of 25 to 30 cm mesh were placed in Tunnel Lake, and the Mississagi River above Tunnel Lake. The set locations were varied, but were usually at, near, or across the deepest basins, or channels. Depths of the lake sets were approximately 20 to 35 m, and most were left in overnight. There are very

few deep pools in the Mississagi River above Tunnel Lake that are accessible by boat. One such location above Gros Cap was sampled. No sturgeon were sampled using this method.

Conclusions

The summer 2003 field program did not result in sampling of any sturgeon. However, the primary reason for conducting this study during the summer months was to target a juvenile basking behavior, which is only expected under certain conditions, as described above. These conditions were not present during this assessment, greatly reducing the likelihood of sampling any sturgeon, if they are present. The baited setline technique is probably a more effective summer method than large mesh nets, and was not available at the time of this assessment. Lack of any sturgeon sampled using the large mesh gill net is also inconclusive. This method is not known to be highly successful during the summer months, even in places where sturgeon are known to be present.

The result of this assessment contributed very little to knowledge and understanding of the Tunnel Lake sturgeon population. Interviews conducted with fishermen who have captured sturgeon by angling in Tunnel Lake in recent years have provided the only substantive evidence that sturgeon are present. The description and credibility of these accounts leaves no uncertainty by MNR that at least some sturgeon are present in Tunnel Lake.

MNR plans another sturgeon assessment in the future to improve their understanding and knowledge of the sturgeon population in Tunnel Lake. This sampling/assessment is planned to precede timing of expected spawning activities, which normally is in May to June, when water temperatures are between 13 and 18^{o}C. There are some sections of the Mississagi River immediately above Tunnel Lake that could be very effectively sampled, using large mesh gill nets, to intercept any sturgeon moving up the river to spawn. Sturgeon are known to travel considerable distances to spawn. Spawning locations are often at the base of an impassable barrier, such as a waterfall. The only significant barriers upstream of Tunnel Lake are at Pig-Pen Chute, and Aubrey Lake Dam/GS. Pig-Pen chute may not be an impassible barrier for sturgeon during spring flows, leaving the Aubrey GS tailrace area as the most likely spawning location; however this would have to be verified.

8.1.7 Pink Salmon Spawning Investigations Below Red Rock GS

This was a joint effort between BRP's environmental consultants and MNR staff. The present commitment with pink salmon spawning involves BRP passing a minimum average daily flow release of 35 m^3/s from November to the beginning of the spring freshet. Since it is not possible to run the turbines at Red Rock GS low enough to ensure a constant flow of 35 m^3/s (due to equipment damage from cavitation), the original agreement allows for the units to be run at a higher flow rate and cycled on and off to achieve the average daily flow of 35 m^3/s. Also, the agreement allows for a maximum shutdown period of no longer than 8 hours such that dewatered eggs might be regularly watered. Accordingly, to maintain the 35 m^3/s daily average BRP runs the plant at approximately 70 m^3/s for 16 hours and then shuts the plant down (zero discharge) for 8 hours. This scenario is referred to as "Standard Salmon Water".

In dry years, the passing of a daily 35 m^3/s average uses valuable water that BRP is trying to conserve in the system. To address this situation, BRP approaches MNR, on occasion, to get a relaxation in the average daily minimum flow from 35 to 28 m^3/s. Making this change involves cycling the plant differently. To achieve the 28 m^3/s average, BRP cycles the flow for 5 hours on at approximately 62 m^3/s and 3 hours off at zero discharge (referred to as "Reduced Salmon Water").

Although MNR has always granted this request, they requested that additional studies be conducted to determine the impact to pink salmon spawning of reducing the daily flow to 28 m^3/s by modifying the cycling of plant operations.

Fieldwork occurred between October 31 and November 17, 2002. The main run of spawning pink salmon was over by this time. However, biologists had visited the river in September 2002 and noted where pink salmon were congregating. The amount of wetted habitat at each area was determined with a GPS unit during high and low water.

The results (NRSI, 2003) indicated minimal difference in wetted habitat between standard salmon water and reduced salmon water. Further

observations are required to determine whether pink salmon use the areas that are regularly dewatered to spawn or whether fish have adapted to many years of the river being cycled and do not use the areas that are regularly dewatered.

8.1.8 Other Spawning and Aquatic Habitat Investigations

A data review of existing information indicated that detailed habitat information was not available for much of the river system. For this reason, and to update existing information, a habitat mapping program was designed and initiated in the spring of 2003 and completed in 2004.

To focus the scope of this field program, Valued Ecosystem Components (VEC) were targeted. The main VEC identified were walleye spawning sites, northern pike spawning sites, smallmouth bass spawning sites, waterfowl nesting sites, and wood turtle habitat. Field crews would also record observations of any other species at risk, or other VEC that should be considered.

MNR staff and BRP's consultant worked together to develop and conduct this program. The project was broken into subprojects as follows.

An initial reconnaissance of most of the river system was done by helicopter to map out and help define the locations that would require ground evaluations. This proved to be very effective, due to the very large geographic area, as well as the limited staff resources and time available. In addition to these considerations, the timing windows for some of the spawning confirmation surveys could also be quite short.

Locations identified as having required attributes for the identified VEC were evaluated by field crews. If the habitat was found to have the necessary attributes, it was mapped and described. These attributes included descriptors such as substrate size makeup, substrate type, vegetation type, water temperature, water velocity, water depth range, probable species usage, and habitat type. GPS coordinates and shape of the habitat were also recorded. This spawning habitat identification was targeted primarily at northern pike, walleye, rainbow trout, and brook trout.

Validation of identified spawning sites was to be done by confirming actual species utilization of the individual sites. This would change the description of a habitat type from potential spawning habitat to confirmed spawning habitat, in addition to improving our knowledge and understanding of the various species. Northern pike are known to spawn around the time of ice-out. The field crews were unable to confirm any northern pike spawning locations with spawning activity. This appeared to be because the northern pike spawn was already completed at the time of the survey. Field crews also checked some known spawning sites for pike, and found no activity, supporting the likelihood that the timing was late. However the field crews did successfully confirm walleye spawning at various locations throughout the system.

It was the intent of this program to verify salmonid spawning at various tributaries along the Mississagi River in the fall of 2003. Rainbow trout and brook trout are present in the river between Tunnel Lake and Aubrey Lake. This fishery consists of natural and stocked populations. Very little is known about the utilization of the main river and the numerous tributaries for spawning and nursery life stages. However, resources required to conduct this work were not available.

Waterfowl nesting and staging habitat was mapped incidentally as crews traveled the river system doing the fisheries habitat mapping. Several new areas were identified as being utilized for waterfowl nesting. Two of the species observed nesting were Canada Goose and Common Loon.

A smallmouth bass nesting survey was conducted in June 2003 on Tunnel Lake by MNR and BRP's consultant. This waterbody was targeted because of the concerns of local tourist operators, as well as the importance and vulnerability of this fishery. The main study issue was to determine the vertical distribution of smallmouth bass nest sites. This is of particular importance because of the potential for the lake to be drawn down below the level of some nests, between the time of egg deposition and fry emergence. MNR believes that a drawdown resulting in exposure of nests during this period would cause complete mortality. The study consisted of visual location of nest sites and measurement of various attributes. These attributes included depth, orientation, substrate type and size, cover proximity and type, slope, distance to shore, and GPS coordinates. Approximately 118 nests were

located and described. This information was useful in estimating the effects of drawdowns during the critical period on smallmouth bass reproductive success. Results indicate that a drawdown of 0.5 m would cause mortality to approximately 30% of nests.

All field data has been summarized on spreadsheets and referenced in a GIS format at the MNR Blind River area office. Details of field investigations conducted in 2004 are included in Appendix F. This data will also be incorporated into MNR's Natural Resource Values Information System (NRVIS) database.

8.1.9 Aubrey Falls Scenic Flows

Under the terms of the Water Power Lease Agreement (No. 94) (Supplemental Letter of Agreement, May 27, 1998), discharges of 8.5 m^3/s are required to be released from the spillway at Aubrey Falls for scenic water over the falls during daylight hours for the duration of the tourist season. The tourist season is further defined as the Saturday before Victoria Day in May to the Saturday after Thanksgiving Day in October. Daylight hours are more specifically described in the agreement as follows:

- 0830h – 1600h (EST) for the months of May and September
- 0830h – 1700h (EST) for the months of June and August
- 0830h – 1800h (EST) for the month of July
- 0830h – 1500h (EST) for the month of October.

The magnitude of scenic spill flows was reviewed by representatives of BRP, MNR, the PAC, and Mississauga First Nation during a site visit on June 16, 2004 to determine whether they were appropriate. Various flows were observed as follows:

Starting Flow	8.5 m^3/s	1115h – 1140h (Photos taken at 1130h)
	5.0 m^3/s	1140h – 1201h (Photos taken at 1155h)
	7.0 m^3/s	1201h – 1228h (Photos taken at 1225h)
	10.0 m^3/s	1228h – 1256h (Photos taken at 1250h and 1255h)
	12.0 m^3/s	1256h – 1330h (Photos taken at 1316h and 1325h)
	8.5 m^3/s	1330h.

Pictures of the falls at each flow are included in the report in Appendix H.

Based on the observations, the group observing the flows concluded that, while the falls did appear more dramatic at higher flows, the 8.5 m^3/s value represented a reasonable compromise between aesthetics and power generation. Any lower flow would greatly impact the attractiveness of Aubrey Falls.

The planning team also considered the potential for reducing or adjusting the hours of operation of Aubrey Falls in order to reduce the volume of water spilled. This was done by reviewing data compiled from Ontario Parks' visitor logbook at the site for the period 1999 to 2004 (see report in Appendix H). It was concluded that the timing of the scenic spill flows matches the timing of the majority of visitors with over 95% of visitors signing in during times of scenic spill flows. Therefore, no change to the current spill regime is proposed except to change the existing hours from Eastern Standard Time to Daylight Savings Time.

8.1.10 Importance of Mississagi River System to Recreational Users and Resort Owners

It was acknowledged by the planning team that socioeconomic data on the importance of Mississagi River system to local lodge owners and the community tourism and recreation industry generally was lacking. Representatives of the PAC agreed to conduct a survey of lodge owners during the spring of 2005 to fill this data gap. The results of the survey are included in Appendix I. It was recognized by the planning team that this was not a formal socioeconomic survey but was still considered useful information in terms of the broad socioeconomic value of the Mississagi River system to the local community.

The value of the river system to the local economy was estimated by survey respondents (lodge/camp operators) to be in the neighborhood of $10,000,000 annually and is therefore very important, particularly to the 13 resorts and several stores doing business on Tunnel Lake and Rocky Island Lake. It is estimated that just over 50% of their revenues are derived from anglers on various sections of the Mississagi River. Tunnel Lake supports almost half of this fishing pressure with the balance from Rocky Island Lake and the river

between the two. The responses of the survey participants indicated that if mitigation measures were taken to control water levels, improve access, and fishing quality, businesses could benefit by as much as a 26% increase in visitor nights with $645,800 to the local economy. Non-resort based fishing increases were valued by survey respondents as adding an additional $243,100 to the economy. This would be offset, however, by losses in renewable energy value to the province, depending on the option selected.

8.1.11 Managing Flows out of Aubrey GS for Canoeists

During one of the Public Information Centres, a concern was raised regarding flow fluctuations on a provincially significant canoe route, particularly in the stretch of river below Aubrey GS. A representative of the PAC suggested the possibility of restricting flows out of Aubrey GS during summer weekends to improve conditions for canoeists.

The vast majority of canoeists are believed to be from the local Algoma area with some from southern Ontario. Most are leisure day trippers and anglers, or they camp along the route and therefore do not have a need for accommodation. These persons may be expected to make some expenditures locally and therefore make a contribution to the local economy. While the PAC has attempted to estimate the usage and economic contribution (Appendix I), no data was collected to substantiate these estimates.

The Mississagi River, as a provincially significant canoe route, is also used regularly by canoeists traveling the river from one of several starting points upstream of Rocky Island Lake. These paddlers typically spend 7 to 14 days on the river, and could travel the reach downstream of Aubrey Lake during any day of the week (i.e., not mainly on weekends). No information is available on the numbers of paddlers on multiday trips, but the river is known to be traveled regularly by individuals as well as organized groups.

Presently, resorts in the Mississagi River valley benefit only modestly from guests who make day trips down the Mississagi River. Resort owners estimate that their guests spend approximately 1300 visitor days on the river. This brings in $267,000 or 9.1% of resort income. Some resort owners don’t recommend the canoe trip, as they cannot guarantee guests will have a

positive experience with the possibility of water levels varying widely and without any notice. Even if water levels were controlled on long weekends as proposed, owners projected only a modest increase of 14.8% in river activity by their guests representing a $40,000 increase in total revenues.

8.1.12 Adequacy of Aubrey GS Baseflow for the Downstream Aquatic Ecology

MNR requested a review of the adequacy of the present Aubrey GS refresh flow, consisting of running one unit hour/day for the benefit of the downstream aquatic ecology. In support of this request, MNR provided documentation on simulated natural flow metrics for the Mississagi River at Aubrey Falls (Appendix J) based on 30 years of historic data (1970 to 1999).

MNR favors a continuous baseflow at Aubrey of 17.9 m^3/s which represents the flow rate that is exceeded 80% of the time based on long-term hydrological records (see Appendix J). This may be partially satisfied by way of the Aubrey scenic spill flow and the available baseflow. It was determined that it would be more practical to express the various flow components in terms of average flow over the day (i.e., the scenic flow averages 3.5 m^3/s over 24 hours, and then add the baseflow, plus the balance provided by single unit power flow release). This method was carried forward into development of the options.

8.1.13 River Ice Management Below Aubrey Falls GS (Public Safety)

Historically, some reaches of the Mississagi River between Aubrey Falls GS and Tunnel Lake have been prone to substantial ice development during the winter season. This ice development, in combination with varying flows from the Aubrey Falls GS, has, in the past, created flooding conditions on Highway 129 and potential public safety issues for those who use the highway and the river.

To determine whether current ice management practices for this area are adequate to protect public safety, BRP commissioned Acres International Limited (now Hatch Energy) to perform a detailed investigation of the ice management practices on the Mississagi River. The investigation consisted of

a review of existing ice management operational guidelines, field reconnaissance during the winters of 2003/2004 and 2004/2005, and subsequent engineering evaluations to better assess the mechanics of ice development on the river and to determine whether refinement of existing ice management procedures was warranted.

The study established that the most significant ice growth occurs during periods of low flow in the river when the ambient air temperatures are below -20ºC. It was found that generation at Aubrey Falls GS and the subsequent increase in flow downstream has the tendency of breaking the ice cover and transporting the floating ice downstream. The floating ice becomes lodged in certain areas (i.e., sharp bends, shallow/narrow reaches) between Aubrey Falls GS and Tunnel Lake, creating hanging ice dams and restricting the flow in the river. The study concluded that during conditions prone to ice development, Aubrey Falls GS should be operated in a way that minimizes prolonged periods of low flow. This would maintain a depth of water in the river channel and allow the ice cover to build progressively upstream, thus minimizing ice damming effects and restrictions in flow, and mitigating the potential for flooding Highway 129.

As a result of the above-mentioned review, it was confirmed that the existing proactive ice management procedures currently in place are adequate and need to be maintained, i.e.,

- continuously monitor winter meteorological conditions when conditions enable ice production
- conduct daily ice reconnaissance trips to monitor ice processes and water levels, and to provide feedback on how Aubrey Falls GS operation is affecting the ice and river conditions
- plan and adjust daily Aubrey Falls GS generation schedules to manage ice movement in the river to the extent possible and control water level staging in flood-prone areas of the river
- implement public safety alerts and activate communication protocols with MTO and MNR in the event of an ice problem being identified on the river, to ensure public safety is maintained at all times.

8.1.14 Wood Turtle Habitat Investigations

Field surveys were conducted by BRP's environmental consultant and MNR in late 2003 and early 2005 to determine the presence or absence of wood turtles and suitable wood turtle habitat in the Mississagi River water management planning area. Wood turtles are classified as endangered in Ontario's SARO list (February 2009) and are at their northern limit in the Mississagi watershed. This species is also classified as "Special Concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Information collected on wood turtles and/or their habitat is confidential to MNR given wood turtle vulnerability. Evaluations and surveys by BRP and MNR staff have confirmed that wood turtle habitat is not affected by water level variations caused by water power operations on the Mississagi River.

8.1.15 Boat Launch Conditions, Tunnel Lake

Some public concern was expressed regarding the ability of boaters to launch their boats at Hooverville Landing on Tunnel Lake (Figure 8.5) during low summer water levels. BRP and MNR representatives visited Hooverville Landing during the summer of 2004 when water levels were near the voluntary minimum. It was determined that this issue could be addressed through improvements to the boat launch area at Hooverville Landing. Construction of a new boat launch ramp was completed in the fall of 2007. This work was funded by BRP and managed by local volunteers.

8.1.16 Fire Control Water, Tunnel Lake

The local fire department expressed concerns about their ability to access water during low summer water levels in Tunnel Lake. This issue was addressed through maintenance works to the boat launch area at Hooverville Landing as noted in Section 8.15 above.

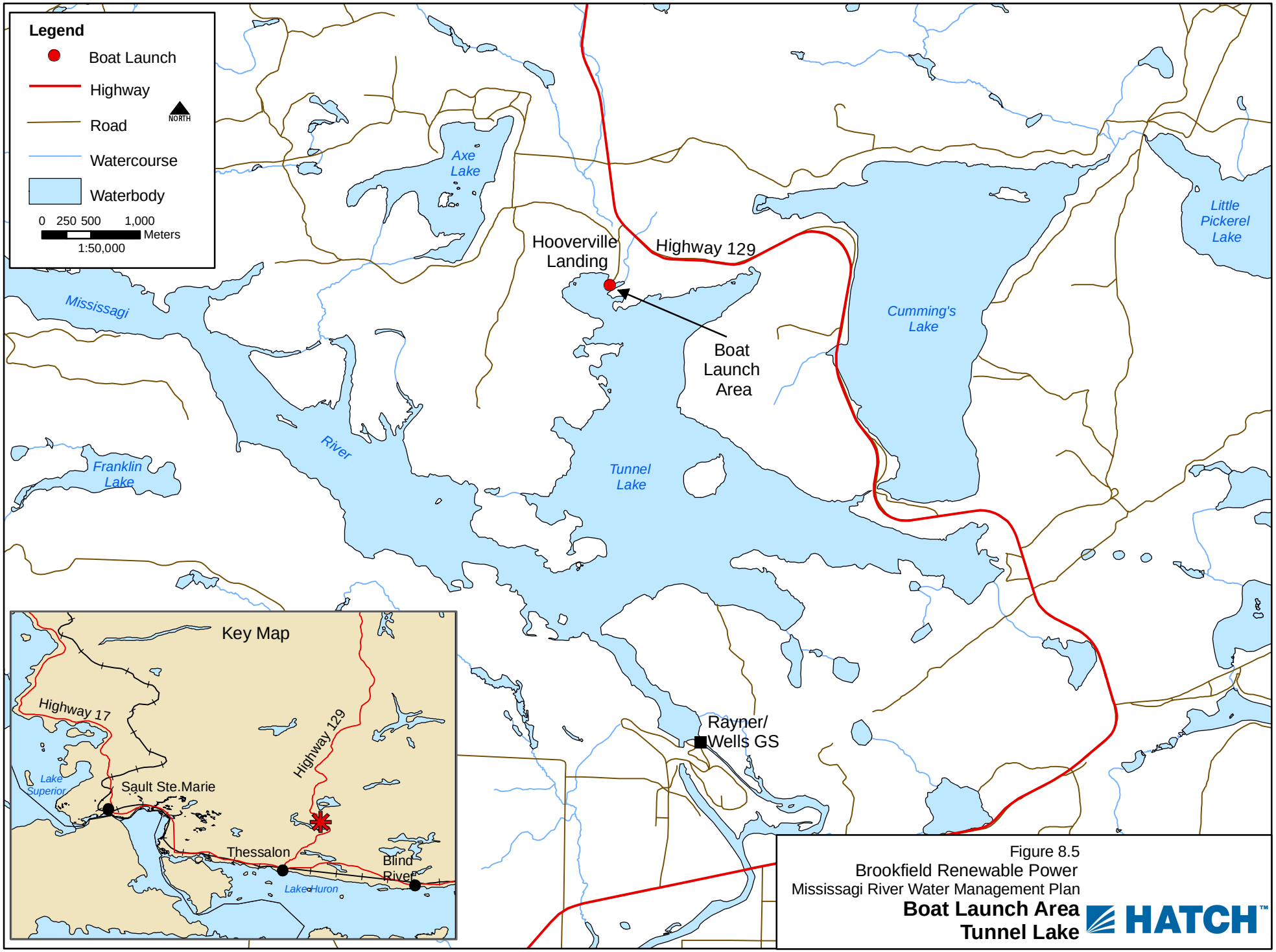

Figure 8.5
Brookfield Renewable Power
Mississagi River Water Management Plan
Boat Launch Area
Tunnel Lake

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8.1.17 Fishermen's Water Investigations

MNR and BRP investigated waterway navigability during the summer of 2004 in the area between Iron Bridge and Red Rock Dam. Navigability was evaluated by traveling through all sections of the river between Red Rock Dam and the village of Iron Bridge using a 5.2 m (17 ft) powerboat. This section of river was found to be easily navigable under existing Fishermen's Water flow conditions, with at least two sections requiring caution. Existing Fishermen's Water consists of 1 unit flow at 50% gate (56.6 m^3/s) when inflow is up to 76 m^3/s. When inflow is above 76 m^3/s, 1 unit is operated continuously with the second unit as required. Fishermen's water is provided daily from 0400 hours to 2000 hours, May 1 to October 31.

Downstream reaches were also evaluated past the Dean Lake road bridge. It was found that areas near and downstream of the Dean Lake bridge were difficult to navigate due to shallow depth across most of the river. As flow in the river is reduced to less than approximately 50 m^3/s, the navigable area of the river is limited to a relatively narrow channel, which can be difficult to follow. Under these conditions, navigability is reasonable for a canoe or kayak, but becomes poor for motorized watercraft. However, no public concerns were raised regarding navigability for fishing below Red Rock Dam during the planning process.

8.1.18 Erosion Review Downstream of Red Rock GS

BRP commissioned a fluvial geomorphologist from the firm Water's Edge to investigate the river reach below Red Rock GS in terms of erosion, integrity of riprap, and whether the 0.61-m daily water level fluctuation restriction is still warranted. Water's Edge concluded that the available data and information from their site visit in 2004 were not sufficient to warrant relaxation of the constraint, but noted that erosion protection works installed in the 1980's are working quite well. Based on these findings, the preferred option must include the 0.61-m constraint at this time, recognizing that this is an adaptive management process, with the possibility of removal of this constraint in the future if further investigations warrant such action.

8.1.19 Erosion Review of Cemetery Site near Mississagi River Delta

A site visit was made by BRP, MNR and Mississauga FN representatives on October 14, 2009 to investigate a FN concern with erosion in the vicinity of a cemetery located near the shoreline of the Mississagi River Delta. It was determined that the closest graves are approximately 15 m from the shoreline and there was no evidence that these graves are presently in danger of being eroded into the channel. The area is highly vegetated with tall grasses and shrubs close to the shoreline. The water level at this location is affected primarily by the water levels of Lake Huron, and to a much lesser extent by Mississagi operations.

8.2 Summary of Data Gaps Filled Prior to Development of Options

Table 8.3 provides a summary of the data gaps filled to enable development of options.

8.3 Issues Addressed by Current Operations on the River System, Through Physical Improvements or Other Methods

Following the filling of data gaps as noted above, the priority issues as listed in Table 6.5 were revisited. It was determined that the following issues could be addressed by current operations on the river system or through physical improvements, or through other methods:

- First Nations Values Database (assistance being provided by BRP and MNR in developing database)
- Rocky Island Lake flood management capability (to be maintained)
- Aubrey Falls Scenic Flows (to be maintained) – hours to be Daylight Savings Time (DST) rather than Eastern Standard Time (EST)
- river ice management downstream of Aubrey Falls GS to Tunnel Lake (current ice management procedures reviewed and determined to be adequate)
- boat launch and access (Rocky Island and Tunnel lakes) [physical maintenance of boat launch sites, channel maintenance (stump cutting, boulder relocation) and maintenance of existing ATV trail access]
- fire control water access on Tunnel Lake during low summer water levels (physical improvements to boat launch at Hooverville Landing)

Table 8.3 Summary of Data Gaps Filled			
Priority Issue	**Data Gap Identified**	**How Data Gap Was Filled**	**Relevant WMP Section(s)**
General			
Preservation and where possible enhancement of renewable energy benefits			
Critical habitat including species at risk (e.g., wood turtles, sturgeon) and spawning/nursery habitat	X	• Fish spawning/nursery surveys • Lake trout (SLIN) survey • Investigation of potential wood turtle habitat areas • Fall walleye netting • Sturgeon assessment	• 8.1.4, 8.1.8 • 8.1.5 • 8.1.14 • 8.1.3 • 8.1.6
First Nation and other cultural values	X	• MNR assistance to Mississauga FN to build database of values	• 8.3.1
Recreational values and impacts (including provincially significant route)	X	• PAC Resort User Survey	• 8.1.10, 8.1.11
Rocky Island Lake			
Flood management capability			
Effect of low summer water levels on aquatic ecology and recreation (navigation/boat access)	X	• Stranded pools mapping from new bathymetric mapping • Boat launch and access investigations	• 8.1.2 • 8.1.1
Aubrey Downstream to Tunnel Lake			
Potential to increase or decrease scenic flows	X	• Site visit to assess aesthetics at various flows	• 8.1.9
Effectiveness of current river ice management (public safety)	X	• Review of ice management procedures	• 8.1.13
Flow fluctuations and effects on ability to canoe safely	X	• Review of canoeists use of river	• 8.1.11
Adequacy of refresh flow for aquatic ecology (i.e., potential to move closer to the natural flow regime)	X	• Review of MNR simulated natural flow metrics data to determine appropriate flow	• 8.1.10
Tunnel Lake			
Low summer water levels and impact on recreation and fire water access (i.e., boat access during low water levels)	X	• Site visit by MNR and BRP to Hooverville Landing boat launch area • Site visit by MNR/BRP and discussion with Fire Department representative	• 8.1.15 • 8.1.16
Impact of water levels on walleye and bass spawning (spring)	X	• FWIN and walleye spawning surveys • Bass spawning investigations	• 8.1.3, 8.1.8 • 8.1.8
Presence/absence of sturgeon	X	• Sturgeon assessment by MNR and DFO	• 8.1.6

Table 8.3 Summary of Data Gaps Filled			
Priority Issue	**Data Gap Identified**	**How Data Gap Was Filled**	**Relevant WMP Section(s)**
Red Rock Downstream			
Potential for flooding in Iron Bridge		• No data gap; new WMP maintains current flood management practices	• 9.6 (Table 9.5)
Adequacy of present salmon and walleye spawning flow releases	X	• MNR review of existing walleye spawning flow releases confirmed acceptability • Pink salmon spawning investigations	• 8.1.7
Adequacy of Fisherman's water flow releases	X	• Site visit by BRP/MNR to assess navigability	• 8.1.17
Water level fluctuation (0.6 m) constraint (erosion concerns)	X	• Independent review by Water's Edge confirmed the need to maintain this constraint at this time	• 8.1.18
Erosion concern at a cemetery site near Mississagi River Delta	X	• Site visit by BRP/MNR/FN representatives to determine whether graves are in danger of erosion	• 8.1.19

- water levels for walleye spawning and incubation on Tunnel Lake (to be maintained to protect Cumming Creek habitat)
- erosion downstream of Red Rock Generating Station – flow fluctuation constraint (to be maintained)
- flooding concerns in Iron Bridge (existing flood management procedures to be maintained)
- fishermen's water below Red Rock Generating Station (to be maintained)
- flows for salmon and walleye below Red Rock Generating Station (to be maintained)
- preservation of wood turtle habitat (not affected by current Full Supply Levels)
- erosion concern at a cemetery adjacent to Mississagi River Delta (existing graves not presently in danger of erosion; water levels primarily affected by Lake Huron water levels at this location).

8.3.1 Wildlife Nesting Platforms – Tunnel Lake

As part of the water management planning exercise for the Mississagi River, fish and wildlife habitat improvements were considered for Tunnel Lake. One improvement involved the placement of floating wildlife nesting platforms to provide opportunities for loons and other wildlife to nest under fluctuating water level conditions. MNR indicates that loons are particularly vulnerable to fluctuating water levels during the incubation period (which lasts approximately 1 month), as nests and eggs may be flooded out by rising water levels or eggs and fledglings may be exposed to increased terrestrial predation resulting from lowered water levels and an increased distance from the protection afforded by the water. For these reasons, this project was identified as an ideal project to conduct as a partnership among BRP, MNR and local tourist operators.

The project was submitted as a Community Fisheries and Wildlife Involvement Program (CFWIP) to the MNR. This program provided much of the funding required to cover the cost of materials.

Five platforms were constructed at BRP's Wharncliffe work station and then deployed at five bays in Tunnel Lake during the spring of 2003. Tourist operators, volunteers and MNR staff worked together to deploy the rafts. Nesting platforms were set up at locations based on the following criteria:

- one platform per bay as loons are territorial
- deployment of the platform in a sheltered bay, outside the immediate influence of the prevailing winds
- choice of locations to avoid, to the extent possible, human disturbance of the birds.

The platforms were constructed of a timber frame and wire under mesh topped with detritus, wetland debris and emergent vegetation. The platforms were situated in water 1.3 to 2 m deep and approximately 10 to 20 m away from the shoreline to allow them to rise and fall with lake water levels without becoming flooded or stranded on shore. Each platform was covered with an organic/soil base with appropriate living natural vegetation placed on it (see Figure 8.6). The vegetation consisted of plants such as local sedges, grasses, cattails and shrubs such as leatherleaf. This vegetation was rooted in the organic soil base and could continue to live and grow.

The platforms were monitored regularly by local tourist operators, who also provided digital photographic updates to MNR. Guests of the tourist lodges were involved to some extent, and were invited to observe the rafts from a safe distance. It was emphasized that people should not approach within 100 m of the rafts. This project fits very nicely with the ecotourism approach local operators are adopting. The local tourist operators as well as local residents were very supportive of this project, and were pleased to be able to participate in it.

During the summers of 2003 and 2004, no loons were observed nesting on the platforms. In 2003, there were two loon pairs seen frequently on Tunnel Lake, occasionally in the vicinity of some of the platforms. One loon pair was observed in the vicinity of one of the nesting platforms in 2004. A loon nest was also observed on the shore of Tunnel Lake in 2004. The platforms were used by other waterfowl such as mergansers for perching. MNR has arranged for a local volunteer to continue observations on the use of the nesting platforms to assess effectiveness (see Section 11.1.3).

8.3.2 Bass Nesting Structures – Tunnel Lake

BRP and MNR cooperated in a joint venture project involving 75 artificial bass nesting structures which were deployed by MNR in June 2004 at a depth of 2 m from Full Supply Level (FSL) on Tunnel Lake. It was observed that

some structures were utilized in 2004, but they were not highly effective, possibly due to the fact that they were deployed too late in the nesting season.

MNR was unable to check on use of the artificial nesting structures between 2005 to 2008 due to other staff commitments but attempted to do so in 2009 as part of the Effectiveness Monitoring Program (see Section 11.1.2).

8.4 Issues Remaining for Consideration in Options Development

The following priority issues remained for consideration in developing water management options:

- preservation/enhancement of renewable energy benefits
- summer water levels (Rocky Island Lake) and impacts on aquatic ecology and recreation (navigation)
- Aubrey Falls refresh flows (i.e., move closer to natural flow regime)
- consideration of summer weekend flow restrictions below Aubrey GS for canoeists
- water levels for bass spawning and nesting on Tunnel Lake.

Figure 8.6
Brookfield Renewable Power
Mississagi River Water Management Plan
Installation of Loon Nesting Platform on Tunnel Lake

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9 Option Development and Evaluation

9 Option Development and Evaluation

MNR's Water Management Planning Guidelines for Waterpower (2002) indicate that "options for the management of flows and levels should be sufficiently distinct that the effects of altering parameters are transparent, and their implications are understandable. Options should be practical and feasible to implement."

Prior to developing options, Table 9.1 was prepared by MNR outlining considerations for the planning team, particularly related to issues on Rocky Island Lake and Tunnel Lake, as well as the flow regime below Aubrey Falls. This information, along with other priority issues listed in Table 6.5 and information gathered to address issues as described in Section 8, was used by the planning team to develop options.

Four options were identified for planning team consideration as described in Table 9.2 and the subsections that follow.

9.1 Option 1 – Base Case

Option 1 represents the interim water management plan developed by OPG in 2001 and applied to BRP's operations by MNR as an interim measure when the generating facilities were acquired from OPG in May 2002. The 2001 water management plan takes into consideration the multiple water resource uses and beneficiaries on the Mississagi system. It reflects a multifaceted approach to water management in that it makes provision for hydroelectric power generation, flood management, fisheries water provision, and scenic flows during the summer.

More specifically, the environmental and social features of Option 1 are as follows.

Rocky Island Lake Reservoir

- Flood management by controlling outflows during flood potential at Iron Bridge

Table 9.1
MNR Considerations for Option Development by the Planning Team

Water Body	Issue	Rationale
Rocky Island Lake Reservoir	Dewatered important habitat	Management of Rocky Island Lake levels to address ecological considerations based on important or critical habitats would require a comprehensive mapping exercise to describe in detail the substrate and shoreline of the entire lake. This would require prolonged access to the lake bottom, either by lowering the lake level to the minimum, or by use of divers or other mapping or viewing technology. The planning team decided the resources required to undertake this type of project were not available. Additionally, the manner in which the data would be interpreted and applied to lake management operating regimes would be subject to a wide range of subjective views. It was decided that the defensibility of this approach would be weak, so it was not pursued.
Rocky Island Lake Reservoir	Stranded pools	The main weakness in attempting to set a minimum summer level based on stranded pools is that the potential for similar stranding of fish will also occur in the winter when the levels are drawn down. To use an approach based on stranding would therefore require a year round minimum level approach. A limited amount of field work did not identify a significant problem associated with stranded pools.
Rocky Island Lake Reservoir	Access	Access is an important component of public use. Without functionality of the existing access points, access to the lake is limited. Access via channels to Seven Mile Bay and to Rouelle Bay is a concern when summer low water levels go below 405.7 mCGD (see Section 8.1.1). Boat access to the south access point is possible below 406 mCGD and above 407 mCGD. There are no other public access points on the lake.
Rocky Island Lake Reservoir	Winter drawdown	The planning team decided that a change in the extent of winter drawdown would not be investigated in detail in this WMP. While there is literature on the ecological effects of water level fluctuations in reservoirs, the defensibility of a specific value would be very weak. In addition, reducing the winter drawdown would have negative implications for flood management. The most defensible approach to assess ecological effects would involve a detailed habitat mapping exercise, which may or may not identify critical habitat types from dewatering.

Table 9.1
MNR Considerations for Option Development by the Planning Team

Water Body	Issue	Rationale
Mississagi River	Ecological flows	The Aquatic Ecosystem Guidelines (Appendix G of WMP Guidelines) prescribe an ecosystem based approach to address issues associated with the riverine environment. The main area of MNR concern with respect to base flow requirements is the Mississagi River between Aubrey Falls and the confluence with the Aubinadong River. Consider shortening the interval between generation cycles. Other reaches of river have other constraints already in place, or are not as significantly affected.
Tunnel Lake Reservoir	Walleye spawning requirements	The present minimum water level for walleye spawning (272.35 mCGD) was targeted at protecting the Cumming's Creek habitat. Field studies have identified two other areas in the lake where walleye spawn. The same water level will not provide for adequate habitat at the other two locations but the main walleye spawning areas are likely in the river upstream of Tunnel Lake.
Tunnel Lake Reservoir	Smallmouth bass spawning requirements	Field work done during the summer of 2003 suggests that smallmouth bass reproductive success is affected by the present range of operating levels (274.2 to 273.2 mCGD) in the order of about 25%. This would increase significantly if the 0.5 m energy reserve level is reached (272.7 mCGD).
Tunnel Lake Reservoir	Commercial tourism	The tourist operators who use Tunnel Lake believe the present level range is too large during the tourist season, even more so when an energy reserve is applied. Access, docks and recreational uses are significantly affected.
Tunnel Lake Reservoir	Recreational uses	Access and recreational uses of the lake are significantly affected when the lake is in the lower extent of the summer range. The Hooverville public access point becomes difficult to use.

Table 9.2 Details of Options Considered					
Location	**Option 1 (OPG WMP, 2001)**	**Option 2 (Includes BRP voluntary summer targets for RI & Tunnel Lakes as of Nov/02)**	**Option 3 (Includes Social/ Ecological Improvements noted at end of table) (Planning Team + PAC input)**	**Option 4 (Includes Social/Ecological Improvements noted at end of table) (Planning Team)**	**Comments**
Rocky Island Lake Reservoir Operating Levels (mCGD)					
Spring, Fall, Winter	408.95 – 396.76 m (normal operating range - no legal minimum)	As Option 1	As Option 1 but with legal minimum of 396.76 m	As Option 1 but with legal minimum of 396.76 m	
Summer	408.95 – 396.76 m (normal operating range - no legal minimum)	408.95 – 406 m June 1 to Sept 30 + 1 m energy reserve to 405	408.95 – 405.7 m June 1 to Sept 30 with no energy reserve	408.95 – 405 m June 1 to Sept 30	For Option 2, BRP must contact MNR District Manager or designate when water level reaches 406.5 m
Rocky Island Lake Outflow	Outflow restricted during flood potential at Iron Bridge	As Option 1	As Option 1	As Option 1	
Aubrey Lake Reservoir Operating Levels	394.63 – 391.58 m	As Option 1	As Option 1	As Option 1	Max. elevation restricted to 393.19 m when implementing flooding strategies for Iron Bridge
Aubrey Falls Scenic Flow					
Spring	8.5 m^3/s daily May 7.5 h 8:30 – 4:00 p.m. EST June 8.5 h 8:30 – 5:00 p.m. EST	As Option 1	As Option 1	As Option 1 except hours to be considered DST	Commencing Saturday before Victoria Day in May
Summer	8.5 m^3/s daily July 9.5 h 8:30 – 6:00 p.m. Aug 8.5 h 8:30 – 5:00 p.m. EST	As Option 1	As Option 1	As Option 1 except hours to be considered DST	

Table 9.2 Details of Options Considered					
Location	**Option 1 (OPG WMP, 2001)**	**Option 2 (Includes BRP voluntary summer targets for RI & Tunnel Lakes as of Nov/02)**	**Option 3 (Includes Social/ Ecological Improvements noted at end of table) (Planning Team + PAC input)**	**Option 4 (Includes Social/Ecological Improvements noted at end of table) (Planning Team)**	**Comments**
Fall	8.5 m^3/s daily September 7.5 h 8:30 – 4:00 p.m. October 6.5 h 8:30 – 3:00 p.m. EST	As Option 1	As Option 1	As Option 1 except hours to be considered DST	Ending Saturday after Thanksgiving Day in October
Aubrey Falls Scenic Flow + Refresh Water + Canoeists Flow Below Aubrey Falls					
Spring	One unit hour per day (approx. 5.8 m^3/s) as river refresh water. (No canoeist flow on weekends)	As Option 1	17.9 m^3/s? (Scenic flow of 3.5* m^3/s + 20.4 m^3/s refresh power flow**, + 4 m^3/s existing base flow) + maximum 1 unit flow for canoeists on Can. & US holiday weekends from Victoria Day to Labour Day from 5:00 p.m. at the start of the weekend to 9:00 p.m. last day of weekend	One unit hour per day (approx. 5.8 m^3/s) as river refresh water + maximum 1 unit flow for canoeists on Victoria Day Canadian holiday weekend (except where flood management or IESO declared system emergency takes precedence)	* Daily average equivalent to 8.5 m^3/s scheduled scenic flow release. ** Minimum single unit flow 2 x 1 hour runs/day timed at equal intervals.
Summer	As above	As Option 1	As above	Minimum refresh power flow of 2 unit hours per day, separated by a minimum of 4 hours for July and August. Maximum one unit flow for canoeists on three Canadian holiday weekends (including Labour Day weekend)	
Fall and Winter	As above	As Option 1	As above except no canoeist flow after Labour Day weekend	One unit hour per day (approx. 5.8 m^3/s) as river refresh water.	
Maximum flow - flood management	Constrained flow release	As Option 1	As Option 1	As Option 1	To reduce/control flooding in Town of Iron Bridge

Table 9.2 Details of Options Considered					
Location	**Option 1 (OPG WMP, 2001)**	**Option 2 (Includes BRP voluntary summer targets for RI & Tunnel Lakes as of Nov/02)**	**Option 3 (Includes Social/ Ecological Improvements noted at end of table) (Planning Team + PAC input)**	**Option 4 (Includes Social/Ecological Improvements noted at end of table) (Planning Team)**	**Comments**
Tunnel Lake Reservoir Operating Levels (mCGD) (Wells forebay)					
Spring	274.44 – 269.80 m + 0.56 m flood allowance to 275.00 m + 0.24 energy reserve to 269.56 m (except during walleye spawn when minimum elevation is 272.35 at start of spawn and gradually rises)	As Option 1	As Option 1	274.44 – 269.56 m + 0.56 m flood allowance to 275.00 m (except during walleye spawn when minimum elevation is 272.35 at start of spawn and keep stable or gradually rising)	Flood management will take precedence over water level elevation for walleye spawning.
Summer	274.44 – 269.80 m + 0.56 m flood allowance to 275.00 m + 0.24 m energy reserve to 269.56 m	274.2 – 273.2 m + 0.56 m flood allowance + 0.5 m energy reserve to 272.7 m June 1 to September 30	274.2 – 273.2 m June 1 to September 1 + 0.56 m flood allowance, but with no energy reserve	274.2 – 273.2 m June 15 to July 15 to improve conditions for bass spawning 274.2 – 272.7 m July 16 to Labour Day + 0.56 m flood allowance 274.2 to 272.2 m after Labour Day to September 30 + 0.56 m flood allowance	
Fall, Winter	As above	As Option 1	As Option 1	274.44 – 269.56 m + 0.56 m flood allowance to 275.00 m	
Maximum water elevation during flood protection strategies for Iron Bridge	272.35 m	As Option 1	As Option 1	As Option 1	
Rayner/Wells Outflow	Maximum flow restricted during flooding potential at Iron Bridge	As Option 1	As Option 1	As Option 1	

Table 9.2 Details of Options Considered					
Location	**Option 1 (OPG WMP, 2001)**	**Option 2 (Includes BRP voluntary summer targets for RI & Tunnel Lakes as of Nov/02)**	**Option 3 (Includes Social/ Ecological Improvements noted at end of table) (Planning Team + PAC input)**	**Option 4 (Includes Social/Ecological Improvements noted at end of table) (Planning Team)**	**Comments**
Red Rock Lake Reservoir (forebay levels) (mCGD)	208.90 – 207.30 + 0.90 m flood allowance to 209.80 + 0.3 m energy reserve to 207.00	As Option 1	As Option 1	As Option 1	
Restricted elevation fluctuation at Iron Bridge	0.61 m in 24 h	As Option 1	As Option 1	As Option 1	To minimize erosion potential and water level fluctuations in general
Red Rock Falls GS Outflow					
Maximum flow	500 m^3/s	500 m^3/s	500 m^3/s	500 m^3/s	To reduce/control flooding at Iron Bridge. Notification of Town to occur at this flow although flows to 600 m^3/s may be safely passed.
Constant flow	50 – 56 m^3/s	50 – 56 m^3/s	50 – 56 m^3/s	50 – 56 m^3/s	3-day period every 3 years (approx) to assist DFO (Sea Lamprey Control Centre) with lampricide treatment
Minimum flow	75 m^3/s	75 m^3/s	75 m^3/s	75 m^3/s	Continuous flow for first 5 days of walleye spawn, then for 18-h period daily for remainder of spawning period (21 to 28 days)

Table 9.2 Details of Options Considered					
Location	**Option 1 (OPG WMP, 2001)**	**Option 2 (Includes BRP voluntary summer targets for RI & Tunnel Lakes as of Nov/02)**	**Option 3 (Includes Social/ Ecological Improvements noted at end of table) (Planning Team + PAC input)**	**Option 4 (Includes Social/Ecological Improvements noted at end of table) (Planning Team)**	**Comments**
Minimum flow May 1 to Oct 31	Inflow up to 76 m^3/s - 1 unit at 50% gate (56.6 m^3/s) Inflow above 76 m^3/s - 1 unit continuously and the second unit as required	As Option 1	As Option 1	As Option 1 (but better clarified and corrected for unit efficiency – see Table 10.1)	Fishermen's water during 16-h period (04:00 to 20:00 h) each day. One unit at 50% gate is equivalent to a minimum daily average flow of 37.7 m^3/s.
Minimum flow Nov 1 to Apr 30	35 m^3/s daily average	As Option 1	As Option 1	As Option 1 (except in dry years) (28 m^3/s)	Salmon spawning and incubation period. Unit on/off cycling to deliver 35 m^3/s (or 28 m^3/s in dry years). Maximum unit shutdown of 8 h.

Additional social and ecological improvements included in some options as noted below.

1 - Rocky Island Lake Reservoir

- Provision for maintenance of the ATV trail at the eastern end of Peshu Lake Road to enable boat launching into Seven Mile Bay (Options 3 and 4).
- Provision for channel maintenance to improve boat access to Seven Mile Bay and Rouelle Bay (Option 4). Maintenance to include stump cutting in middle 50% of channels and boulder relocation in channel leading to Seven Mile Bay.
- Provision for boat launch maintenance at South Access Point to improve access (Option 4).
- Peshu Lake Road maintenance, including brushouts and fixing of two culverts at Martin Lake (Option 4).

2 - Tunnel Lake Reservoir

- Provision for loon nesting structures (Options 3 and 4)
- Provision for bass nesting structures (Options 3 and 4)
- Provision to improve boat launch area at Hooverville Landing (Options 3 and 4) for access during low summer water levels (Options 3 and 4).

N.B. A walleye spawning structure has already been installed at Cumming Creek as a separate undertaking.

Aubrey Lake Reservoir/Aubrey Falls/Aubrey Falls GS

- Flood management of flows to reduce potential for winter flooding of Highway 129, and downstream in Iron Bridge
- Scenic flows of 8.5 m^3/s over Aubrey Falls from the Saturday before Victoria Day to the Saturday after Thanksgiving.
- Minimum refresh flow of one unit hour per day (approximately 5.8 m^3/s) for fisheries and fish habitat.

Tunnel Lake Reservoir/Rayner and Wells GS

- Flood management through restrictions on maximum flows during flood potential at Iron Bridge
- Implementation of a minimum water level (272.35 mCGD) at the start of walleye spawning and gradually rising for approximately 21 days to ensure access to spawning beds (unless flood management considerations downstream in Iron Bridge take precedence).

Red Rock Lake Reservoir/Red Rock GS

- Flood management by restricting the maximum flow to 500 m^3/s during flood potential in Iron Bridge.
- Minimum flow of 75 m^3/s for up to 28 days during the spring walleye spawning period.
- Minimum flow of one unit at 50% gate (56.6 m^3/s) for fishermen's water from May 1 to October 31.
- Minimum flow of 35 m^3/s daily average with no more than 8 h down time for fall spawning fish from November 1 to April 30.
- Constant flow of 50 to 56 m^3/s over 3 days every 3 years to assist the Department of Fisheries and Oceans (DFO), Sea Lamprey Control Centre, with lampricide treatment.
- Restrictions on daily water level fluctuations to 0.6 m below Red Rock GS to minimize erosion.

The complete water management plan for Option 1 is included in Appendix A.

The above environmental and social constraints on water levels and flows for power generation are equivalent to approximately $820,000 in lost renewable energy power value to the provincial grid annually.

9.2 Option 2 – Base Case + Summer Water Level Restrictions on Rocky Island Lake and Tunnel Lake Reservoirs

Option 2 is similar to Option 1 in that it incorporates all the environmental and social features of Option 1, but differs only in defining summer minimum water levels on Rocky Island Lake and Tunnel Lake Reservoirs (see Table 9.2). The economic impact of implementing these summer minimum water levels is equivalent to an additional $390,000 in lost renewable energy value to the province annually compared with Option 1. Therefore, the total annual renewable energy value lost is approximately $1,210,000 for Option 2 compared with $820,000 for Option 1.

Option 2 is also known as the "interim water management plan" that was developed by MNR and BRP in October 2002 following a summer drawdown on Rocky Island Lake and Tunnel Lake in 2002. While BRP was within its legal drawdown limits on these reservoirs, a voluntary agreement was subsequently made between BRP and MNR to maintain summer minimum water levels on Rocky Island Lake and Tunnel Lake as outlined for Option 2 in Table 9.2. Under the voluntary agreement, BRP will notify MNR, resort owners and the general public prior to any change below the voluntary minimum summer reservoir level on Rocky Island Lake and Tunnel Lake due to demand and/or hydrologic conditions.

MNR defines Low Water Indicators in their Water Management Planning Guidelines (MNR, 2002) when water power operators may have to operate outside their approved operating conditions with prior notification to MNR. In extreme situations, the "Ontario Low Water Response" document (Appendix K) is followed. The document defines three levels of low water conditions:

- Level I condition is the first indication of a potential water supply problem
- Level II indicates a potentially serious problem
- Level III indicates the failure of the water supply to meet the demand, resulting in progressively more severe and widespread socioeconomic effects.

BRP was in a Level II situation during the summer of 2005 and gave notice to provincial and municipal authorities, as well as resort owners on Rocky Island Lake and Tunnel Lake, and the general public.

9.3 Option 3 – Additional Social/ Ecological Improvements

The key features of Option 3 are outlined in Table 9.2. This option represents an effort by the planning team to incorporate additional environmental and social features that specifically address the priority issues raised during the water management planning process that were not addressed during filling of data gaps as outlined in Section 8 of this plan. Specifically, the issues addressed in Option 3 are as follows:

- A reduced summer drawdown for Rocky Island Lake by 0.7 m (compared with Option 2) to improve conditions for tourism, recreation and the aquatic ecology.
- Increased minimum power flows through Aubrey Falls GS from one unit hour per day to two 1-hour runs/day timed at equal intervals, so that the combined scenic flow, power flow and baseflow equal an average daily flow of 17.9 m^3/s (being equivalent to the 80% exceedance flow for a simulated natural flow regime, as per MNR Waterpower Project Science Group's calculations – see Appendix J).
- Introduction of a canoeists flow (maximum one unit flow) on Canadian and US holiday weekends from Victoria Day to Labour Day from 5:00 p.m. on the first day of the weekend to 9:00 p.m. on the last day of the weekend.
- A reduced summer drawdown on Tunnel Lake by 0.5 m (compared with Option 2) from June 1 to September 1 to improve conditions for tourism, recreation and the aquatic ecology.

In addition, some physical improvements involving (a) maintenance to an existing ATV trail to provide better boat launch access to Rocky Island Lake, and (b) maintenance to an existing boat launch on Tunnel Lake, and (c) provision of loon and bass nesting structures on Tunnel Lake were also part of this option.

The economic impact of Option 3 in terms of total annual renewable energy value lost to the provincial grid is $1,630,000 compared with $1,210,000 for Option 2 and $820,000 for Option 1.

9.4 Option 4 – Compromise Option

Option 4 was considered a "compromise" option by the planning team. It involved (a) modifying some of the operational changes associated with social and ecological improvements in Option 3 to reduce the economic impact on BRP

operations and (b) incorporating some additional physical improvements to ensure access to Rocky Island Lake reservoir during low summer water levels. This compromise option also recognizes the need in the province for additional renewable energy and preserves hydroelectric generation flexibility to meet system demands.

The key features of Option 4 that differ from existing conditions (Option 2) are noted in Table 9.2 and are summarized as follows.

- Summer minimum water level to 405 mCGD on Rocky Island Lake from June 1 to September 30.
- Higher summer minimum water level than presently exists on Tunnel Lake (to 273.2 m from 272.7 mCGD) from June 15 to July 15, to improve conditions for bass spawning.
- Refresh power flow out of Aubrey Falls GS to be at least 2 unit hours a day, separated by at least 4 hours for July and August.
- Canoeists flow, i.e., maximum one unit flow from Aubrey GS on Canadian holiday weekends (except where flood management or IESO declared system emergency takes precedence).

The economic impact of Option 4 in terms of annual loss in renewable energy value to accommodate the above changes is estimated at $1,370,000 compared with $1,630,000 for Option 3, $1,210,000 for Option 2 and $820,000 for Option 1.

Other recreational and ecological enhancements agreed on by the planning team and PAC as part of Option 4 were as follows:

Rocky Island Lake Reservoir

- ATV trail maintenance to improve access to a boat launch area on Seven Mile Bay (by BRP) at the eastern end of Peshu Lake Road.
- Maintenance (by BRP) to improve channel access to Seven Mile Bay and Rouelle Bay (stump cuttings).
- Relocation of boulders in channel leading to Seven Mile Bay (by BRP) to improve access.
- Maintenance (by BRP) to improve the boat launch area at South Access Point.

- Peshu Lake Road maintenance including brushouts and fixing of two culverts at Martin Lake. Work to be shared by BRP/MNR.

Tunnel Lake Reservoir

- Maintenance to improve the boat launch area at Hooverville Landing (BRP).
- Provision of loon nesting structures (MNR/BRP).
- Provision of bass nesting structures (MNR/BRP).

9.5 Evaluation and Selection of a Preferred Option

The planning team spent considerable time reviewing and discussing the options, particularly Options 3 and 4 which make provision for addressing the priority issues that arose during the water management planning process. The various options were evaluated on a comparative basis, i.e., comparing the degree of ecological and recreational enhancements in each option due to operational changes. The results of this evaluation are provided in Table 9.3, with Option 3 ranking first.

Option 3 ranks highest in the ecological/recreational evaluation as it has the most summer water level and flow changes that would benefit the aquatic ecology and/or recreational activities (boating/canoeing) compared with the other options (also see Table 9.2). However, it does not include as many physical improvements to access Seven Mile Bay and Rouelle Bay on Rocky Island Lake reservoir as Option 4. This is because these improvements are not needed to the same extent as Option 4 which has a lower summer water level on Rocky Island Lake than Option 3 (see Table 9.2).

Option 4 did not rank quite as high as Option 3 from an ecological/recreational perspective as tradeoffs were made to reduce the impact on renewable energy values (Table 9.4). This was achieved by reducing the magnitude of changes to summer water levels and flows, thereby slightly reducing the benefit to the aquatic ecology and recreational activities (boating/canoeing) compared with Option 3.

Options 1 and 2 have no provision for a canoeists flow or any change to present refresh flows out of Aubrey Falls GS. However, Option 2 fares slightly better

than Option 1 due to improved summer water levels on Rocky Island Lake and Tunnel Lake (see Table 9.2).

MNR and PAC members of the planning team favored Option 3 as it included more water level and flow changes to create ecological and recreational benefits compared with the other options. However, BRP had strong concerns with Option 3 in terms of the annual impact on renewable energy values (Table 9.4) compared with the other options, particularly given the present need in the province for renewable energy.

The planning team and PAC recognized the impacts on BRP's renewable energy values with Option 3 and the benefits of renewable energy to the province and came to agreement on the compromise option (Option 4), with the proviso that additional items would be incorporated into Option 4 to enable improved boat access and navigation in Rocky Island Lake during low summer water levels. The full list of physical improvements included in Option 4 is provided at the end of Table 9.2. The preferred option by the planning team was then subject to Steering Committee approval and review by other stakeholders (i.e., DFO, the general public and local First Nations).

9.6 How the Proposed Option Addresses the Priority Issues

Table 9.5 summarizes how the proposed option addresses the priority issues identified during the water management planning process.

Table 9.3 Ecological/Recreational Evaluation of Options				
	Rank (relative to other options)			
	Option 1	Option 2	Option 3	Option 4
Rocky Island Lake Reservoir				
Summer water levels for recreation/aquatic ecology	3	2	1	2
Maintenance to improve access to Seven Mile Bay, Rouelle Bay and South Access Point*	3	3	2	1
Aubrey Falls GS				
Refresh water below Aubrey Falls for the aquatic ecology	3	3	1	2
Canoeists flow on summer holiday weekends from Aubrey GS	3	3	1	2
Tunnel Lake Reservoir				
Summer water levels for recreation/aquatic ecology	4	3	1	2
Improve boat launch at Hooverville Landing	2	2	1	1
Totals	18	16	7	10
Overall Ranking	**4**	**3**	**1**	**2**

*Defined at end of Table 9.2

Table 9.4 Energy Value of Various Options (Approximates in $ 2007)			
	Value of Power Lost to Provincial Grid Due to Constraints ($k/yr)	Incremental Change in Value of Power Gained/Lost to Provincial Grid Due to Constraints ($k/yr)	Energy Value Rank
Unconstrained	0	+820	1
Option 1 (OPG)	-820	-	2
Option 2 (Voluntary)	-1210	-390	3
Option 3	-1630	-810	5
Option 4	-1370	-550	4

N.B. – Energy value losses primarily reflect a change from on-peak to off-peak generation.

Table 9.5
How the Proposed Water Management Strategy (Option 4) Addresses the Priority Issues

Priority Issue	Resolution of Issue
General	
Preservation and possible enhancement of renewable energy benefits	Loss of additional $550,000 in annual energy value to provincial grid compared with Option 1 to provide improved ecological/recreational conditions on Mississagi River system as noted elsewhere in this table.
Potential impact of water levels on habitat of wood turtle (Species at Risk)	Field investigations to date by MNR/BRP confirmed no impact on wood turtle habitat in the planning area.
First Nation Values	MNR and BRP are working with Mississauga First Nation in developing a Values Data Base. First Nation values will not be adversely affected by the proposed water management strategy. Operational and structural changes proposed in this WMP are intended to improve one of their key values (the fisheries resource).
Rocky Island Lake Reservoir	
Flood management capability	Flood management capability maintained.
Low summer water levels and effects on aquatic ecology	The interim summer minimum of 405 m that was implemented in November 2002 will become the new legal summer minimum (compared with previous legal summer minimum of 396.76 m).
Low summer water levels and effects on recreation (boating and access to Seven Mile Bay and Rouelle Bay)	• ATV trail maintenance by BRP at the end of Peshu Lake Road to improve boat launch access at Seven Mile Bay on Rocky Island Lake. • Channel maintenance by BRP to improve Peshu boat access to Seven Mile Bay and Rouelle Bay (stump cutting). • Relocation of boulders by BRP in channel leading to Seven Mile Bay. • Maintenance by BRP of South Access Point boat launch site to improve access. • Road brushing and pushouts along Peshu Lake Road to make it easier for vehicles to pass (BRP). • Fixing of two culverts on Peshu Lake Road at Martin Lake (MNR).
Aubrey Falls Scenic Flows	
Potential to increase or decrease scenic flow.	Based on observations of various scenic flows (see Section 8.1.8) it was concluded that the current 8.5 m^3/s value represents a reasonable compromise between aesthetics and power

Table 9.5
How the Proposed Water Management Strategy (Option 4) Addresses the Priority Issues

Priority Issue	Resolution of Issue
	generation. The timing of scenic flows remains the same except for a change from Eastern Standard Time to Daylight Savings Time.
Aubrey Falls Downstream to Tunnel Lake	
Effectiveness of current river ice management	A review of current ice management procedures by BRP consultant indicates that daily ice monitoring practices are adequate and enable Aubrey GS schedules to be adjusted as necessary to manage ice movement effectively. Also, procedures for public safety alerts and communication protocols are in place between BRP, MTO and MNR.
Adequacy of refresh flow from Aubrey Falls GS (i.e., potential to move closer to the natural flow regime)	Refresh power flow out of Aubrey Falls GS to be increased from 1 unit hour/day to at least 2 unit hours/day, separated by at least 4 hours during low flow months of July and August, with 1 unit hour/day during rest of year.
Canoeists Flow	A canoeists' flow consisting of a maximum one unit flow on four (4) Canadian holiday weekends from Victoria Day to Labour Day (from 5:00 p.m. at the start of the weekend to 9:00 p.m. last day of weekend).
Tunnel Lake Reservoir	
Bass spawning success	• Installation of 75 bass nesting structures • Improved conditions for bass spawning from June 15 to July 15 by maintaining water levels within the range 274.2 to 273.2 m.
Low summer water levels and effects on recreation and fire water access	• From June 15 to July 15 the new minimum level will be 273.2 mCGD. • The new summer minimum from July 16 to Labour Day will be 272.7 mCGD (compared with previous legal summer minimum of 269.56 mCGD). • The new minimum water level the day after Labour Day to September 30 will be 272.2 mCGD. • BRP constructed new boat launch area at Hooverville Landing in 2007 to improve access during low summer water levels.

Table 9.5 How the Proposed Water Management Strategy (Option 4) Addresses the Priority Issues	
Priority Issue	**Resolution of Issue**
Walleye spawning success	• Maintain existing environmental constraint, i.e., minimum water level of 272.35 mCGD at start of spawn and keep stable or gradually rising, to protect Cumming Creek habitat • Physical improvements at Cumming Creek to improve conditions for walleye spawning (outside WMP).
Red Rock Falls Downstream	
Adequacy of present salmon spawning and incubating flow releases (November 1 to April 30)	Field investigations concluded that existing base flow of 35 m^3/s daily average with no more than 8 hours downtime should be maintained except in dry* periods (28 m^3/s).
Adequacy of present walleye spawning releases	Existing continuous flow for first 5 days of walleye spawn, then for 18-hour period daily for remainder of spawning period to be maintained.
Adequacy of fishermen's water flow releases (May 1 to October 31)	BRP and MNR investigated waterway navigability and concluded that existing flows for this purpose are reasonable (see Table 10.1).
Potential flooding concerns in Iron Bridge	Current upstream water level and flow restrictions and notification procedures to be maintained (see Section 10, Table 10.1).
Water level fluctuation constraint (erosion concerns)	• Investigations by consultant (Water's Edge) concluded that the 0.61-m/day water level fluctuation constraint should be maintained and that erosion protection works are performing well. • BRP to inspect adequacy of riprap bank stabilization measures every second year and report results to MNR.
Erosion concern at a cemetery near Mississagi River Delta	• Existing graves not presently in danger of erosion. • Cemetery location primarily affected by water levels of Lake Huron rather than Mississagi River water management.

*Defined in Section 12 (Compliance Monitoring and Reporting) of the WMP.

9.7 Public Consultation on the Options

A PIC was held on June 27, 2007 to provide an opportunity for the general public to review the options considered and the preliminary decision by the planning team on a preferred option. Concern with the planning team's preferred option (Option 4) was expressed by three people due to an inability to access Seven Mile Bay on Rocky Island Lake below 405.7 mCGD. See resolution of this issue in Table 9.5.

The only other concern expressed was related to high water levels on Aubrey Lake reservoir from May to July in 2007. This was a comment by one local citizen regarding difficult boat launch access at high water levels. A BRP representative subsequently contacted the citizen and explained that there was a substantial amount of rain during this time, but that the reservoir was still below its legal full supply limit during the period in question.

The following is a summary of the opinions provided on the preferred option during the PIC held in Iron Bridge on June 27, 2007.

	No. of Respondents			Total Respondents	Total Attending PIC
	Yes	No	Unsure		
Are you in agreement with the proposed WMP for the Mississagi River?	1	3*	3	7	Approximately 20 to 25 (not all signed in)

* Concerns are noted in above paragraphs.

In view of public concerns with the minimum summer water level proposed on Rocky Island Lake for Option 4 (405 mCGD) and difficulties with boat access to Seven Mile Bay and Rouelle Bay below 405.7 mCGD, an evaluation of navigation through the channel leading to these bays was subsequently undertaken. The results are provided in Section 8.1.1 of this plan. The planning team and PAC subsequently reconfirmed Option 4 as the preferred option with the proviso that channel maintenance be undertaken by BRP to improve access to Seven Mile Bay and Rouelle Bay during low summer water levels. This work is in addition to the ATV trail maintenance that had previously been proposed at the end of Peshu Lake Road to improve boat launch access to Seven Mile Bay. BRP has also agreed to conduct maintenance at the South Access Point on Rocky Island Lake to improve the boat launch area.

9.8 First Nation Participation in Options Review

MNR made a presentation to the Thessalon First Nation on March 21, 2007 to update them on the status of WMP activities, including the option development and evaluation process. Their participation was encouraged but there were no comments on the options considered or the evaluation process and no issues were raised.

An Information Centre for the Mississauga First Nation was held on June 26, 2007 to enable their participation in reviewing the options development and evaluation process. In addition, a representative of the Mississauga First Nation had the opportunity, as a member of the planning team, to participate throughout the water management planning process (see Appendix D – Summary of Aboriginal Involvement).

The following is a summary of the opinions provided on the preferred option during the Information Centre held at the Mississauga First Nation Board Office on June 26, 2007.

	No. of Respondents			Total Respondents	Total Attending PIC
	Yes	No	Unsure		
Are you in agreement with the proposed WMP for the Mississagi River?	2	-	3	5	Approximately 35 (not all signed in)

10 New Water Management Strategy and Operating Plans for Waterpower Facilities on the Mississagi River System

10 New Water Management Strategy and Operating Plans for Waterpower Facilities on the Mississagi River System

10.1 Key Features

The focus of the planning team in developing a modified water management plan for the Mississagi River system was on strategies that would

- maintain existing flood management capability, particularly to protect the community of Iron Bridge
- enable BRP to continue their power operations with a reasonable return on investment
- improve conditions for the aquatic ecology
- not exacerbate erosion of the banks of the Mississagi River below Red Rock GS
- improve conditions for recreational users of the Mississagi River system during the summer months
- recognize and document First Nation traditional values on and adjacent to the Mississagi River system and improve conditions for the fisheries resource value where possible.

This was achieved through

- new, more restrictive legal limits on operating ranges at Rocky Island Lake and Tunnel Lake reservoirs to improve conditions for the aquatic ecology and recreational users
- channel maintenance to improve access to Seven Mile Bay and Rouelle Bay on Rocky Island Lake during low summer water levels
- boat launch site maintenance to improve conditions for boat launching into Rocky Island Lake (South Access Point) and a new boat launch at Tunnel Lake (Hooverville Landing)
- additional refresh flows out of Aubrey Falls GS during July and August to improve conditions for the aquatic ecology when they are typically most highly stressed
- introduction of a Canoeist's Flow (maximum 1 unit flow) from Aubrey Falls GS on four Canadian holiday weekends (Victoria Day to Labour Day) from 5:00 p.m. on the first day of the weekend to 9:00 p.m. on the last day of the weekend
- modification of the hours of scenic viewing of Aubrey Falls to reflect the Daylight Savings Time hours of viewing, rather than Eastern Standard Time hours of viewing as was specified in OPG's previous water management plan

- maintenance of a maximum 0.61-m water level fluctuation over 24 hours below Red Rock GS at Iron Bridge to minimize erosion potential through this stretch of the Mississagi River system
- provision of 5 loon nesting structures and 75 bass nesting structures on Tunnel Lake to improve reproductive success of these species
- support to Mississauga First Nation from BRP and MNR in development of a Native Values Database to document traditional areas of value, and proposing operational and structural changes to enhance the fishery resource value
- preservation of the majority of BRP's existing waterpower generating capabilities except for the additional operating constraints on water levels and flows as noted above and in Table 10.1.

10.2 Operating Plans for Each Waterpower Facility

The new operating plans for each waterpower facility on the Mississagi River are as stated in Table 10.1. Also shown on this table are present voluntary limits and present legal requirements for comparison. Where changes have been made, these are highlighted. The approved plan requirements are restated in Section 12 (Compliance Monitoring and Reporting) and are shown graphically for the reservoirs in Figures 12.1 to 12.4.

Table 10.1 New Water Management Plan for the Mississagi River			
Water Body, Operating Ranges and Key Environmental/Social Components	**Approved New Water Management Plan Legal Requirements***	**Present Voluntary Limit**	**Present Legal or Other Requirement ** **
Rocky Island Lake Reservoir			
• Summer minimum water level for aquatic ecology and recreation (June 1 to September 30)	405.00 mCGD	406.00 mCGD + 1 m energy reserve to 405.00 mCGD	None
• Legal operating range rest of year	408.95 m to 396.76 m		408.95 to 396.76 mCGD
• Outflow during flood potential at Iron Bridge	See Notes (no change from present practice)	-	See Notes
Aubrey Lake Reservoir			
• Operating range	394.63 to 391.58 mCGD		394.63 to 391.58 mCGD
• Operating procedures during flood potential in Iron Bridge	See Notes (no change from present practice)		See Notes
• Aubrey Falls scenic flows (Saturday before Victoria Day to Saturday after Thanksgiving)	8.5 m^3/s [same times (see Notes) but Daylight Savings Time]		8.5 m^3/s (daylight hours are expressed in Eastern Standard Time)
• Refresh flow below Aubrey Falls GS for aquatic ecology	Minimum of 5.7 m^3/s equivalent to one unit hour/day discharging at efficiency except in July and August when it will be a minimum of 11.4 m^3/s equivalent to 2 unit hours per day discharging at efficiency, separated by a minimum of 4 hours.		Minimum 1 unit hour/day (approximately 5.8 m^3/s)
• Canoeists flow on four Canadian holiday weekends (at the start of the weekend, Victoria Day to Labour Day) 5:00 p.m. to 9:00 p.m. last day of weekend (see operating notes at end of table)	Maximum release of 170 m^3/s equivalent to 1 unit flow when the reservoir is at maximum level		None
Tunnel Lake Reservoir (Wells/Rayner Forebay)			
• Spring water level for start of walleye spawning (as advised by MNR) (except in potential flood situation)	Minimum elevation of 272.35 mCGD and stable or gradually rising (for approximately 20 to 28 days) until completion of spawning		Minimum elevation of 272.35 mCGD and rising (for approx. 20 to 28 days) until completion of spawning.
• Summer waters level for bass spawning • Summer water levels for rest of season	274.76 to 273.20 mCGD – June 15 to July 15 includes 0.56 m flood allowance 274.76 to 272.70 mCGD – July 16 to Labour Day includes 0.56 m flood allowance 274.76 to 272.20 mCGD after Labour Day to September	273.2 mCGD + 0.5 m energy reserve to 272.7 mCGD (June 1 to September 30)	None
• Operating range rest of year	275.00 to 269.56 mCGD (includes 0.56 m flood allowance)		274.44 to 269.80 mCGD + 0.56 m flood allowance to 275.00 mCGD + 0.24 m energy reserve to 269.56 mCGD

Table 10.1 New Water Management Plan for the Mississagi River			
Water Body, Operating Ranges and Key Environmental/Social Components	**Approved New Water Management Plan Legal Requirements***	**Present Voluntary Limit**	**Present Legal or Other Requirement ****
• Operating procedures during flood potential in Iron Bridge	See Notes (no change from present practice)		See Notes
Red Rock Lake			
• Operating range	209.80 to 207.00 mCGD (includes 0.90 m flood allowance and 0.3 m energy reserve)		208.90 to 207.30 mCGD + 0.90 m flood allowance to 209.80 mCGD + 0.3 m energy reserve to 207.00 mCGD
Red Rock Falls GS Outflow			
• Operating procedures during flood potential at Iron Bridge	See Notes (no change from present practice)		See Notes
• Constant flow from Red Rock GS to assist DFO (Sea Lamprey Control Centre) with lampricide treatment (approximately 60 hours over 3-day period every 3 years)	50 to 56 m^3/s		50 to 56 m^3/s
• Continuous flow for first 5 days of walleye spawn, then for 18-hour period daily for remainder of spawning period (approximately 21 to 28 days)	75 m^3/s minimum flow, starting approximately April 21 to 30 as advised by MNR		75 m^3/s minimum flow
• Fishermen's water during 16-hour period (04:00 to 20:00) each day (May 1 to October 31)	Minimum release equivalent to an average daily flow of 37.7 m^3/s corresponding to a single unit discharging 56.6 m^3/s (50% gate) for 16-hour period.		See Notes
• Minimum flow during salmon spawning and incubation period (November 1 to April 30)	35 m^3/s daily average (or 28 m^3/s in dry years with approval of MNR). Maximum unit shutdown of 8 hours		35 m^3/s daily average. No more than 8 hours downtime.
• Maximum water level fluctuation at Iron Bridge to minimize bank erosion	0.61 m/d		0.61 m/d

* Highlighted legal requirement is new.

**As defined by Licences of Occupation and Waterpower Leases; and/or OPG's 2001 Mississagi River Water Management Plan.

Operating Notes:

Rocky Island Lake

1. Maximum elevation of 408.95 mCGD for Rocky Island Lake is defined by Licence of Occupation No. 7198.

Aubrey Falls Scenic Flows

1. In accordance with Water Power Lease Agreement No. 94, (Supplemental Letter of Agreement, dated May 27, 1998), discharges of about 8.5 m^3/s are required to spill for scenic water during daylight hours of the tourist season (from the Saturday before Victoria Day in May to the Saturday after Thanksgiving Day in October). The schedule for a minimum discharge of 8.5 m^3/s is as follows (as amended by this plan to Daylight Savings Time), after which time the gate will close:
   a. 0830 to 1600 hours DST for the months of May and September
   b. 0830 to 1700 hours DST for the months of June and August
   c. 0830 to 1800 hours DST for the month of July
   d. 0830 to 1500 hours DST for the month of October

Red Rock GS Fishermen's Water

1. As inflows to Red Rock increase, progressively increase releases as follows:
   - equivalent average daily release of 50 m^3/s (single unit discharging at efficiency for the required 16-hour period
   - equivalent average daily release of 75 m^3/s (single unit discharging at efficiency 24 h/d
   - equivalent average daily release of 75 to 150 m^3/s (single unit continuous operation at efficiency plus second unit at efficiency, as required)

Flood Management Operating Procedures/Guidelines During Flooding Potential in Iron Bridge

1. Pass inflows at Red Rock GS up to maximum turbine flow without spill (180 m^3/s)
2. When inflows reach maximum turbine flow (180 m^3/s), ensure Rocky Island Lake Dam is closed off to flow release
3. Maintain both Aubrey Lake and Tunnel Lake reservoirs at minimum drawdown levels
4. If inflows continue increasing, discharge up to 300 m^3/s at Red Rock Falls GS
5. When Red Rock Falls GS discharge reaches 300 m^3/s, decrease Aubrey Falls GS and Wells GS discharge and build each station's reservoir storage to 50% full in accordance with the water levels given in the table below.

Reservoir	Elevation When Half Full (mCGD)	Remaining Operating Storage (m^3/s days)*
Aubrey Falls GS forebay	393.19	351
Wells/Rayner GS forebay	272.35	498
Total		849*

* The remaining operating storage does not include the flood storage in the head pond of Wells/Rayner GS. The flood storage is between the elevations of 274.44 to 275.00 mCGD and is 147 m^3/s days. Red Rock Falls GS forebay is not considered due to the small amount of storage.

6. At a maximum flow of 500 m^3/s from Red Rock outflows, notify the Municipality of Huron Shores re potential for flooding in the Iron Bridge area, as per flood emergency response procedures.

Aubrey Falls GS Canoeists Flow

Day that Canadian Holiday Falls On	Canoeists maximum flow release equivalent to one unit flow (170 m^3/s) for holiday weekend
Monday	5:00 p.m. Friday to 9:00 p.m. Monday
Tuesday	5:00 p.m. Saturday to 9:00 p.m. Tuesday (weekend before holiday)
Wednesday	5:00 p.m. Thursday to 9:00 p.m. Sunday (weekend following holiday)
Thursday	5:00 p.m. Thursday to 9:00 p.m. Sunday
Friday	5:00 p.m. Thursday to 9:00 p.m. Sunday

11 Effectiveness Monitoring Program

11 Effectiveness Monitoring Program

The Water Management Guidelines for Waterpower (Section 8.7.2) (MNR, 2002) indicate that Effectiveness Monitoring (EM) is required to evaluate changes made to the operations of waterpower facilities and water control structures through the WMP process. EM is not only applicable to ecological values, but also to social and economic values. If an operating regime for a waterbody is changed, an EM program is specifically designed to evaluate the introduced change. If no changes are made to a particular operating regime, an EM program is not required for the waterbody regulated or affected by that operating regime.

The results of the EM program will be evaluated on an ongoing basis by a Standing Advisory Committee (SAC) and will be used to justify any adaptive management that may be agreed upon by BRP and MNR during this or subsequent WMP cycles.

11.1 Aquatic Ecology/Habitat Monitoring

EM for the WMP will be shared by MNR and BRP and will focus on the following areas to assess whether aquatic ecology improvements result from changes implemented during this WMP cycle:

- assessment of changes in dissolved oxygen (DO) and water temperature resulting from changes to refresh flows out of Aubrey Falls GS,
- monitoring of bass nesting structure utilization in the reservoir at Tunnel Lake resulting from placement of 75 artificial nesting structures combined with an improved minimum water level during the bass spawning and nesting season
- monitoring of loon nesting structure utilization on Tunnel Lake resulting from placement of 5 loon nesting platforms at 5 bays[1]
- assessment of the degree of use by pink salmon, of habitat that would be dewatered in dry years as a result of reducing salmon spawning minimum flows through Red Rock Falls GS from 35 m^3/s daily average to 28 m^3/s in dry years.

Each of these is discussed in the subsections that follow, including specific responsibilities and timing of the monitoring activities.

[1]While this item does not technically fit the definition of EM as defined above, it is included to assess the effectiveness of the mitigation. Floating loon nesting structures are intended to provide a more stable area for loon nesting since they are not affected by changing water levels.

11.1.1 Monitoring Downstream Aquatic Conditions Resulting from Changes to Refresh Flows out of Aubrey Falls GS

Issue: Adequacy of refresh flow through Aubrey Falls GS for the downstream ecology, particularly during summer flow period.

Objective: To move closer to the natural flow regime to improve conditions for the aquatic ecology downstream of Aubrey Falls GS during the summer low flow period.

The rationale for increasing the refresh flow from a minimum of 1 unit hour/day to a minimum of 2 unit hours/day, separated by a minimum of 4 hours, during July and August is to move closer to MNR's simulated natural flow regime, during the summer months, a period where low flow can cause stress for aquatic organisms.

Monitoring of DO and water temperature levels will be conducted by BRP/MNR in July and August of Years 1, 3 and 5 to see if a change in refresh flow is detectable downstream in DO and water temperature readings. More specifically, monitoring will determine whether (a) DO levels with and without 1 unit hour/day refresh flows currently meet Canadian Water Quality Guidelines for DO for the Protection of Aquatic Life (CEQG/CCME, 1999) (Table 11.1) and (b) whether an increase in refresh flow to 2 unit hours/day from 1 unit hour/day improves DO concentrations and lowers water temperatures to improve conditions for aquatic life. Preferred summer water temperatures for cold water fish, e.g., brook trout (MNR's target for management of this river section) are below 20°C (Power, 1980). MNR will purchase and install the water temperature data loggers and BRP will provide the DO equipment and measurements.

Table 11.1
Water Quality Guidelines for Dissolved Oxygen in Freshwater for the Protection of Aquatic Life
(Based on CCREM, 1987, AEP 1997, and Truelson 1997)

Ecosystem	Guideline Value (mg/L)*	
	Early Life Stages	Other Life Stages
Warm water	6	5.5
Cold Water	9.5	6.5

*Lowest acceptable dissolved oxygen concentration.

The precise number and location of samples will be agreed upon with MNR. Sampling will commence at least 24 hours after on-peak generation has ceased when there are no water releases to the downstream environment. Sampling will occur immediately prior to a one unit flow and immediately following a one unit flow. This sampling sequence will be repeated for a 2-unit flow approximately 1 week later. Samples will be taken in the late afternoon of a hot day when DO levels would be expected to be lowest and water temperatures highest. Sampling will be coordinated with the Aubrey Falls GS plant operator to ensure the desired refresh flows during an off-peak period. Sampling for the 2-unit hour operation will be timed to avoid the maximum 1-unit flow required during Canadian holiday weekends for canoeists.

DO and water temperature measurements will be recorded in the tailrace area and downstream before the river joins up with oxygenated flows from Aubrey Falls. A control site on the Aubinadong River will also be used to differentiate between natural factors and the effects of operations. The results may allow comparison of DO and water temperature levels with existing (1 unit hour) and new (2 unit hours) refresh flows and will be provided by BRP to MNR in a report at the end of the summer period. The results will also be shared with the SAC and the Steering Committee.

It is anticipated that any improvement in refresh flows may be inherently beneficial to the aquatic ecology but may be too small to detect a change in DO and/or water temperature levels, particularly given the variability of generation flows from the Aubrey Falls GS.

11.1.2 Monitoring of Bass Nesting Structure Utilization in Tunnel Lake Reservoir

Issue: Reproductive success of bass in Tunnel Lake given changes in water levels due to waterpower operations.

Objective: To improve reproductive success of bass in Tunnel Lake by selectively enhancing spawning habitat in locations and elevations not likely to be affected by changes in water levels due to waterpower operations.

Bass reproductive opportunities in Tunnel Lake have potential for improvement as a result of two changes made during this WMP cycle i.e.,

- placement of 75 artificial bass nesting structures in June 2004 at a depth of 2 m below full supply level,
- implementation of a water level range for bass spawning of 273.20 m to 274.76 mCGD from June 15 to July 15.

Several attempts were made by MNR during the summer of 2009 to locate the structures without success and they may have been damaged by ice during winter drawdown. However, MNR did note that some bass nesting was occurring in general on Tunnel Lake. Additional efforts by MNR to locate the structures will be done to determine how many need to be repaired or replaced prior to any further monitoring.

Monitoring of utilization of the bass nesting structures in July of each year for 5 years will be undertaken by MNR, with support from the North Shore Fisheries Management Association (NSFMA). Observations will be made on whether nests are being used. Water level ranges will be recorded during this effectiveness monitoring program. The results will be reported by MNR annually to BRP, the SAC, and the Steering Committee. Depending on results, adaptive management may be warranted that may consist of moving bass nesting structures to a different depth or geographic location, adding more structures to areas where present structures are used, fixing damaged structures, placement of boulders, adjusting the timing of the minimum water levels for bass spawning and/or adjusting the water level itself.

11.1.3 Monitoring of Wildlife Nesting Structure Utilization on Tunnel Lake Reservoir

Issue: Reproductive ability of loons on Tunnel Lake given changing water levels due to waterpower operations.

Objective: To improve reproductive ability of wildlife on Tunnel Lake, particularly loons.

Five wildlife nesting platforms were constructed at BRP's Wharncliffe site and deployed at 5 bays on Tunnel Lake since the spring of 2003. The purpose of these platforms is to provide a more stable area for wildlife nesting (particularly loons) that would not be affected by changing water levels.

Monitoring of the utilization of these nesting platforms was undertaken in 2003 and 2004. While use of these platforms by loons for nesting has not been observed to date, two loon pairs were seen frequently on Tunnel Lake in 2003, occasionally in the vicinity of the platforms and have been observed nesting on the shore of Tunnel Lake. One loon pair was observed on Tunnel Lake in 2004. Also, various waterfowl including mergansers have been observed using the platforms for perching and turtles have been observed in the area. No monitoring of the platforms was undertaken from 2005 to 2009 due to limited resources and loss of some of the platforms which are being replaced.

Monitoring of the loon nesting platforms will continue for at least 3 more years to determine their success. Monitoring observations will include the use of the platforms by all wildlife, not just loons. MNR will oversee the monitoring with assistance from a local volunteer, and will be responsible for issuing the results annually to BRP and the Standing Advisory Committee (SAC).

11.1.4 Changes in Salmon Spawning Flows Below Red Rock Falls GS During Dry Years

Issue: Salmon spawning flows during dry years when less than average flows are available.

Objective: To ensure salmon spawning flows below Red Rock Falls GS during dry years.

There was previously a formal agreement in place between OPG to provide 35 m^3/s daily average flow from November 1 to April 30, which BRP has continued to provide. However, there was no formal agreement in place to provide salmon spawning flows below Red Rock GS during dry years, although BRP did agree informally to provide 28 m^3/s daily average in dry years.

The new WMP now formally provides for a minimum flow during the salmon spawning and incubation period (November 1 to April 30) as follows:

- 35 m^3/s daily average
- 28 m^3/s daily average in dry years (as defined in Section 12.2).

The effectiveness of this measure in terms of minimizing impacts on pink salmon has already been assessed in part. Biologists observed the amount of wetted habitat at 35 and 28 m^3/s daily averages in the fall of 2002 with a GPS unit. The results (NRSI, 2004) indicated minimal difference (<5%) in wetted habitat area between the higher and lower flows.

MNR has indicated that additional monitoring is recommended to better understand the effects of this habitat loss in terms of the extent of use of this area by pink salmon. Monitoring would include mapping sites used, determining the proportion affected by reduced flow, and assessing the effects of dewatering on redds affected by monitoring fry emergence (compared with non-affected sites) over a range of depths.

MNR will lead this monitoring program with potential support from DFO as it is related to fish habitat. Timing will be dependent on the availability of MNR/DFO resources.

11.2 Physical, Social and Socioeconomic Monitoring

EM for physical, social and socioeconomic aspects of the WMP will focus on the following areas to assess whether measures taken to address priority issues have been effective:

- inspection of existing riprap bank stabilization below Red Rock Falls GS to ensure ongoing effectiveness of erosion control
- liaison with boaters and the resort operator on Rocky Island Lake reservoir regarding the effectiveness of improved access to Seven Mile Bay and Rouelle Bay
- liaison with boaters and resort operators near the Tunnel Lake reservoir regarding the effectiveness of the improved boat launch site at Hooverville Landing
- letters will be sent to canoeists in the area notifying them of safer canoeing conditions on Canadian summer holiday weekends and inviting feedback on the new conditions
- a resort operators' survey on Tunnel Lake and Rocky Island Lake to assess impacts on them resulting from improved boat access to both lakes, actions taken to improve bass reproductive success on Tunnel Lake, and operational

changes made to improve summer water levels for recreational activities on Tunnel Lake.

The nature, timing and responsibility for the EM activities listed above are described in the subsections that follow.

11.2.1 Inspection of Bank Stabilization Measures Below Red Rock GS

Issue: Bank stabilization below Red Rock Falls GS to Mississagi Chutes.

Objective: To ensure the ongoing effectiveness of bank stabilization measures.

BRP will be responsible for ensuring that a routine inspection of the integrity of existing rip rap bank stabilization measures below Red Rock Falls GS is undertaken every 2 years to ensure ongoing erosion protection in the Iron Bridge area. A report with photographs will be provided to MNR following each inspection, with recommendations for supplemental mitigation, if deemed necessary.

11.2.2 Rocky Island Lake Reservoir – Access to Rouelle Bay and Seven Mile Bay

Issue: Boat and ATV access to Seven Mile Bay, and boat access to Rouelle Bay during low summer water levels on Rocky Island Lake.

Objective: To improve access to Seven Mile Bay and Rouelle Bay during periods of low summer water levels.

BRP has agreed to conduct maintenance on channels leading to Rouelle Bay and Seven Mile Bay on Rocky Island Lake to improve boat access. This will consist of cutting stumps in the middle 50% of two channels leading to these bays during late winter when water levels have been drawn down. This work will also include the relocation of a few boulders from the Seven Mile Bay channel to improve boat access. BRP has also agreed to conduct maintenance on the trail access to Seven Mile Bay near the Peshu Lake Road access point. This trail will allow early and late season users to access Seven Mile Bay

during periods when low water levels will not allow normal water access. In addition, BRP will conduct maintenance at the south access point for boat launching on Rocky Island Lake to improve the stability of the boat launch site. MNR and BRP will share responsibilities for maintenance on Peshu Lake Road consisting of road brushing and pushouts, as well as fixing two culverts at Martin Lake.

Following the above work, BRP and MNR will liaise with the resort operator and boaters on Rocky Island Lake and users of Peshu Lake Road to confirm the effectiveness of the improvements made.

11.2.3 Tunnel Lake Reservoir – Boat Launch at Hooverville Landing

Issue: Boat launching difficulty at Hooverville Landing during low summer water levels.

Objective: Improve boat launching conditions during low summer water levels.

BRP constructed a new boat launch ramp at a new site at the Hooverville Landing in 2007. This facility is functional over a much greater water level range than the previous location. BRP and MNR will liaise with resort operators and boaters on Tunnel Lake to confirm the effectiveness of the improvements made at the site.

11.2.4 Weekend Canoeing between Aubrey Falls and Tunnel Lake

Issue: Flow fluctuations out of Aubrey Falls GS, creating less than ideal conditions for canoeists.

Objective: Improve conditions for canoeists during peak recreational periods by providing a maximum one unit flow out of Aubrey Falls GS on Canadian summer holiday weekends.

MNR will send letters to local paddling groups, including Algoma Paddlers, local youth camps such as Camp Bil-o-wood, John Island, and Sudbury

paddling club, notifying them of improved canoeing conditions on Canadian summer holiday weekends from Aubrey Falls to Tunnel Lake. They will also invite feedback on the new conditions.

11.2.5 Resort Operators Survey – Tunnel Lake/Rocky Island Lake Reservoirs

Issue: Effects of low summer water levels on resort operators' businesses.

Objectives: Improve conditions for boat launching on Rocky Island and Tunnel Lakes; improve potential for fisheries reproductive success on Tunnel Lake; restrict drawdowns in summer on Tunnel Lake.
The SAC will ensure that a resort operators' survey is undertaken for the Tunnel Lake/Rocky Island Lake area 5 years following implementation of the new water management plan to compare with pre-water management plan data collected by the PAC. It will be similar to the informal survey conducted by PAC volunteers for the first socioeconomic survey if volunteers are available, and will include questions to assist in assessing changes in the walleye and bass fishery in these reservoirs. The socioeconomic survey will also take into account external influences that may have occurred during the period between surveys.

11.2.6 General Community Concerns

General community concerns may be communicated at any time by First Nations, the public, riparian landowners, or other interested parties, to MNR. All written correspondence will be kept on file by BRP and MNR and made available for review by the SAC.

Any concerns of BRP that arise from implementation of this new WMP may be expressed at any time to MNR.

11.3 Monitoring of Economic Costs to BRP of Implementing New Water Management Plan

Issue: Additional loss in annual energy values to BRP to implement additional operational changes on the Mississagi River system to further enhance aquatic ecology conditions and recreational opportunities.

Objective: To limit the extent of additional loss in annual energy values to BRP by compromising on the extent of operational changes on the river system (Option 4).

At the end of Year 5, BRP will submit a letter report to MNR advising of the actual annual costs of implementing the operational changes for the new water management plan, as reflected by water releases that would have otherwise been maintained in a reservoir for on-peak generation. This report will include an average annual cost of the operational changes over the 5 years, and comment on whether costs were higher, lower or as predicted in this plan for the selected option (Option 4) (see Section 9, Table 9.4).

11.4 Other Issues for Monitoring Prior to Next WMP Cycle

MNR and the PAC identified several other issues where monitoring is desirable prior to the next cycle of water management planning, primarily to fill data gaps that still exist (rather than effectiveness monitoring which assesses whether the changes made were effective in achieving the objectives). Filling of these data gaps for the issues noted below is intended to serve as background information for the planning team to be assigned for the next cycle of water management planning.

MNR Responsibility

- *Issue: Effects of low summer water levels on Rocky Island Lake on the aquatic ecology*. Document stranded fish on Rocky Island Lake at any time levels are drawn down quickly, once the water level reaches 405.7 mCGD to determine whether such drawdowns are adversely affecting the fishery significantly.
- *Issue: Condition of lake trout fishery in Rocky Island Lake*. Evaluate lake trout fishery on Rocky Island Lake and success of MNR lake trout

stocking program after 5 years. Scheduled for 2010 using a Spring Littoral Index Netting (SLIN) survey with support from NSFMA.

- *Issue*: *Lack of knowledge on brook trout and rainbow trout populations in riverine stretch below Aubrey GS.* Conduct monitoring to identify/ confirm spawning nursery areas (as time permits).
- *Issue: Lack of knowledge on sturgeon population in Tunnel Lake and Mississagi River, particularly life history habitat requirements, below Red Rock GS.* Continue baseline sturgeon investigations to confirm presence and habitat utilization, thereby improving understanding and knowledge, and building on previous investigations as noted in Section 8.1.6 of this plan and work in 2007 by the Great Lakes Fisheries Management Unit. Monitor 2010, 2014 and 2018 with DFO support.
- *Issue: Effects of changing water levels on potential wood turtle habitat.* Ongoing species at risk monitoring programs will assess presence or absence of species, and continue to evaluate and monitor potential and utilized habitat.
- *Issue: Effects of fluctuating water levels on spawning habitat downstream from Wells GS to Red Rock Lake*. Conduct walleye, pike and brook trout spawning habitat investigations to gain an understanding of the effect of fluctuating water levels on spawning habitat (as time permits).
- *Issue*: *Loss of walleye spawning habitat due to low spring water levels in Tunnel Lake and effects on fishing success.* Monitor walleye utilization at Cumming Creek weir and Hooverville through End of Spring Trap Netting (ESTN) survey 2010, 2015. Include estimation of numbers, sex of fish using Cumming Creek weir, and estimate of fry numbers. Use NSFMA/Grand Falls Camp for support in this undertaking.
- *Issue*: *Lack of knowledge on existing base flow below Aubrey GS during summer*. Base flow measurements will be undertaken during a period without rain and without generation (the precise timing will be as coordinated between MNR and BRP).

The priority, nature and extent of the above monitoring programs will be determined by MNR (Blind River) and will be subject to the availability of resources. The intent, however, is to have some or all of the above monitoring programs completed prior to the next WMP cycle. It is recognized that some of the above priorities may change if new issues having higher priority appear prior to the next WMP cycle. BRP has indicated a willingness to be involved in one or more of the above programs 2 years prior to the next WMP cycle.

Brookfield Renewable Power Responsibility

- *Issue: Bank erosion in river reach downstream of Aubrey GS and from Wells GS to Red Rock Lake*. Monitor erosion on banks, particularly at the site of the old Ansley farm, between Wells GS to Red Rock Lake through the placement of survey stakes, with photographic records taken once every 2 years over a 10-yr period, and a report submitted to MNR following each 2-yr period.

Ontario Parks Responsibility

- *Issue: Lack of knowledge on the extent of visitor use of Rocky Island Lake in summer months*. Install guest registers at main access points to Rocky Island Lake to monitor number of visitors to the area and purpose (camping, boating, fishing, paddling, etc). Ontario Parks will provide a tally of site visitors to the Standing Advisory Committee and MNR (Blind River) at the end of each year.

- *Issue*: *Lack of knowledge on public perceptions of adequacy of Aubrey Falls scenic flows from Victoria Day weekend to Thanksgiving.* Add comment form in sign-in box for site visitors inviting an opinion on scenic flow aesthetics (excellent, good, unacceptable).

12 Compliance Monitoring and Reporting Programs

12 Compliance Monitoring and Reporting Programs

Subsection 23.1(7) of the LRIA requires that facility operators operate their facilities in accordance with an approved WMP. Guiding principles related to assessing compliance with the plans are listed below as outlined by MNR in their WMP guidelines (MNR, 2002) (Appendix J):

- Compliance with the law is an obligation borne by everyone.
- Noncompliance with standards or legislation in the name of economics or convenience is never acceptable.
- Dam owners and/or operators will self-monitor and report to MNR.
- Communication is the first step in problem identification and resolution.
- While monitoring and enforcement activities will apply to all mandatory components contained in each WMP, industry monitoring and MNR inspection and audit activities will focus on the water flow and levels components specified in the approved WMPs.
- Compliance and enforcement actions will be administered in a fair and equitable manner.
- Enforcement action and penalties (to the extent that MNR can recommend to the court) will be applied in a manner that considers conclusions made after a review of the nature of the infraction, the impact or potential impact of the infraction and the historic performance of the owner/operator.
- Planning is an iterative process and the operating plans may change through adaptive management or as additional information becomes available to support amendments to the WMP.
- Water levels and flows that are agreed upon in WMPs will be recorded as an absolute number (i.e., water level in meters referred to a geodetic datum, or flow in m^3/s). The self-monitoring and reporting data may reflect the range of operations and may be based on a calculated instead of an absolute number (e.g., an average).
- The owner/operator will maintain the data required to support the self-monitoring and reporting data (e.g., daily average could be supported by hourly or less frequent data).

BRP will be responsible for ongoing self-monitoring, and will report to MNR any instances where there is deviation from the mandatory flow and water level components of the WMP. MNR may inspect or perform spot audits to ensure compliance.

A compliance monitoring strategy is presented in the following section for water power operations on the Mississagi River.

12.1 Mandatory Compliance

Operational requirements placed on BRP by MNR as outlined in this WMP (Table 12.1) are considered mandatory with the following exceptions:

- In instances where, due to energy imperatives (e.g., system reliability, demand/supply challenges, etc), the Independent Electricity System Operator (IESO) requests that the operator seek relief from certain provisions of this plan, MNR will consider those requests expeditiously. After consultation with IESO and the Owner, MNR may allow short-term relief from certain provisions. (An IESO/MNR Industry Protocol will be established and documented.)

- In instances of unscheduled facility imperatives (e.g., emergency maintenance, etc), MNR will consider requests from the owner for temporary relief from the plan expeditiously with consideration to the relative priorities of both MNR and the Owner.

- Conditions outlined in this WMP may not apply when managing operations outside of the agreed upon operational rule curves if a low or high water indicator has been met as specified in Section 12.2 of this WMP. As a result, operators will not automatically be out of compliance with this WMP when they operate outside the defined operating range while these indicators exist.

- Mandatory provisions of this Plan will be waived, as appropriate, when the plan holder and MNR are requested to do so by a police agency or other recognized emergency organization.

Table 12.2 outlines the methods used to monitor and assess compliance with water levels and flows listed in Table 12.1. Figures 12.1 to 12.4, at the end of this section, provide water level compliance requirements graphically.

Table 12.1 Compliance Water Levels and Flows	
Water Body	**Water Level and Flow Requirements**
Rocky Island Lake Reservoir	
• Summer minimum water level for aquatic ecology and recreation (June 1 to September 30)	405.00 mCGD
• Legal operating range rest of year	408.95 to 396.76 mCGD
Aubrey Lake Reservoir and Outflow	
• Operating range	394.63 to 391.58 mCGD
• Aubrey Falls scenic flows (Saturday before Victoria Day to Saturday after Thanksgiving)	8.5 m^3/s (see Notes)
• Refresh flow below Aubrey Falls GS for aquatic ecology	Minimum of 5.7 m^3/s equivalent to one unit hour/day discharging at efficiency except in July and August when it will be a minimum of 11.4 m^3/s equivalent to 2 unit hours per day discharging at efficiency, separated by a minimum of 4 hours.
• Canoeists flow on four Canadian holiday weekends (Victoria Day to Labour Day) from 5:00 p.m. on first day of weekend to 9:00 p.m. last day of weekend (see Operating Notes at end of table)	Maximum release 170 m^3s (equivalent to one unit flow) when the reservoir is at maximum level.
Tunnel Lake Reservoir (Wells/Rayner Forebay)	
• Spring water level for start of walleye spawning (as advised by MNR) (except in potential flood situation)	Minimum elevation of 272.35 mCGD and stable or gradually rising for approximately 20 days to a maximum of 28 days following either notification by MNR that walleye have started spawning, or when surface water temperatures in the Mississagi River at Wells/Rayner reach 5°C.
• Summer waters level for bass spawning • Summer water levels for rest of season	274.76 to 273.20 mCGD – June 15 to July 15 274.76 to 272.70 mCGD – July 16 to Labour Day 274.76 to 272.20 mCGD after Labour Day to September 30
• Operating range rest of year	275.00 to 269.56 mCGD
Red Rock Lake Reservoir	
• Operating range	209.80 to 207.00 mCGD
Red Rock Falls GS Outflow	
• Constant flow from Red Rock GS to assist DFO (Sea Lamprey Control Centre) with lampricide treatment (approximately 60 hours over 3-day period every 3 years)	50 to 56 m^3/s
• Continuous flow for first 5 days of walleye spawn, then for 18-hour period daily for remainder of spawning period (approximately 21 to 28 days)	75 m^3/s minimum flow, starting approximately April 21 to 30 as advised by MNR
• Fishermen's water during 16-hour period (04:00 to 20:00) each day (May 1 to October 31) (dependent on upstream generation releases, local inflow and Red Rock Lake Reservoir level management).	Minimum release equivalent to an average daily flow of 37.7 m^3/s corresponding to a single unit discharging 56.6 m^3/s (50% gate) for 16-hour period.
• Minimum flow during salmon spawning and incubation period (November 1 to April 30)	Minimum daily average flow of 35 m^3/s (or 28 m^3/s in dry years* with approval of MNR) through operation of a single unit in a practical and efficient manner to limit continuous unit shutdown to no more than 8 hours.

Table 12.1 Compliance Water Levels and Flows	
Water Body	**Water Level and Flow Requirements**
• Maximum water level fluctuation at Iron Bridge to minimize bank erosion	0.61 m/d

*See Section 12.2 for definitions of dry years (i.e., low water indicators).

Operating Notes:

Rocky Island Lake

1. Maximum elevation of 408.95 mCGD for Rocky Island Lake is defined by Licence of Occupation No. 7198.

Aubrey Falls Scenic Flows

1. In accordance with Water Power Lease Agreement No. 94, (Supplemental Letter of Agreement, dated May 27, 1998), discharges of about 8.5 m^3/s are required to spill for scenic water during daylight hours of the tourist season (from the Saturday before Victoria Day in May to the Saturday after Thanksgiving Day in October). The schedule for a minimum discharge of 8.5 m^3/s is as follows (as amended by this plan to Daylight Savings Time), after which time the gate will close:

    a. 0830 to 1600 hours DST for the months of May and September
    b. 0830 to 1700 hours DST for the months of June and August
    c. 0830 to 1800 hours DST for the month of July
    d. 0830 to 1500 hours DST for the month of October.

Aubrey Falls GS Canoeists Flow

Day that Canadian Holiday Falls on	Canoeists maximum flow release equivalent to one unit flow (170 m^3/s) for holiday weekend
Monday	5:00 p.m. Friday to 9:00 p.m. Monday
Tuesday	5:00 p.m. Saturday to 9:00 p.m. Tuesday (weekend before holiday)
Wednesday	5:00 p.m. Thursday to 9:00 p.m. Sunday (weekend following holiday)
Thursday	5:00 p.m. Thursday to 9:00 p.m. Sunday
Friday	5:00 p.m. Thursday to 9:00 p.m. Sunday

Table 12.2
Water Level and
Flow Monitoring Methods

Location	Tenure Instrument	Monitoring Measure	
		Water Level	Flow Rate
Rocky Island Lake Reservoir	License of Occupation 7198	Reservoir pressure transducers linked to SCADA system. Water levels available on hourly basis.	Calculated based on water level readings and stop log settings
Aubrey Lake Reservoir	Water Power Lease Agreement No. 94	Reservoir pressure transducers linked to SCADA system. Water levels available on hourly basis.	Hourly flow rate back-calculated from generator output. Spill flow calculated from Spill Gate setting.
Tunnel Lake Reservoir	Water Power Lease Agreement No.35(Note 2)	Reservoir pressure transducers linked to SCADA system. Water levels available on hourly basis.	Hourly flow rate back-calculated from generator output. Spill flow calculated from Spill Gate setting.
Red Rock Lake Reservoir	Water Power Lease Agreement No. 35(Note 3)	Reservoir pressure transducers linked to SCADA system. Water levels available on hourly basis.	Hourly flow rate back-calculated from generator output. Spill flow calculated from Spill Gate setting.

12.2 Deviations from Mandatory Compliance with Natural Variations in Water Supplies

MNR recognizes that weather conditions and their impacts on water supplies are a source of ongoing uncertainty in managing water power facilities and other control structures.

Operators will not be considered out of compliance with their WMP when they operate outside the operating range as a result of a high or low water condition as defined below by MNR (WMP Guidelines, Appendix J).

Low Water Indicators

Facilities with minimum downstream flow and minimum reservoir/head-pond water level requirements are in a low water condition when all of the following indicators are met:

- outflow from the facility is at or below the minimum flow required in Table 12.1 of the WMP
- water level in the head pond/reservoir is at or below the minimum water level stipulated in Table 12.1 of the WMP, and
- the head pond/reservoir water level is decreasing.

Facilities with no minimum downstream flow requirements but having a minimum reservoir/head-pond water level are in a low water condition when all of the following indicators are met:

- outflow from the facility is at the minimum possible (i.e., all discharge facilities are closed and generation is shut down)
- the head pond/reservoir water level continues to decrease.

High Water Indicators

High water conditions exist at a facility when all the following indicators are met:

- water level in the head pond/reservoir is at or above the maximum operating level stipulated in Table 12.1 of the approved WMP
- head pond/reservoir water level is increasing, and
- discharge facilities have been operated in accordance with flood handling protocols to maximize flow release while mitigating downstream flood damage potential

In instances where BRP reports that they can no longer operate within the approved operating range because a low or high water condition has been met, they will

- immediately advise the MNR Area Supervisor in Blind River and file an incident report
- comply with any conditions/components contained in the WMP related to these circumstances.

MNR requires owners of facilities that have mandatory water flow and level requirements to convene the Standing Advisory Committee (SAC) which will be established by the Steering Committee. One of the SAC's responsibilities will be to assess options once a low water indicator has been met. Assessments will consider the circumstances of the situation against the priorities that were set during the planning process and will make recommendations accordingly. Standing Committees do not have a regulatory role. The role is to provide advice during low water conditions where operations are outside of the approved plan (MNR, 2002).

MNR requires that an official record be maintained of all recommendations made by the SAC to the operator and copied to the MNR Area Supervisor in Blind River.

Once a high or low water condition has been met, the Plan will permit the owner/operator to operate outside the operating range while continuing to meet any other requirements of the Plan until the condition described by the indicator ends (i.e., as long as the conditions applies, operations outside of the approved operating range will be in compliance with the Plan).

MNR may request appropriate existing data and information to confirm or assess the high or low water conditions, or may independently verify the situation. MNR has indicated that reports generated as a result of such a review do not usually constitute non-compliance unless the owner/operator is found to be deliberately or negligently operating outside the approved operating range.

12.3 Compliance Monitoring and Annual Reporting of Water Levels and Flows

BRP will prepare an Annual Compliance Report for the items listed in Table 12.3.

Table 12.3
Compliance Monitoring and Annual Reporting Requirements and Rationale

Facility	Data Requirement	Reporting Period	Rationale	Responsibility
Rocky Island Lake	Hourly instantaneous water levels and flows*	Annually or on request by MNR for inspections	WMP requirement	BRP
Aubrey Lake and Aubrey Falls GS	Hourly instantaneous water levels and flows*	Annually or on request by MNR for inspections	WMP requirement	BRP
Tunnel Lake and Rayner/Wells GS	Hourly instantaneous water levels and flows*	Annually or on request by MNR for inspections	WMP requirement	BRP
Red Rock Lake and GS	Hourly instantaneous water levels and flows*	Annually or on request by MNR for inspections	WMP requirement	BRP

*For compliance and enforcements, upon request, the power producer will provide hourly instantaneous readings of flows and levels data. Pertinent operation data that are monitored through the SCADA system are archived in the Plant Information (PI) database every hour. Information queries from the PI database will form the basis for data transfer to meet compliance monitoring requirements. For water levels, an instantaneous reading is taken at the end of the hour which, for operation and water management purposes, allows an accurate change in reservoir volume to be determined. No additional readings within the hourly period are archived. For flow data, an hourly average value is calculated based on an integration of numerous readings as they occur over the hourly period and is archived into the PI database.

In accordance with MNR's WMP guidelines, BRP agrees to the following with respect to the reporting of information:

- BRP will complete an annual report in a form provided by MNR and forward the report to the MNR Area Supervisor in Blind River annually by March 31 of the following year.
- Data required for compliance monitoring and reporting will be recorded and maintained by BRP for a period of 1 year beyond the term of the WMP but at

no time will the retention period be less than 5 years following it being recorded.

- BRP will make this existing data available to an MNR inspector or engineer when requested to do so.
- When requested by MNR to supply such information, BRP will do so in the timeframe indicated in the request.
- BRP will monitor and report on their operations as required in this WMP.

It is recognized that water level measurements may be unavailable from time to time due to equipment failure or environmental conditions. BRP will maintain data for their respective facilities and make it available to MNR upon request for audit activities. MNR will undertake a number of compliance activities, such as monitoring of real-time water levels and flows from time to time or occasional audits.

BRP will make the data required in this plan, available to an MNR inspector or engineer when requested to do so. In the absence of a specific request contained in the plan, or from time to time by an inspector, BRP will supply the data annually in electronic format unless otherwise agreed.

12.4 Incident Notification and Reporting

12.4.1 Incident Notification

The facility operator is required to contact MNR for all incidents of failing to meet mandatory components of the operating plan within 24 hours of the incident being discovered. To the extent that information is available, the owner/operator will explain the nature of the incident, why it happened if known, what is being done to bring operations back into compliance, how long it will take, and any corrective action required. Notification shall be given by calling MNR at the Provincial Coordination Unit (PCU) at 1-877-847-7667 (TIPS MNR). The PCU is staffed 24 hours a day, 7 days a week.

12.4.2 Incident Reporting

- The facility operator will be required to report any deviations from the WMP to MNR within 30 days of discovery of the incident, together with a rationale for the deviations, and proposals for remediation of any problems, if necessary. This report shall be provided in a standard form to MNR, and shall be signed and dated by the owner/operator.

- MNR will take into account the nature, severity and the reasons for the non-compliance. The owner or operator will be provided with a fair and reasonable opportunity to explain what happened and their actions before any enforcement action is taken.

- MNR will maintain a copy of all reports on file for at least 5 years from the date of the report. After this period reports may be removed from the file in accordance with the file retention schedule.

- All reports produced are subject to the Freedom of Information and Protection of Privacy Act and are considered public documents subject to mandatory exemptions in that Act and may be available to the public on request.

A procedure detailing the reporting process including templates to be used for completing the incident report and annual report has been developed. Incident reporting forms are included in Appendix N.

12.5 Investigation and Enforcement

MNR will, from time to time, carry out compliance inspections of the site as provided for in Section 20 of the LRIA. It is understood that where there is a failure to comply with the mandatory components of an approved WMP, the following actions will be taken by MNR:

- Companies that do not operate their waterpower facilities in accordance with their approved WMP will be held accountable.

- MNR will determine the response to noncompliance in accordance with legislation and policy.

- In instances of noncompliance, MNR will conduct a review. These reviews will take into account a number of factors including weather, the intent of the offender, failure of equipment and unforeseen events.

- Procedures will be developed to help determine the most appropriate enforcement action (including warnings, orders and laying charges under S.28 of the LRIA) based on a number of factors including the history of the offender and the impact of the offence.

- A procedure will be written by MNR to provide guidance in deciding on appropriate recommendations to the courts for penalties.

12.6 Public Involvement and Awareness

Public awareness, public involvement and transparency for compliance monitoring will be achieved primarily through the use of a Standing Advisory Committee (SAC) for the Mississagi River WMP. The SAC will be established by the Steering Committee prior to disbanding of the Planning Team and PAC, and within 3 months of sign-off of the WMP by the MNR's Regional Director. The SAC will be composed of a number of citizens representing a diversity of interests and expertise, some of whom might be members of the existing Planning Team and PAC, or any membership as named by the MNR District Manager.

The SAC will monitor the implementation of the plan and produce an annual status report each year to be distributed to BRP, MNR, First Nations and the public. The SAC will review all data collected during monitoring of the plan and provide a communication link with the public to foster and maintain credible relationships. Public complaints about flows and/or water levels on the Mississagi River system will be maintained by BRP and reviewed annually by the SAC.

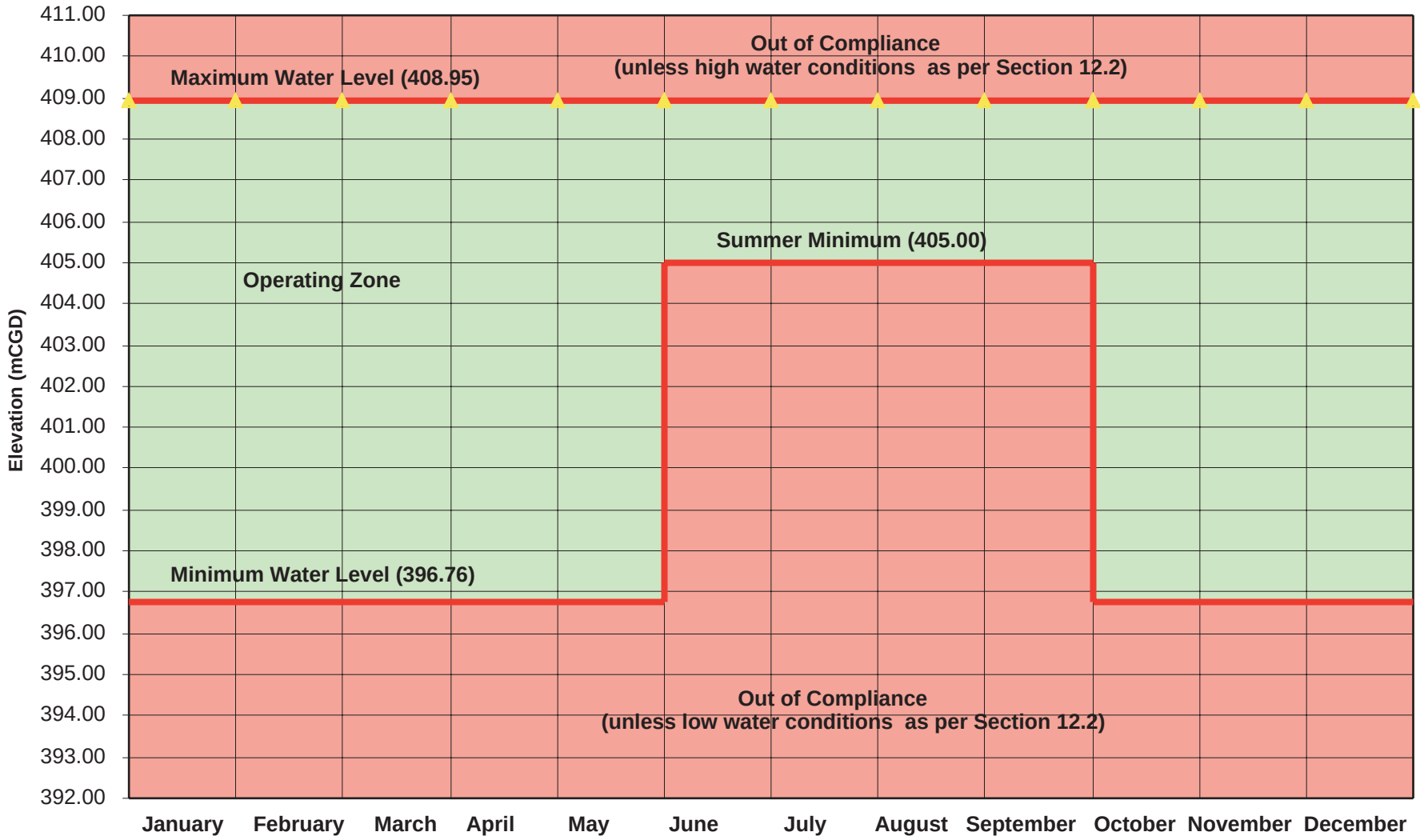

Figure 12.1
Brookfield Renewable Power
Mississagi River Water Management Plan
Rocky Island Lake - Compliance Operating Levels

HATCH™

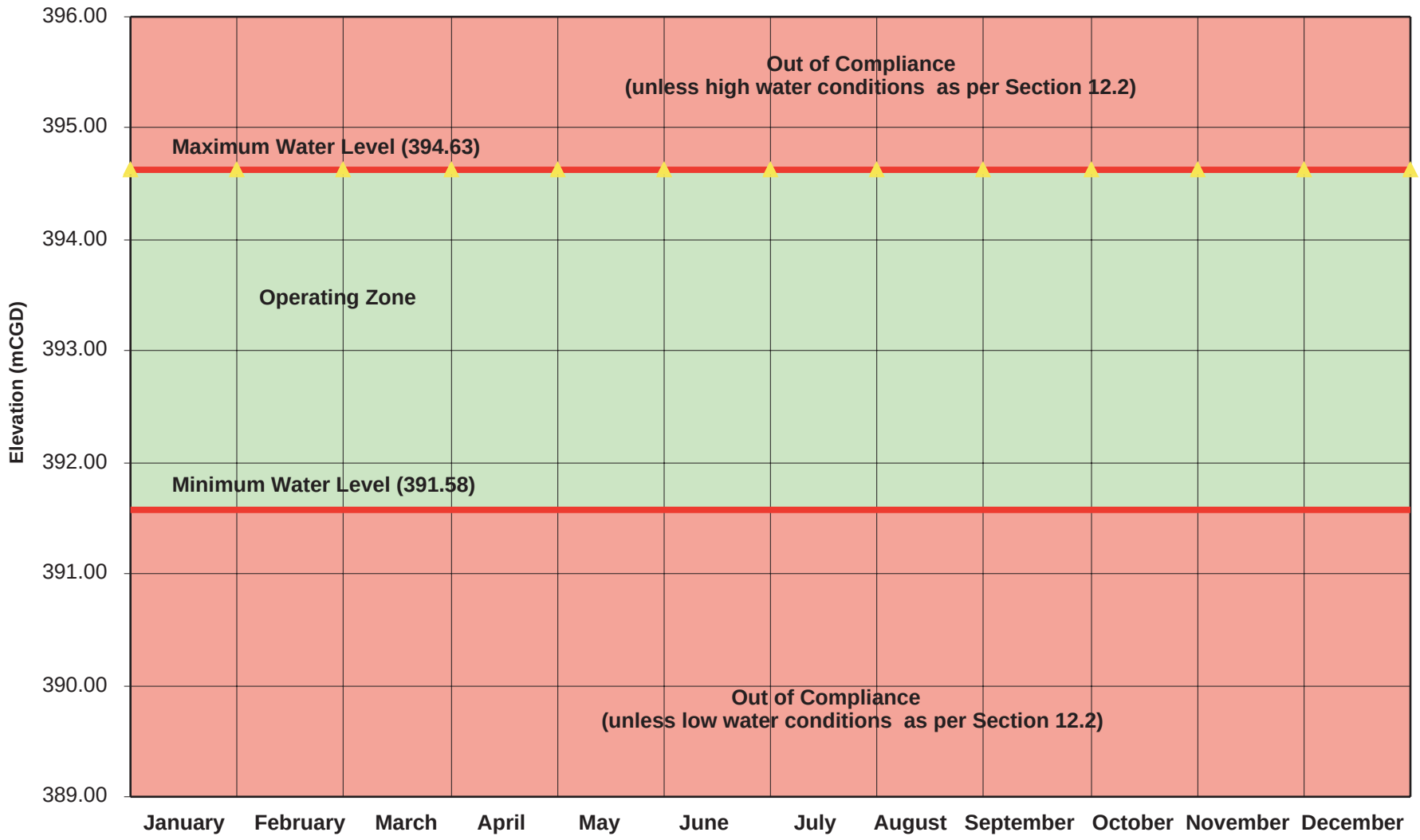

Figure 12.2
Brookfield Renewable Power
Mississagi River Water Management Plan
Aubrey Lake - Compliance Operating Levels

HATCH™

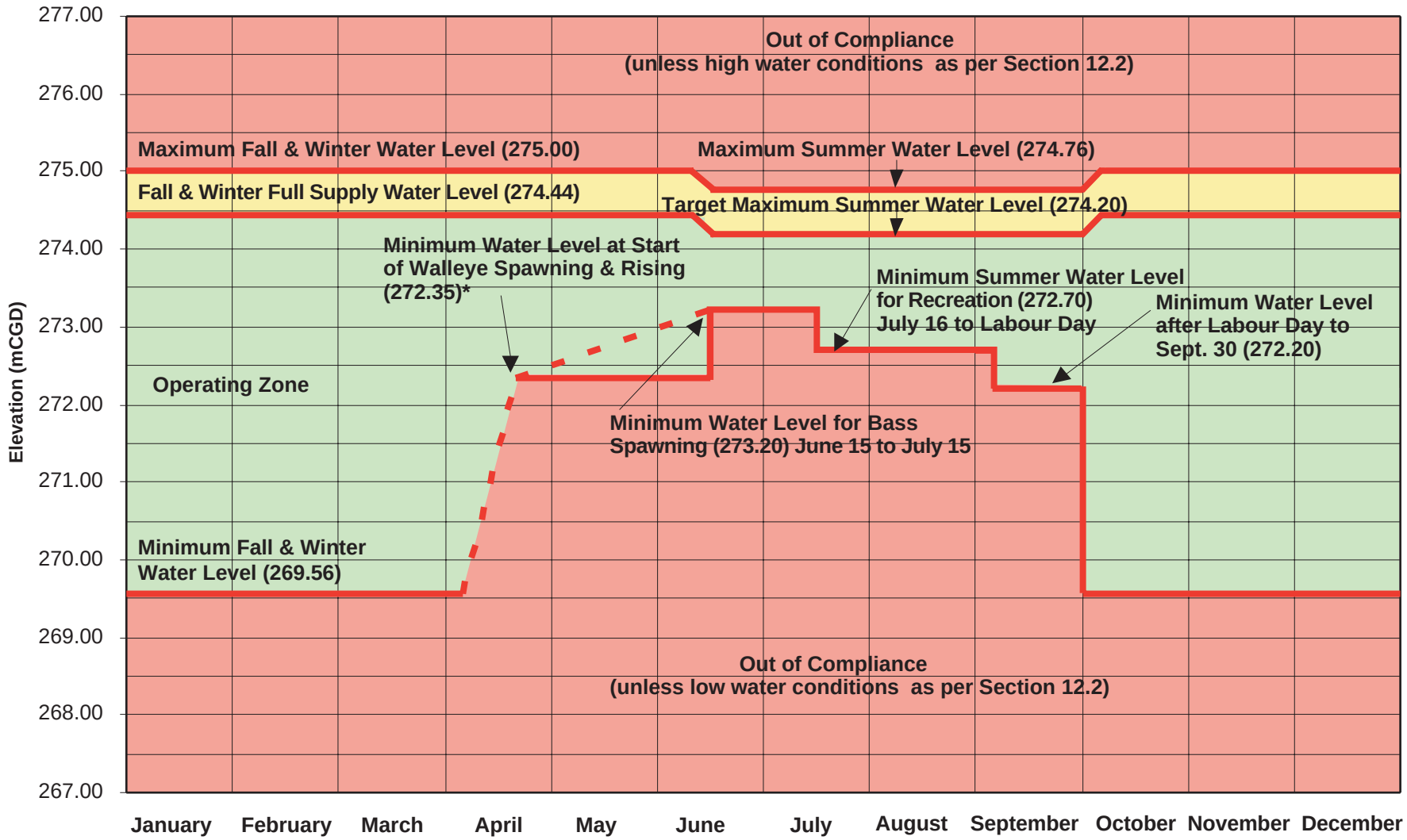

Figure 12.3
Brookfield Renewable Power
Mississagi River Water Management Plan
Tunnel Lake - Compliance Operating Levels

HATCH™

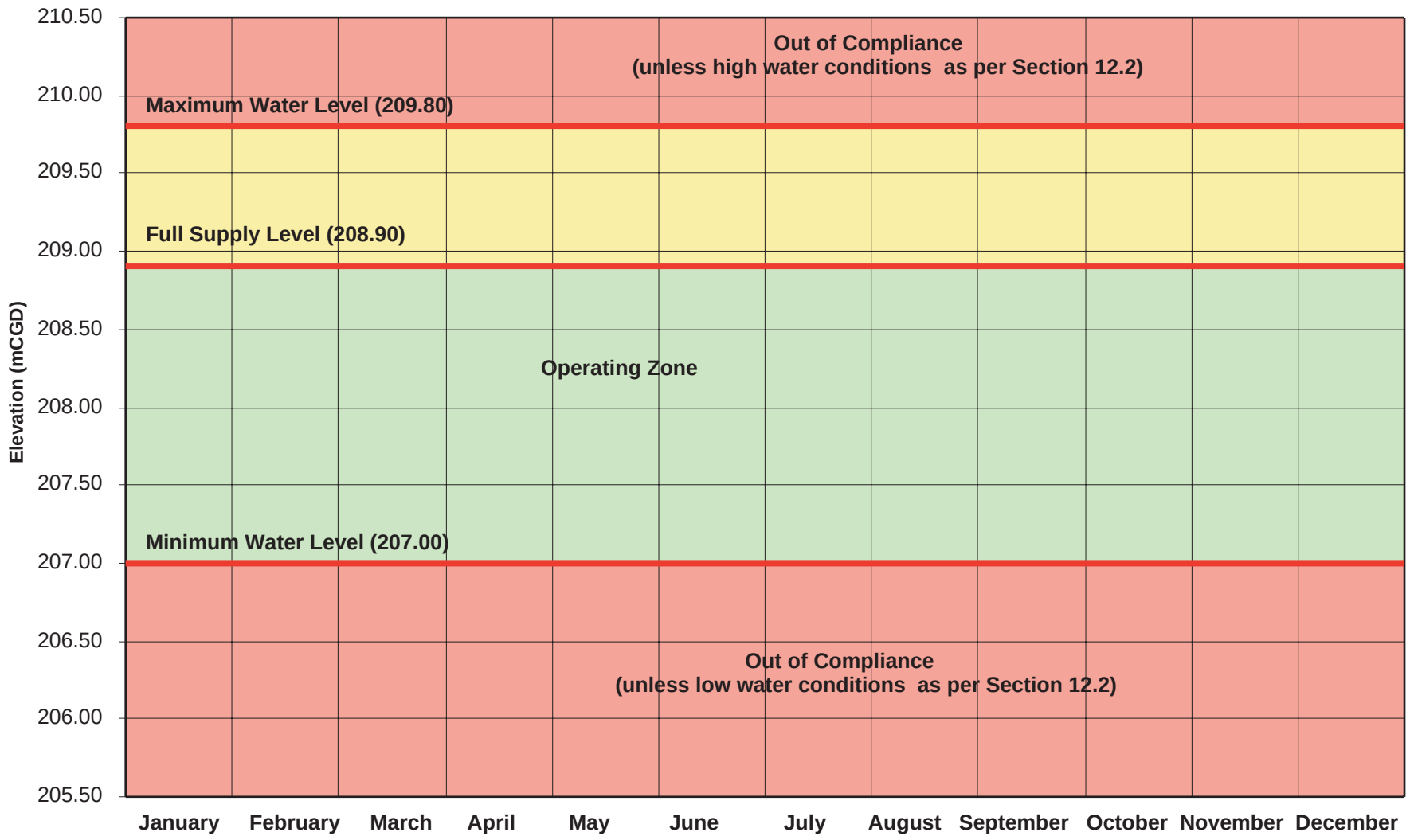

Figure 12.4
Brookfield Renewable Power
Mississagi River Water Management Plan
Red Rock Lake - Compliance Operating Levels

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13 Plan Review, Amendment and Renewal

On approval by MNR, the plan will remain in effect for a period of 10 years. It will then be subject to review and renewal as determined by the Steering Committee. The plan review process will be initiated 18 to 24 months prior to the end of the plan term. There may be no change in the plan, or review may necessitate an amendment or revision to the plan.

The plan could be reviewed sooner than 10 years if a key issue triggers the review process (e.g., a new dam, new policies, scientific research, monitoring for the WMP, etc). Subsequent reviews of the plan will be carried out as required and as determined by MNR and waterpower producers.

When new data, information or issues arise as a result of policies, research, studies or monitoring, the Standing Advisory Committee will review the information, and may request a review of the operating regime of one or more waterpower facilities or associated water control structures by MNR or the Steering Committee. If the WMP needs to be amended, MNR will issue an order to amend the plan.

13.1 Plan Amendment Procedure and Categorization

- Amendments can be made to the WMP and Operational Plans during the term of the plan provided that the outcomes remain consistent with the goals and objectives defined in the WMP. Amendments may be minor (in the immediate vicinity of one dam) or major (extensive geographic areas upstream or downstream of a dam or have an impact on environmental, social or economic attributes). Amendments to the goals and objectives require that the plan development process be followed and some degree of public consultation may be required depending on the type of amendment. The SAC will be given the opportunity to comment on plan amendments.

There are three categories of amendments as defined by MNR:

- administrative
- minor
- major.

The amendment process described below has been provided by MNR and involves

- submission of a request to MNR for an amendment
- review of the request by MNR, with advice from the SAC
- acceptance or denial of the request
- if acceptance, assignment of a category to the amendment
- completion of all applicable planning requirements, including public consultation
- recordkeeping requirements.

Any request must be accompanied by sufficient information to allow MNR to determine whether the proposed amendment should proceed, and whether the amendment should be treated as administrative, minor or major.

The amendment request must contain the following information:

- a brief description of the proposed amendment
- the rationale for the proposed amendment and a discussion of its significance
- if new operations are proposed
  - a brief description of the proposed operations, and a description of the previously approved operations in the water management plan which will be changed by the proposed amendment
  - an outline of the applicable planning requirements for the proposed operations, including public consultation, based on the planning requirements for similar operations in a water management plan.

MNR is responsible for determining whether an amendment should proceed, and for categorizing the amendment as administrative, minor or major. In making this determination, MNR will assess the appropriate extent of public consultation and MNR review and approval necessary.

MNR considers the following factors in determining whether to grant the request for an amendment, and in determining the appropriate category for the amendment:

- whether there are legitimate time constraints which must be met for reasons of public safety, ecological or industrial necessity, or public convenience and necessity

- whether there has been previous notification that the requested amendment will be required, and the degree to which planning and public consultation has taken place previously (e.g., decisions deferred in the water management plan; amendments required after public consultation in other planning processes)

- the adequacy of the information concerning the resource features, land uses and values potentially affected and the anticipated potential effects of the requested operations

- the number of previous requests for similar amendments.

The decision on the amendment request, and the appropriate category of amendment, will normally be made within 30 days of receipt of the request. MNR will prepare a written decision, and any disagreements with the categorization of the amendment will be recorded in that written decision.

13.1.1 Administrative Amendments

If MNR decides that a proposed amendment should proceed, and that the appropriate category of amendment is administrative, MNR will approve the amendment when the necessary planning has been completed. (Note: There are no formal public consultation requirements for the preparation of an administrative amendment.)

Documentation requirements for administrative amendments include

- the amendment request
- replacement text for the changes to the approved water management plan
- a map of the area affected by the amendment, if applicable
- all documentation associated with the planning of operations, if applicable, including any associated supplementary documentation
- recommendations from the SAC.

13.1.2 Minor Amendments

If MNR determines that a proposed amendment should proceed, and that the appropriate category of amendment is minor, one formal public consultation opportunity will be provided. At least 15 days prior to a final decision on approval of a minor amendment, MNR will issue a Notice of Minor

Amendment Inspection which indicates that the proposed minor amendment is available for inspection at the Blind River MNR area office.

An example of a minor amendment may be the request for a generating station to adopt a 30-cm increase in operating elevations when all required approvals have been satisfied.

The notice will normally contain the following information in concise non-technical language:

- a statement that the proposed minor amendment will be approved by a specified date unless concerns are raised
- a statement that further public consultation may be required if concerns are raised
- a map of the river reach/area for which the amendment is being prepared
- a description of the subject matter of the proposed amendment
- the method by which the public may obtain additional information on the proposed amendment
- a request for comments
- the names of appropriate contact people
- a brief explanation of how comments received will be dealt with according to the relevant provisions of the Freedom of Information and Privacy Act
- a statement of the relevant opportunities for resolution of issues.

A French Language Services Act will govern the provision of French language services for public consultation in the preparation of a minor amendment.

If the response to the public notice indicates no significant concerns, or if any concerns received can be resolved with no substantial change to the proposed amendment, MNR will approve the amendment.

If the response to the public notice indicates significant unresolved concern about the proposed amendment, the amendment request will be re-categorized as major, unless MNR determines that the objection is unreasonable or that the amendment is a matter of urgency. In the latter case, MNR will approve the amendment.

If an issue arises during the preparation and review of the minor amendment, the issue resolution procedure described above will apply, with whatever modifications are necessary in the circumstances.

Documentation requirements for minor amendments include the same requirements as for administrative amendments (see Section 13.1.1), as well as documentation of the results of the formal public consultation opportunity for inspection of the amendment.

13.1.3 Major Amendments

If MNR determines that a proposed amendment should proceed, and that the appropriate category of amendment is major, formal public consultation opportunities will be provided at two stages.

Public notices will be issued by MNR at each stage of the public consultation process.

Notices will normally contain the following information, in concise non-technical language:

- a statement of the purpose of the notice and the public consultation opportunity
- a map of the river reach/area for which the major amendment is being prepared
- a description of the subject matter of the proposed amendment
- the particulars and schedule for any additional formal public consultation opportunities
- the method by which the public may obtain additional information on the proposed amendment
- a request for comments
- the names of appropriate contact people
- a brief explanation of how comments received will be dealt with according to the relevant provisions of the Freedom of Information and Privacy Act
- a statement of the relevant opportunities for resolution of issues.

The French Language Services Act, as amended from time to time, will govern the provision of French language services for public consultation in the preparation of a major amendment.

Stage One of the public consultation process for major amendments will begin by issuing a Notice of an Information Centre, at least 30 days before the date of the information centre. At the same time as the Notice of an Information Centre is issued, the provisions of the Environmental Bill of Rights (EBR), as amended from time to time, require that a Registry Proposal File be prepared and submitted to MNR's Land Use Planning Branch, Main Office, for placement on the EBR Environmental Registry.

A 30-day period is provided after the information centre for interested persons to provide comments on the proposed amendment. The required documentation for the major amendment is then produced and submitted to MNR for review. After the review, the major amendment will be certified and approved by MNR.

Stage Two of the public consultation process for major amendments will begin by issuing a Notice of Major Amendment Inspection. This notice will be issued upon MNR approval of the major amendment, and will provide direction on how to obtain access to the major amendment documentation. At the same time as the Notice of Major Amendment Inspection is issued, the provisions of the Environmental Bill of Rights (EBR), as amended from time to time, require that a Registry Decision File be prepared and submitted to MNR's Land Use Planning Branch, Main Office for placement on the EBR Environmental Registry.

If an issue arises during the preparation of a major amendment, the issue resolution procedure will apply, with whatever modifications are necessary in the circumstances.

Documentation requirements for major amendments include the same requirements as for administrative amendments, as well as documentation of the results of public consultation. A brief description of how MNR's Statement of Environmental Values (SEV) under the Environmental Bill of Rights (EBR), as amended from time to time, has been considered in the development of the major amendment must also be produced, in the form of an SEV briefing note.

13.1.4 Amendment Records and Distribution

All approved amendments will form part of the approved water management plan. A copy of each approved amendment will be filed with the approved water management plan at the appropriate MNR district office immediately upon approval. A record of all amendment requests and all approved amendments will also be maintained.

List of References

List of References

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