Bonnechere River
Water Management Plan

September 2004
Amended March 2005
Amended March 2009
Amended December 2009
Amended September 2014

WATER MANAGEMENT PARTNERS

The following waterpower operators are responsible for the implementation of the Bonnechere River Water Management Plan:

RENFREW POWER GENERATION INC.

MULTISTREAM POWER CORPORATION

EGANVILLE GENERATION CORPORATION

VORNWEG WATERPOWER

Copies of this water management plan are available for viewing at the Ontario Ministry of Natural Resources office at 31 Riverside Drive in Pembroke, and through each of the waterpower companies listed above.

PDF copies are available through each of the waterpower companies listed above and through the Ministry of Natural Resources in Pembroke, and from the Renfrew Power Generation web site:

www.renfrewpg.ca

For more information on waterpower and water management planning in Ontario see the Ministry of Natural Resources renewable energy website:

www.mnr.gov.on.ca/en/Business/Renewable

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The development of the Bonnechere River Water Management Plan was supported and partially funded by the Ontario Ministry of Natural Resources.

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Scope of the Bonnechere River Water Management Plan

This water management plan (WMP) sets out legally enforceable provisions for the management of flows and levels on this river within the values and conditions identified in the WMP.

In instances where, due to emergency energy shortages, the Independent Electricity Market Operator (IMO) requests that owners of the waterpower facilities and associated water control structures seek relief from certain provisions of this WMP, the Ministry of Natural Resources (MNR) will consider those requests expeditiously and, after consultation with the IMO, may allow short-term relief from certain provisions.

The mandatory provisions of this WMP will be waived, as appropriate, when the dam owners (which may include other dam owners, such as MNR) are requested to do so by a police service or other emergency organization.

This plan does not authorize any other activity, work or undertaking in water or for the use of water, or imply that existing dams(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*. Approval of this WMP does not relieve the dam owners from their responsibility to comply with any other applicable legislation. For the purposes of this plan, an operational plan means a plan for the management of flows and levels.

BONNECHERE RIVER
Water Management Plan

Bonnechere River Waterpower Producers and
the Ontario Ministry of Natural Resources, Pembroke District, Southern Region
For the ten-year period September, 2004 to September, 2014

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

Peter Boldt, Renfrew Power Generation
I have authority to bind the corporation.

Date: Sept 8, 2004

Stephen Headford, Multistream Power Corporation
I have authority to bind the corporation.

Date: Sept 8, 2004

Frank I. Sheer, Eganville Generation Corporation Inc.
I have authority to bind the corporation.

Date: Sept 08, 2004

Andreas Vornweg, Vornweg Waterpower
I have authority to bind the corporation.

Date: Sep, 08, 2004

I certify 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 that direction from other sources, relevant policies and other obligations have been considered. I recommend this plan be approved for implementation.

Ray Bonenberg, District Manager, Pembroke District
Ontario Ministry of Natural Resources

Date: Sept 08/2004

Approved by:

Ron Running, Regional Director, Southern Region
Ontario Ministry of Natural Resources

In 1994, MNR finalized its Statement of Environmental Values (SEV) under the *Environmental Bill of Rights*. The SEV is a document that describes how the purposes of the EBR are to be considered whenever decisions are made in the ministry that might significantly affect the environment. During the development of this water management plan, the ministry has considered its SEV

Ministry of Natural Resources and Forestry

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Regional Operations Division
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Ministère des Richesses naturelles et des Forêts

Bureau du directeur
Région du Sud
Division des opérations régionales
300, rue Water
Peterborough (ON) K9J 3C7
Tél: 705-755-3235
Téléc: 705-755-3233

Ontario

September 19, 2014

Subject: Ministry of Natural Resources and Forestry Approval of Administrative Amendment to Extend the Term of the Bonnechere River Water Management Plan

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This letter is to advise that the Bonnechere River Water Management Plan has been amended under Section 23.1(6) the *Lakes and Rivers Improvement Act.* An administrative amendment was undertaken and approved September 19, 2014. The amendment extended the term of the plan for an additional 18 months. This will ensure that the existing water management plan remains in effect while providing time for the results of the proposed changes to provincial requirements for the preparation, amendment and review of water management plans under the *Lakes and Rivers Improvement Act* to be known. The plan will now expire in March 31, 2016.

Changes as a result of this amendment are reflected in the updated (September 2014) version of the Bonnechere River Water Management Plan.

Regards,

Jane Ireland

Jane Ireland
Regional Director
Southern Region
Ministry of Natural Resources and Forestry

HISTORY OF AMENDMENTS

MARCH 2005 AMENDMENTS

In the spring of 2005, MNR reviewed two requests for amendments to this water management plan. The requests included:

- An application from Eganville Generation Corporation for a minor adjustment to the operating regime for the Eganville Dam.

- An application from Multistream Power Corporation for a minor adjustment to the operating regime for the Douglas Dam.

The two requests were reviewed as minor amendments under Section 4.3.4 of this plan, approved March 31, 2005, and included in the 2005 amended version of the Bonnechere River Water Management Plan.

MARCH 2009 AMENDMENTS

In 2008 MNR reviewed four requests for amendments to this water management plan. The requests included:

- An application from Renfrew Power Generation to establish daily limits (maximum/minimum value) that would be used for reporting and enforcement at the current reservoir lakes (excluding Lake Clear) and generating facilities. Reporting and compliance will be based on a daily reading which will be an average of the all the readings taken in a 24 hour period from 12 midnight to 12 midnight.

- An application from Renfrew Power Generation to change the upper limit of the Renfrew reach to reflect the historical operation of the Renfrew generating stations. The upper limit at the Renfrew site would be 111.03 for weeks 1 to 10, 111.19 from weeks 11 to 21 and 110.86 from weeks 22 to 52.

- An application from Renfrew Power Generation to change Section 2.5.2 to better reference the co-relationship between the water levels on Round and Golden lakes during periods of high water and to more clearly describe the restricted ability to control water levels on one lake without adversely affecting the other.

The above three requests were reviewed as administrative amendments under Section 4.3.3 of this plan, approved in January of 2009, and included in the March 2009 amended version of the Bonnechere River Water Management Plan.

- An application from Renfrew Power Generation to revise the fall limit on Golden Lake so that it is the same value as the spring at 168.71, after the summer period of week 31 with a gradual drawdown to week 44.

The fourth request above was reviewed as a minor amendment under Section 4.3.4 of this plan, approved in March of 2009, and included in the March 2009 amended version of the Bonnechere River Water Management Plan.

DECEMBER 2009 AMENDMENT

In 2009 MNR received a request from Renfrew Power Generation for an amendment to this water management plan that would change lower limits of the operating regime for Round Lake, and remove the specific lower limits during the spring period, known as the lake trout box.

This request was reviewed as an administrative amendment under Section 4.3.3 of this plan, approved in January of 2010, and included in the January 2010 amended version of the Bonnechere River Water Management Plan.

The amendment resulted in changes to:

- Table 10 on Page 32
- Text on page 33 referring to the typical operating line and lake trout
- Figure 8 on Page 33
- Appendix 8

SEPTEMBER 2014 AMENDMENT

In September 2014, the Ministry of Natural Resources and Forestry (MNRF) approved an amendment to the Plan which extends the term of the plan by 18 months (from September 2014 to March 31, 2016). This request was categorized as administrative under Section 4.3.3 of the Bonnechere River Water Management Plan. The amendment resulted in changes to the following sections of the Plan:

i. Approval Page

ii. Section 4.3 Plan Term, Review and Amendment.

Copies of all amendment documents are on file at the Pembroke office of the Ontario Ministry of Natural Resources and Forestry.

I. ACKNOWLEDGEMENTS

This water management review and plan would not have been possible without the support and involvement of a large number of individuals, agencies and organizations.

The Public Advisory Committee (PAC) for the Bonnechere River Water Management Plan deserves a great deal of credit for the success of this effort and for the quality of the final product. For more information and a profile of PAC members see Appendix 3.

Municipal leaders, landowners and members of the public also contributed during the planning process by providing feedback through open-house public consultation sessions.

The Ontario Ministry of Natural Resources made a significant contribution to this plan, leading the review process and providing land-based data and mapping resources, staff time and financial support.

Other government agencies that have contributed to the planning process on the Bonnechere River include the Ontario Ministry of the Environment, the Ontario Ministry of Agriculture and Food, and Fisheries and Oceans Canada.

Waterpower producers on the Bonnechere River *watershed* provided important historical data on flow and level management on the Bonnechere River and contributed staff time, and financial and technical assistance during the review and planning process.

II. TECHNICAL TERMS, UNITS OF MEASURE, ABBREVIATIONS AND TYPOGRAPHICAL CUES IN THIS PUBLICATION

It is unavoidable that a publication of this nature, in attempting to describe complex interrelated systems, includes some technical terms, concepts and abbreviations that may not be immediately understood by the reader.

We have included a glossary (Section 8) in this plan, providing definitions for all technical terms. The words referenced in the glossary appear in italics on first reference in the plan.

For ease of reading we are abbreviating some terms and proper names for programs or agencies. On first reference these terms and names are spelled out followed by the abbreviation in brackets. Uncommon abbreviations are also included in the glossary.

Measurements are provided in metric. Where appropriate, imperial equivalents are provided (in brackets).

The abbreviation LD is used to specify “local datum” water levels. In most references, water level information is provided in meters above sea level with the local datum equivalent in brackets (e.g. 107.5 LD).

III. EXECUTIVE SUMMARY

Waterpower (hydro-electricity) has been produced in Ontario for more than 150 years and has contributed significantly to the economic health of the province.

There are about 200 waterpower facilities in Ontario, owned and operated by over 83 different producers (MNR, 2002). Waterpower facilities contribute about 26 percent of the province's total generating capacity.

In recent years the Government of Ontario moved to restructure Ontario's electricity market. Bill 35 (*Energy Competition Act)* was passed in 1998. In May 2000, the government endorsed a "new business relationship" with Ontario's waterpower industry including, among other things, a requirement that formal plans for the management of flows and levels be prepared for the province's waterpower facilities. In December 2000, the *Lakes and Rivers Improvement Act* (LRIA) was amended to provide the Minister of Natural Resources with the authority to require dam owners to prepare water management plans in accordance with guidelines approved by the Minister. This authority was expanded and new penalty provisions were added to the LRIA in June 2002. The Water Management Planning Guidelines for Waterpower (WMPG) were approved by the Minister in May 2002.

Ontario's electricity market is administered by the Independent Electricity Market Operator (IMO), which works in conjunction with the Ontario Energy Board (OEB) and the federal Competition Bureau.

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 is achieved through the management of water levels and flows as they are affected by the operations of waterpower facilities and associated water control structures.

The following principles guide the preparation, review, approval and implementation of WMPs:

- Maximum net benefit to society – WMPs should attempt to maximize the net environmental, social and economic benefits of waterpower operations.
- Riverine ecosystem sustainability – WMPs should, at a minimum, arrest any on-going degradation of the riverine ecosystem resulting from the manipulation of water levels and flows, and should seek to improve the ecosystem.
- Planning based on best available information – Planning should proceed based on the most recent and best quality information that is available at the time of decision-making.
- Thorough assessment of options – A sound assessment of the possible options for the management of water flows and levels requires a thorough and open review. Tradeoffs among options should consider their qualitative and quantitative environmental, social and economic benefits and costs.
- Adaptive management – Planning will use this long-term management process that strives to continually improve resource management, to reduce areas of uncertainty, build on successes and make adjustments to limit failures.
- Timely implementation of study findings – Information that arises after a WMP has been approved should be addressed and implemented in a timely manner.
- Aboriginal and treaty rights – Water management planning will be undertaken without prejudice to the rights of Aboriginal people and treaty rights.
- Public participation – WMPs will be developed using open and transparent processes and will be built on consensus-based decisions.

The specific objectives of the Bonnechere River Water Management Review and the resulting WMP are:

- To meet the requirements of existing and new legislation and regulations in the management of flows and levels on the Bonnechere River.
- To apply a system-wide, comprehensive approach to managing flows and levels within the Bonnechere River.
- To balance the environmental, social and economic benefits of the river's resources, and to ensure the sustainability of those resources for future generations.
- To maintain or improve the aquatic and riparian ecosystem of the Bonnechere River.
- Through consultation, to improve the public understanding of the issues related to the management of flows and levels on the Bonnechere River.

There are four waterpower companies operating on the Bonnechere River watershed:

- Renfrew Power Generation Inc. (RPG)
- Multistream Generation Corporation
- Eganville Generation Corporation Inc.
- Vornweg Waterpower

Historically, these waterpower facilities have been operated as *run of the river* with no established operating regimes. For more information on waterpower generation on the Bonnechere, see Section 3.2.

The operating regimes in this plan (see Section 4.6) for each of the control structures on the Bonnechere River, are designed to:

- maintain healthy aquatic *ecosystems*
- protect shorelines
- provide water for various uses along the river (such as recreation and municipal sewage treatment)
- allow for the production of electricity

The operating regimes are mandatory and will be enforced under the LRIA.

The planning process for this water management plan involved a Public Advisory Committee (PAC) and several public consultation initiatives. The PAC played a key role in ensuring that all interests and stakeholders on the river were represented during the planning process.

Specific issues identified through the public consultation process were assessed in the development of this water management plan. For a list of the issues raised and the resulting responses and actions, see Section 5.

There is a strong commitment to maintaining public involvement during the implementation of the plan. A Standing Advisory Committee (SAC) (see Section 4.2.2) will have a role in generating solutions to concerns that may be raised in the future. The SAC will help oversee the fulfillment of information needs on the river system, and will act as a link between waterpower producers, MNR and the general public.

One of the many accomplishments of this process is the establishment of a closer and more positive working relationship among waterpower producers, MNR and the public. This working relationship will be key in achieving the following goals, shared by all partners:

- sustaining and enhancing the Bonnechere River's aquatic ecosystems
- supporting recreational, tourism, industrial and *riparian* land uses
- fostering public awareness and understanding of the issues involved with levels and flows management on the whole river system
- generating electricity safely, efficiently, reliably and economically

Table 1: Planning Team Organization

PLANNING TEAM ORGANIZATION	
Working Group	
	Waterpower Producers: P. Boldt, M. Dupuis, M. Bimm, F. Scheer, A. Vornweg, R. Thom
	Government Agencies: P. Moreau, J. Gaweda, J. Cote, R. Spurr, T. Giesler, N. Paroschy, K. McWatters, V. Castro, M. Bohm, J. Niefer, L. Trute, D. Skeggs
Public Advisory Committee	
	Robert Afelskie, Don Bohart, Aurel Boucher (vice-chair), Glen Briscoe, Murray Borer, Ron Deshane, Karen Handford (chair), Neil Mantifel, Wendy Milne
Steering Committee	
	Waterpower Producers: P. Boldt, M. Dupuis, M. Bimm, A. Vornweg
	Government Agencies: R. Bonenberg, M. Bohm, K. Carnegie, S. Martin
	Algonquins of Pikwàkanagàn Representative: P. Bernard (J. Leroux, alternate)
	Municipal Representative: G. Bimm

1.0 INTRODUCTION

Over the years, sawmills, gristmills, log and timber slides, water control structures and dams have changed the character of the Bonnechere River system. For the purposes of this plan, the river is divided into a series of *reaches* or sections.

Operating the existing dams with the objective of producing electricity, while balancing the needs of fish and wildlife, property owners, and a variety of other users of the Bonnechere River, is a complex task. Adjacent reaches are not always managed in the same way because of differences in topography, local land uses and other limitations. However, the management of one reach directly impacts the levels and flows of other reaches up and downstream. For example, releasing water from Round Lake through the Tramore Dam can affect neighboring residents, but can also have different implications for the shoreline residents of the Bonnechere River, Golden Lake or Wilber Lake. Conversely, in order to ensure adequate water is passed at the sewage treatment plants in Eganville and Renfrew, water flows through structures upstream may have to be adjusted.

1.1 PLANNING PROCESS AND PLANNING TEAM STRUCTURE

The Bonnechere River water management review and planning process was a collaborative effort involving:

- a steering committee
- a Public Advisory Committee (PAC)
- a technical Working Group (WG)

See Table 1 for planning team organization. See Table 2 for a schematic of the planning process. See Appendix 1 for Terms of Reference and additional information.

There are three broad stakeholders with an interest in the management of flows and levels on the Bonnechere:

- landowners and the public
- regulatory agencies
- waterpower operators

Landowners and the Public

The broad stakeholder group referred to as the public, includes local landowners, residents on the watershed, and the general public of Ontario. The Public Advisory Committee (PAC) represented the interests and issues of this group during the planning process. Members of the Public Advisory Committee were recruited through a selection process facilitated by MNR and waterpower partners. Individuals were invited, through public advertisements and letters of invitation, to submit an expression of interest. Applicants were evaluated and chosen through an interview process, with the intent of establishing a group of individuals who could represent the diverse mix of public interests on the Bonnechere River. For more information on the PAC see Appendix 3.

Regulatory Agencies

Through the *Lakes and Rivers Improvement Act* (LRIA), MNR is the public agency responsible for water management planning in Ontario with a vision of sustainable development and a mission of ecological sustainability. Section 23.1 of the LRIA applies specifically to water management planning.

MNR also has a role in involving other agencies that may have an interest or a regulatory mandate on the watershed (e.g. the Ontario Ministry of the Environment, the Ontario Ministry of Agriculture and Food, Fisheries and Oceans Canada, the Algonquins of Ontario).

Waterpower Operators

There are four waterpower operators involved in managing river flows and levels. Two operations are municipally owned and directed. Two operations are privately owned. The waterpower operators are involved in generating electricity for profit, and are also responsible for ensuring public safety around their structures and providing some level of flood control.

1.2 THE DEVELOPMENT OF WATER MANAGEMENT ALTERNATIVES

The process of developing water management alternatives for the Bonnechere River Water Management Review involved three components:

- the identification of issues through an extensive consultation process
- analysis of issues and alternatives by the Public Advisory Committee and Working Group
- the development of a hydrological model

The overall objective in developing alternatives was to build a level and flow management regime for the entire river system, that would balance the needs of all water users while protecting critical values.

The public consultation process is discussed in Section 1.3 of the plan. Issues raised during this process are addressed in Section 5.

The engineering analysis conducted by ACRES International was critical in developing the two water management alternatives, and in selecting one of those alternatives in the development of operating regimes for the control structures on the system. This work included the preparation of a hydrologic/hydraulic background document, which consolidates the information and constraints related to water flow and the operation of the dams and hydro stations in the Bonnechere River Watershed.

The alternatives developed and the model analysis associated with each are referenced in Appendix 2. More detailed information is available in the final report (ACRES International, 2003).

The hydrologic model used in the Acres analysis simulated the existing operations on the river system, identifying conflicts and constraints with respect to hydrostation operations, social conditions, and environmental requirements.

Round Lake is the primary reservoir along this river system. It has the largest water storage capacity on the system (approximately 55,700 *acre feet*) and a surface area of approximately 30.8 km^2 (see Table 3). Golden Lake, although slightly larger than Round Lake with a surface area of 33.8 km^2, has a water storage capacity of only 38,000 acre feet. Lake Clear has a storage capacity of more than 10,200 acre feet, with a surface area of approximately 17.3 km^2.

Because Round Lake is the primary reservoir on the Bonnechere River, a seasonal regime of water levels on the lake was used as the starting point for the development of alternatives for model analysis (see Appendix 2 for model analysis charts showing Round Lake water levels under Alternatives 1 and 2).

The model was used to determine the most effective scenarios for dam operations. These scenarios were fine-tuned by the Planning Team to meet ecosystem needs and other constraints along the river. The development of these refinements was supported by ACRES international through their participation in PAC and Working Group meetings.

General Principles

The following principles guided the preparation of a background engineering document for the Bonnechere River Water Management Plan project:

- Changing water levels and flows has an impact on the ecosystem. The consultant was advised of known spawning sites, sites with erosion potential, hydraulic constrictions and existing minimum flow requirements, where they exist.
- The best information available was collected describing technical, hydrologic, financial and environmental conditions, issues and constraints that impact the waterpower producers.
- Background collection was undertaken without prejudice to the rights of Aboriginal people and treaty rights.
- Information was collected using an open and transparent processes.

The development of specific alternatives involved the consideration of the following. These items had been identified throughout the process and are discussed in the plan on a reach-by-reach basis.

- Flows available for walleye spawning and incubation for the period of March 19 to May 27 (i.e. operational weeks 12 to 21).
- The expected winter levels at Round Lake between November 1 and March 31.
- The expected year-round levels on Golden Lake.
- The change in expected flows at power stations in Eganville, Douglas and Renfrew.
- The practicality of the Alternative 1 operating band for Round Lake.

Base Case

The baseline data collection process, using 44 years of lake level data and 26 years of modeled inflow data, lead to the establishment of a base case for flows and levels on the Bonnechere system. The base case, as a water management regime, represents the way that flows and levels have been managed historically.

Alternative 1

Alternative 1 was developed using the base case, with adjustments in flows and levels to protect ecological values (e.g. walleye and lake trout spawning habitat) and to ensure the balanced provision of water to all users on the system (e.g. shoreline property owners, municipal facilities, and waterpower producers). The principle of natural flow regimes was also applied in Alternative 1 (e.g. summer water levels on Round Lake and Golden Lake).

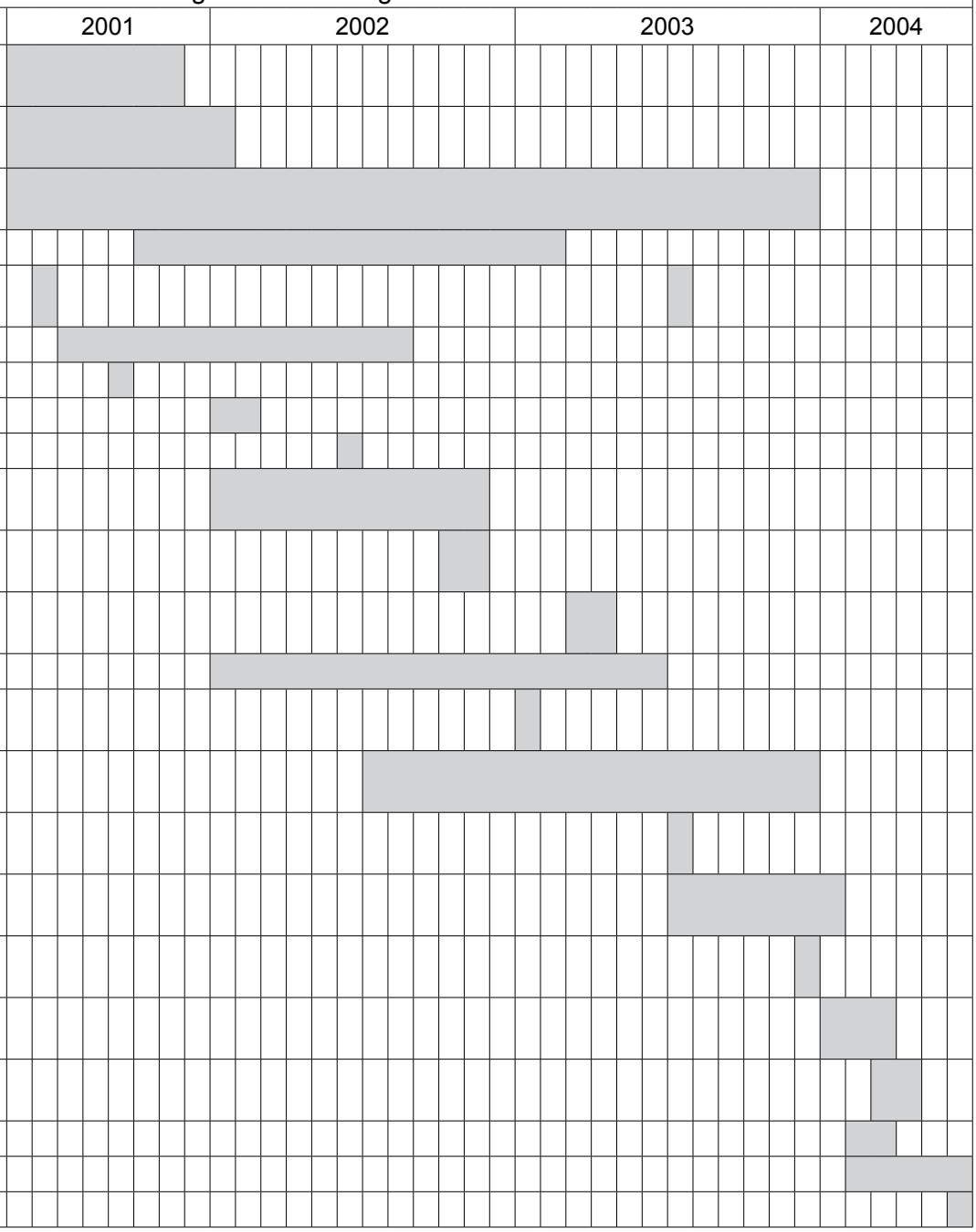
Alternative 2

Alternative 2 was developed by the Round Lake Property Owners Association using the base case and Alternative 1, and presented to the Public Advisory Committee for consideration. The primary consideration in Alternative 2 was the management of water levels on Round Lake.

Alternative Selection

Alternative 1 from this study, which was developed in the context of the Ontario Government's Statement of Environmental Values, was chosen by the PAC and by the Working Group as the most balanced and appropriate water management alternative. Alternative 1 was used in the development of operating regimes in this water management plan for each of the control structures on the Bonnechere River.

Table 2: The Bonnechere River Water Management Planning Process



1.3 PUBLIC CONSULTATION REPORT

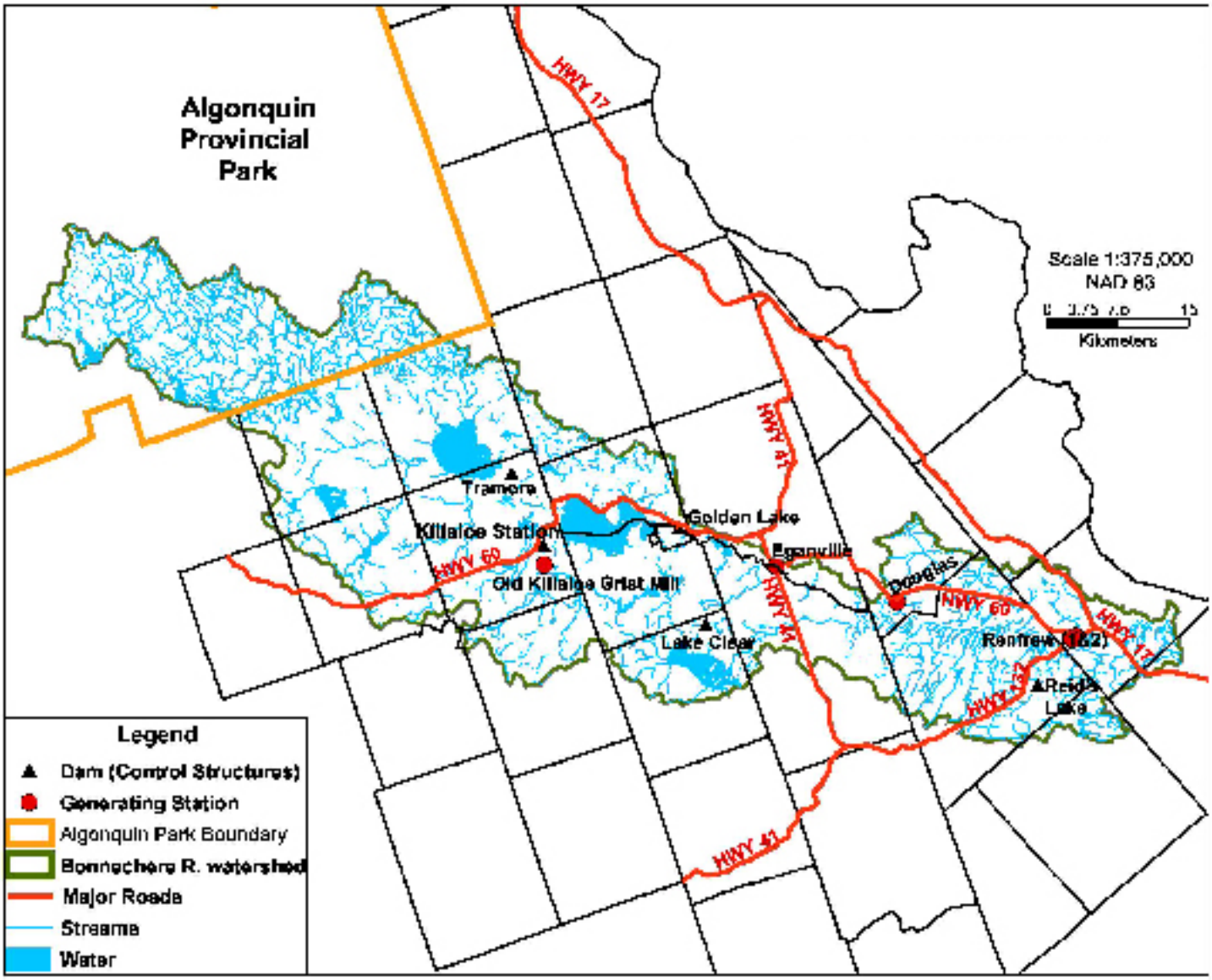
Public consultation is a critical element in water management planning in Ontario. Waterpower producers and MNR led a series of public consultation sessions throughout the Bonnechere River water management review process. See Appendix 3 for the consultation record.

Municipal representatives in the watershed were informed of the process and the scope of the management plan in February and March of 2001.

Two focus group sessions were held in September of 2001 to invite public and stakeholder input. Municipalities, along with various stakeholders (e.g. snowmobiling clubs, fish and game clubs, naturalists clubs, local trappers, cottaging and ratepayers associations, agricultural organizations, owners of farming operations, local business operators, Ontario Parks, as well as concerned citizens) were invited to identify their concerns about water levels and flows on the Bonnechere. Stakeholders attending the focus group sessions identified their concerns on a general and a reach-by-reach basis. These two sessions were co-hosted by the waterpower producers, MNR and the PAC.

A public open house followed in June of 2002 to provide background information and to confirm that all the issues had been identified.

Figure 1: Waterpower and Control Structures on the Bonnechere River Watershed



In July of 2003 the draft WMP was posted on the *Environmental Bill of Rights* (EBR) registry for a 30-day public review and comment period.

Two open house sessions were held in July 2003 to review the draft WMP and solicit comments from the public.

Several other consultation and communication techniques used to solicit public input on the background information, the issues identified through consultation, and the draft management plan, included:

- presentations to various interest groups
- distribution of fact sheets
- preparation of progress reports
- presentations in collaboration with Bonnechere Provincial Park planning staff and with the *Bonnechere River Watershed Group*

A Bonnechere River information display was created and showcased at community events and workshops.

Issues raised through public consultation assisted the PAC in assessing the impacts of levels and flows on user groups, and contributed to the development of the operating regimes set out in Section 4.6 of this plan.

The PAC was instrumental in helping design solutions for complex and sensitive issues, despite some information gaps. The PAC also made recommendations on potential future research to fill information gaps.

1.4 FIRST NATIONS INVOLVEMENT

Water management planning in Ontario is undertaken without prejudice to the rights of Aboriginal people and treaty rights.

The entire watershed of the Bonnechere River is within the traditional territory claimed by the Algonquins of Ontario.

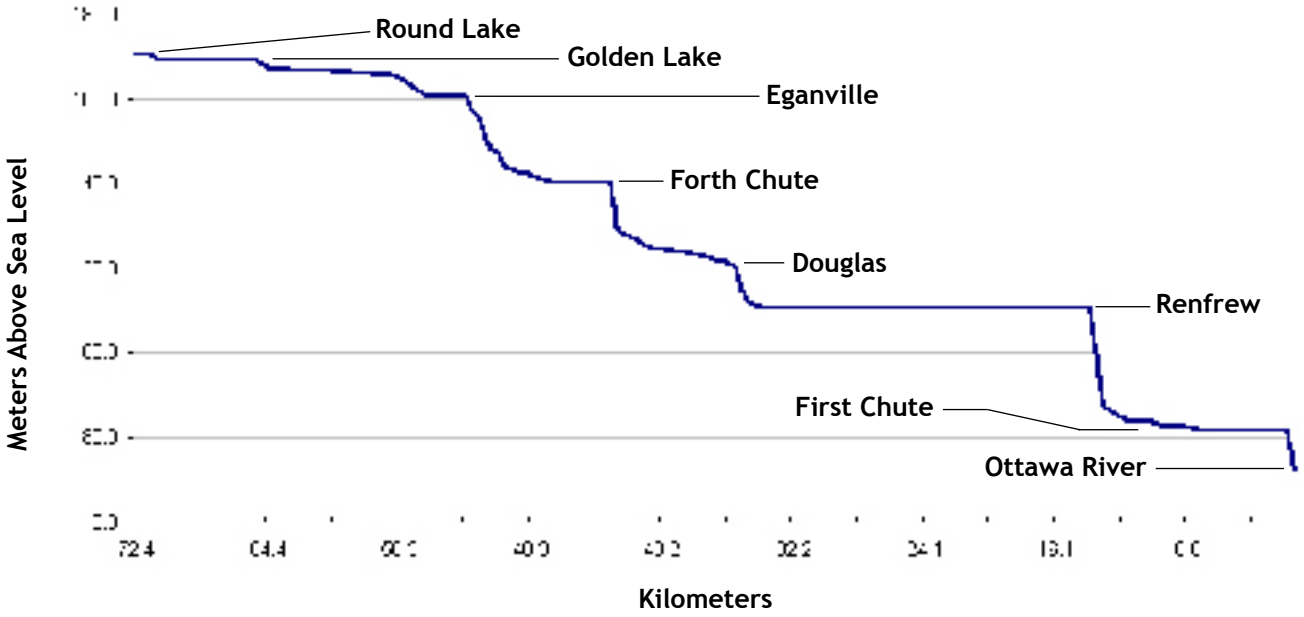
In keeping with the principle of ensuring First Nations involvement in water management planning in Ontario, the Algonquins of Pikwàkanagàn at Golden Lake were invited to participate at the start of the planning process. Council appointed Peter Bernard (and alternate Jan Leroux) as their representative on the Steering Committee (SC) and Public Advisory Committee (PAC) for the Bonnechere Plan.

Mr. Bernard (or his alternate Jan Leroux) attended SC and PAC meetings throughout the planning process. Mr. Bernard also made an presentation to the PAC in January of 2003 on First Nations traditional ecological knowledge (TEK) and its application in resource management planning.

Pembroke MNR also engaged the services of the District Resource Liaison Officer during the development of the plan to monitor the planning process from a First Nations perspective and communicate with the Algonquins.

In May of 2004, a draft copy of the Bonnechere River Water Management Plan was presented to the Pikwàkanagàn Council for review. One issue was raised by Council during that process – the potential impact of

Figure 2: Upper and Lower Extents of Reaches 8 to 1 on the Bonnechere River Watershed



flows and levels on wild rice crops. This issue has been added to the Issues section of the plan with an associated Information Need in the Information Needs Table / Data Collection Program (see #18 in Section 6.2).

1.5 ISSUES RAISED THROUGH PUBLIC CONSULTATION

Issues raised by the public and stakeholders were listed and categorized by the PAC as related to or not related to level and flow manipulation on the Bonnechere River. The list was reviewed by the Working Group.

Issues raised through the public consultation process can be grouped into the following categories:

- public concerns about extreme fluctuations in levels and flows on the river and lakes
- information dissemination, communication, public education about water levels and flows
- recognition of effects on major tributaries
- fish spawning and rearing habitat
- wildlife habitat protection in water and riparian areas
- minimum flows and coordination with water and sewage treatment facilities
- drought and flood/weather provisions, *contingency plans*
- recognition and regard for *water taking permits* on the river and main tributaries
- recognition and regard for existing and future water use for irrigation purposes
- erosion impacts on private riparian properties, municipal road allowances, and Crown land, and the solutions or possible mitigation methods

The PAC reviewed the identified issues, associated impacts, responses, actions and information needs, in the context of environmental, social and economic factors. Issues were then forwarded to the Working Group for discussion and analysis, in the context of electrical generation, fish and wildlife, and public needs.

Some of the issues were used as constraints in a *hydrologic model* developed specifically for the Bonnechere River by ACRES International. This model became a decision support tool for the Working Group and PAC. Two water management alternatives (or scenarios) were modeled and presented to the PAC for review, and further comment (see Section 1.2 and Appendix 2).

2.0 THE BONNECHERE RIVER WATERSHED

2.1 REGIONAL PHYSIOGRAPHY

The Bonnechere River watershed encompasses an area of approximately 2,400 square kilometers (935 sq. miles), a drainage half the size of Prince Edward Island (see Figure 1).

For the purposes of this plan, the Bonnechere River has been divided into ten reaches, or sections. The regulated or controlled part of the river begins at Round Lake (Reach 8) (Figure 2 shows the upper and lower extents of Reaches 8 to 1).

Approximately 80 percent of the land in the watershed is privately owned.

Most of the river's *headwaters* are in the geographic Township of Niven, Nipissing District (in Algonquin Provincial Park).

The river's source is McKaskill Lake in Algonquin Provincial Park. The river meanders through the forested and rocky Precambrian Highlands of the *Canadian Shield*, and then through open farmland with erodible clays, human settlements and scattered woodlands.

The river is navigable by canoe along much of its course, though portages are necessary at five well-known chutes (falls) and at several rapids.

The character of the Bonnechere River changes from cold and clear close to Algonquin Park, to warm and *turbid* as it approaches the Ottawa River near Castleford. The Bonnechere empties into the Ottawa River through a *Provincially Significant Wetland*.

Other ecologically important features include a Provincially Significant Wetland on Wilber Lake, many rapids and *oxbows,* and the Bonnechere Caves at Fourth Chute (an *Area of Natural and Scientific Interest*).

The Bonnechere River flows through Round Lake and Golden Lake, two of the largest lakes in Renfrew County. Both these lakes have historically supported strong fish communities. Extensive cottage and residential development along the shorelines of these lakes began in the 1950s.

Lake Clear on the southern edge of the Bonnechere Watershed is connected to the Bonnechere River by Hurds Creek. Lake Clear is a popular area for outdoor recreation.

Southern Ontario is generally characterized by 55 natural regions. Most of the Bonnechere River watershed

falls within the region referred to as the Algonquin Highlands Natural Region (Chapman and Putnam, 1984). This region is defined by the dome-shaped highlands of the Canadian Shield, exposed rugged *bedrock outcrops*, ridges, and variable, stony and largely shallow soils, with deeper deposits of sand and gravel in small valley bottoms. The coarse-grained granitic bedrock substrate causes soils in this area to be acidic, low in nutrients and not generally suitable for agriculture. The local climate is significantly influenced by the Algonquin Dome.

The remainder of the watershed lies within the Ottawa Valley clay flats or plains near the Ontario shore of the Ottawa River. Here the landscape is flatter, with several noticeable hills resulting from uplifted bedrock along existing fault lines. The sedimentary sandstone, limestone and shale bedrock is generally softer and more susceptible to *weathering*, and other forms of erosion. This has resulted in finer, silty-clay soils which are generally more fertile. Much of the predominantly private land along the lower, southeastern reaches of the Bonnechere River is actively used for agriculture.

2.2 LANDSCAPE DEVELOPMENT

In an attempt to understand the Bonnechere River today it is important to consider its beginnings during the last ice age. The last glaciation was at its peak some 20,000 years ago, when vast glaciers several kilometers thick covered and scoured the landscape. It is estimated that the Ottawa Valley has been free of ice for only 10,000 to 12,000 years, when the last of the glaciers melted and receded. During this ice retreat, enormous volumes of melt-water flowed away from the ice front, typically draining along fault lines in the bedrock below. These *fluvial* forces carried materials over large distances from the glacier front. As these materials were dropped along the way, they left behind a legacy of outwash deposits. Today these deposits can be seen as *stratified* bands of sand and gravel along steeper river valleys, and as wide outwash plains in flatter areas. The sand plain that surrounds most of Round Lake and extends to the west end of Golden Lake is an example of an outwash plain.

As the glaciers receded, the Bonnechere River watershed was covered by a large tropical sea which blanketed a vast majority of Eastern Ontario some 12,800 years ago. This body of salty water, referred to as the Champlain Sea, was up to 190 meters deep in some areas. Numerous glacial meltwater rivers carried the finest particles of sediment, silt and clay to the Champlain Sea where they settled as flat beds along the lake bottom. Evidence points to the Bonnechere River having played an important role in fluvial environmental changes at this time. In several places in the watershed, this is seen as stratified silt, silty-clay and sand layers – evidence that glaciers were close by even during the regression of the tropical sea approximately 10,000 years ago. As the Champlain Sea retreated, forces of erosion contributed to the buildup of thicker, more productive soils, and progressively more clay substrate closer to the Ottawa River.

The depth of sand that covers the clay deposits varies throughout the watershed. Exposed bedrock or rocky outcrops are commonplace along the upper reaches of the river, where the soil layer is shallow. Many types of fossils can be found in and along the Bonnechere River downstream of the Village of Eganville. The clays in the watershed are composed primarily of feldspar, quartz and amphibole, with relatively small proportions of actual clay content. These marine clays or *leda clays* are highly liquid-like in nature and are susceptible to slope failure as they become saturated with rain water, either by rising water table levels, or by changes to the shape and angle of slopes. Collapsing slopes, landslides and *earthflows* are quite common along the banks of the Bonnechere River. The physical characteristics of the terrain over which the Bonnechere River flows are slowly but continually being altered by river dynamics, while forces such as water, wind and increasing human development change the landscape.

2.3 CLIMATIC CONDITIONS

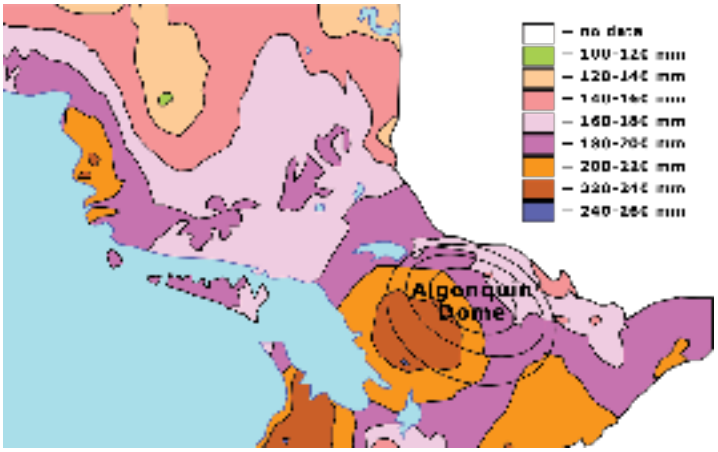


Figure 3: Precipitation Three Months Before Growing Season

The Algonquin Dome is a hump-like feature on the landscape that is the major influencing factor on the local Ottawa Valley climate. The dome begins at 177 m

Table 3: Physical and Hydrological Data for Round Lake, Golden Lake and Lake Clear			
	Round Lake	Golden Lake	Lake Clear
Surface Area (km^2)	30.8	33.8	17.3
Storage Capacity (acre feet)	55,700	38,000	10,200
Perimeter (km)	30.9	46.7	31.6
Height Above Sea Level (m)	175.0	169.5	230.0
Mean Depth (m)	13.2	8.9	11.2
Maximum Depth (m)	54.9	24.4	42.7

(above sea level) on the shores of Georgian Bay, climbs to an altitude of 587 m in Algonquin Provincial Park, and descends irregularly in an easterly direction back to 182 m at the edge of the Ottawa Valley (Chapman and Putnam, 1984). The dome creates a *rain shadow effect* on its eastern side, reducing the mean rainfall and temperature, and limiting the growing season at higher elevations (see Figure 3). This is evident in the upper reaches of the Bonnechere River watershed, specifically in the Round Lake area.

The upstream areas of the watershed lie within the climatic region known as the Haliburton Slopes, while the downstream areas fall within the Renfrew climatic region. Within southern Ontario, both of these regions experience relatively low mean annual temperatures and mean annual precipitation.

2.4 ECOLOGICAL SITE REGIONS AND SITE DISTRICTS

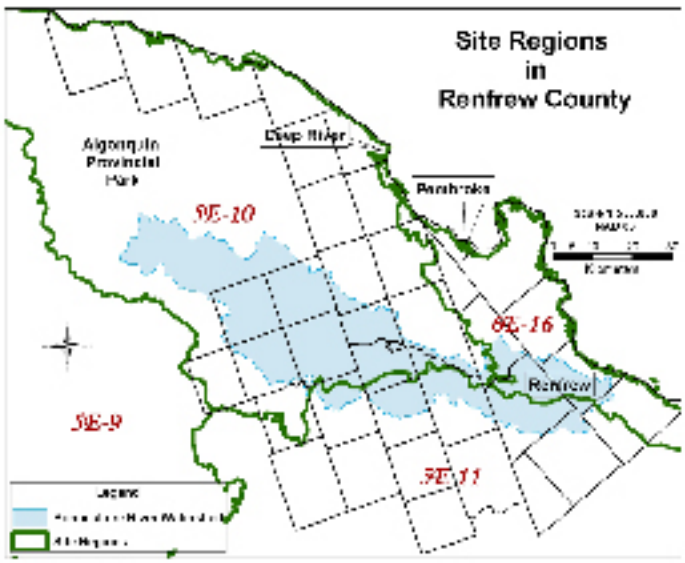


Figure 4: Site Regions in Renfrew County

Ecological Site Regions and Site Districts for Ontario have been developed by MNR to provide an ecological context to aid in broad-scale and landscape approaches to resource management and other planning activities. Site Regions share similar broad climatic patterns (e.g. temperature and precipitation) while Site Districts within these Site Regions are areas where vegetation communities respond similarly to landscape features (e.g. depth of soil, soil type) (see Figure 4).

The Bonnechere River watershed is in Site Region (5E) and Site Region (6E). The area is within Site Districts 5E-10, 6E-16 and 5E-11 (Crins, 2002). 5E-10 stretches from Algonquin Park through Golden Lake towards Fourth Chute. The agricultural areas in the watershed downstream of the Fourth Chute area fall in Site District 6E-16.

2.5 HYDROLOGY

Water flows and levels in the Bonnechere River are regulated, from Round Lake to the Ottawa River, through control structure operations. There is one water survey station near Castleford at the lower end of the watershed, which monitors flows. Other gauges monitor only water levels controlled by specific dams.

The Bonnechere River is a regulated system. The dams along the system provide some ability to respond to weather events and control flooding. For more information on flood control see Section 2.5.2.

Flow and levels have historically been managed under the flooding limits provided by three Licences of Occupation and through the management practices of operators, primarily Renfrew Power Generation which controls levels on Round Lake, Golden Lake and Lake Clear.

The mean annual flow of the Bonnechere (at Castleford) is 19.2 cubic metres per second (cms), but flows have historically ranged between 33.6 and 7.59 cms. The

minimum daily flow record has been 0.3 cms while the highest daily peak has been recorded at 286 cms.

Table 3 details the physical and hydrological data for Round Lake, Golden Lake and Lake Clear, the primary storage lakes on the system. This is based on flooding limits set under the Licences of Occupation and lowest water levels as per historical operations.

2.5.1 NATURAL FLOW REGIMES

Actual (pre-development) natural flow regimes are not available for most rivers in Canada. But they can be calculated using computer models. These natural flow calculations represent our best estimate of the characteristics of a river before the installation of dams and other structures, using what we know today about the watershed, the river and the local climate.

Calculated natural flow regimes for the Bonnechere are presented in Appendix 6. These flow regimes were not available and were not considered during the process of developing the operating regimes for each of the control structures on the Bonnechere River (see Section 4.6). They are appended to this plan for information only.

Maintaining the health of the aquatic ecosystems through the management of flows and levels in a way that generally mimics natural flows was an important principle in the development of the operating regimes in this plan. In some cases the operating regimes are designed to more closely mimic natural flows (e.g. gradual lake level reductions through the summer).

2.5.2 ABOVE NORMAL AND LOW-WATER CONDITIONS

The operating regime provisions of this water management plan do not apply during:

Declared floods – When a flood emergency is declared by a local municipality. Impacts from these flooding events are managed through local emergency response plans. Operators will co-operate with local emergency response teams to address flooding issues.

Low-water emergencies – When a Level-2 low-water response is in effect. Operators will co-operate with low-water response teams to address the low-water conditions.

In high or low water conditions not involving a declared flood or low water emergency, a high or low water indicator may force an owner/operator to report that they can no longer operate within the approved operating range because a low or high water indicator has been met. In this situation, the WMP is not suspended and the owner/operator shall:

- Immediately advise MNR and file an incident report
- Comply with the provisions as outlined in section 4.2.4 of the WMP

Although the water management plan is not suspended, the incident will not be considered a non-compliance event. Low and high water indicators are of relevance only when the operation of the facility is outside of the approved operating range.

Low Water Indicators

Facilities with minimum downstream flow and minimum reservoir water level requirements are in a low water condition when all of the following conditions are met:

- Outflow from the facility is at or below the minimum flow required in the WMP;
- Water level in the reservoir is at or below the minimum water level stipulated in the WMP, and
- The reservoir water level is decreasing

High Water Indicators

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

- Water level in the reservoir is at or above the maximum water level stipulated in the approved WMP;
- The reservoir water level is increasing, and
- Discharge facilities have been operated to discharge the maximum discharge possible (while minimizing upstream and downstream flood damages)

Seasonal flood control associated with spring freshet and periods of heavy rainfall, is an important secondary function of waterpower operations on the river.

Prior to European settlement and damming on the Bonnechere River system, the spring freshet clearly had significant impacts on riparian areas. Spring flooding and inundation of bays and riparian areas, was followed by low volumes of water and lower lake levels throughout much of the summer and fall.

Today, the risk of seasonal flooding is reduced through the operation of control structures that have waterpower production as a primary function. Managing the risk of large-scale floods and the protection of human life and

property is an important role for waterpower companies on the system.

Knowledge of the river system, close monitoring of water, ice and snow conditions, as well as precipitation in the watershed, are key to minimizing the risk of flooding.

Round Lake is used by Renfrew Power Generation (RPG) to reduce the flooding effects of the spring freshet or large-scale snowmelt. Historically, water has been released gradually from Round Lake starting in the first week of January, reaching the lowest levels by about the second week in March. This favoured power production and prepared for the spring freshet.

The level of Golden Lake is directly affected by a natural constriction near the bridge upstream from the Golden Lake Dam. This natural constriction places an upper limit on the discharge capacity of the Golden Lake Dam, which constrains the operator's ability to evacuate water from Golden and Round lakes.

When evacuating water from the upper Bonnechere, the Tramore and Golden Lake dams are operated together, with the lower discharge capacity of the Golden Lake Dam being the limiting constraint on operations.

Round Lake feeds into Golden Lake through a short stretch of the river known as the Tramore section.

In high water conditions, during spring freshet or periods of heavy rainfall, Golden Lake will generally reach the upper limit of the operating range prior to Round Lake.

Operationally, logs are pulled from both the Round Lake and Golden Lake dams to increase discharge from the upper Bonnechere. In high water conditions, with all logs removed from the Golden Lake Dam, the system is operating at full discharge capacity. When Golden Lake is full and inflows exceed that maximum discharge capacity, flooding occurs. Operations at the Tramore Dam can be used to balance where flooding occurs (i.e. on Round Lake, in the Tramore section of the river and on Golden Lake).

The goal of the operator in this situation is to minimize flooding and damage to shoreline properties to the extent possible. While doing so, the operator attempts to bring the water level in both Golden Lake and Round Lake back within the approved operating range as soon as possible.

If a high water indicator is met, this excursion outside the approved operating range is considered an incident; however, it is not considered a non-compliance event.

The management of the dam at the Multistream Generation Station in Douglas and the stresses placed on the dam during spring freshet have also been an operational constraint on the Round Lake and Golden Lake dams.

The new operating regimes for water control structures on the system are designed to address, to the extent possible, the potential for flooding of riparian property and provide for the co-ordinated release of water through the river.

Landowners and other groups along the river play an important role in maintaining the integrity of their properties, homes and communities, and mitigating some impacts of flooding. Municipalities are responsible for identifying and limiting development on areas subject to or at risk of natural hazards such as flooding and dynamic beaches under Section 3.1 of the Provincial Policy Statement. MNR plays an advisory role in this process.

Landowners along the waterfront need to be aware that water fluctuations, storm events and related natural processes continuously reshape riparian areas through flooding, erosion and accretion of sand and sediment. These processes are an integral part of the aquatic ecosystem. Interference with these processes, through various forms of development, often in areas at risk such as floodplains and along dynamic beaches, can result in increased risk of flooding, shoreline erosion, slope failure, economic losses, and risk to public safety.

Landowners along the waterfront are strongly encouraged to take preventive action to ensure their properties are prepared to withstand flooding and erosion. Construction setbacks from the high-water mark and various shoreline stabilization methods are commonly used in Ontario to prevent or mitigate such impacts.

2.5.3 MINIMUM FLOWS

Historically, some levels of minimum flow have been maintained in the Bonnechere River, based on leakage through, and the normal operation of, control structures.

Specific minimum flows are required to maintain fish habitat and to assimilate sewage effluent. Those specific minimum flows will be established through the implementation of this plan (within two years) and added to the operating regimes for the control structures on the river through amendments. The setting of specific minimum flows will involve the participation of the Ontario Ministry of Natural Resources, the Ontario Ministry of the Environment, Fisheries and Oceans Canada and waterpower producers.

As an interim measure, minimum flows will be maintained at all times by ensuring that historic flows are continued through each structure, through dam

manipulations, powerhouse operation, or leakage. The intent is to ensure that a continuous, uninterrupted minimum flow is maintained in the Bonnechere River for the protection of fish habitat.

This overall requirement to maintain minimum flows is not intended to address any specific local habitat issues, if and where they may exist, but is intended only to address the continuation of a level of minimum flow in the river at all times.

2.6 CULTURAL HISTORY

The 145-km Bonnechere River has a rich and colourful history. Since the retreat of the glaciers from this region, the Bonnechere River has been a key transportation corridor. The river first attracted the Aboriginal people who may have inhabited the area as early as 5,000 years ago (Kennedy, 1970). Fur traders who established trading posts at Golden Lake, and as far as Lac Lavielle in Algonquin Park in the 1820s and 1830s, used the Bonnechere to transport their goods (Kennedy, 1970). The lumbermen and settlers to the Ottawa Valley also relied on the Bonnechere as a key transportation route**.**

Although no longer used as a primary transportation corridor, the Bonnechere River retains its value to the local economy as an important recreational waterway.

The Bonnechere River was a hub of activity during the first half of the nineteenth century. Red and white pine, hemlock and oak were harvested and transported down the river during the spring freshet*s* or floods. As early as 1829 there was a sawmill and later a gristmill at First Chute, a 9-m falls about a mile from the mouth of the Bonnechere (Kennedy, 1970). From 1854 to 1884, the Bonnechere River contributed an average of almost 13 percent of the annual square timber production in the entire Ottawa Valley (Ontario Parks, Mark Stabb, 2001). By 1884, Basin Depot was a thriving little community and a gathering place upstream from Round Lake for many involved in the local lumber industry (Mackay, 1996).

The lack of large lakes for *booming* or moving lumber downstream forced logging teams to engineer various structures that helped move water from streams in order to help drive logs down river. Between 1847 and 1853 at least 23 dams and additional timber slides had been built on the Bonnechere River between the present hydro-line in Algonquin Provincial Park and Round Lake (Ontario Parks, Mark Stabb, 2001; Mackay, 1996).

By the 1830s log slides stood at First and Second chutes, a gristmill had been built at Fifth Chute, or Eganville, and dams had even been built upstream of Round Lake (Mackay, 1996). In the 1850s the lower reaches of the River were settled and townships were mapped (Mackay, 1996). Following the depression in the timber trade in the 1870s and 1880s and a further slowdown in the 1920s, many of the old river improvements had deteriorated to a great extent (Mackay, 1996). The last noted drive of timber on the river is reported to have been from the red pine lumber camps between McKaskill and White Partridge Lakes (Mackay, 1996) in Algonquin Park.

Although dams and slides were important to the logging industry, subsequently they were often converted to other uses. For example, the Old Eganville Grist Mill was converted into a fanning mill to process grain. Later, the site was used to supply power to parts of the village of Eganville. Mills were constructed on both sides of the river in Renfrew to make use of waterpower harnessed at Second Chute (Kennedy, 1970). The Renfrew Power Generation facility was historically the site of a gristmill, sawmill, woolen factory and axe factory. Today the McDougal Mill Museum marks the historic location of these structures. The waters of the Bonnechere powered a hub of industrial activities in Renfrew.

The demand for energy in Ontario boomed during the 1940s and 1960s, while at the same time waterpower became a common, renewable source of electricity (MNR–OPG, 2000). *Licences of Occupation* were issued even before this on the Bonnechere River to companies investing in the electricity industry. Control structures and waterpower generating dams were built along several surrounding river systems including the Madawaska River and the Ottawa River.

Cottaging in this area of the Ottawa Valley became increasingly popular throughout the 1950s and 1960s. Bonnechere Provincial Park and the Foy Property Provincial Park were formed in the late 1960s. Local tourism in the Bonnechere River watershed flourished, fueled by recreational activities such as fishing, hunting and trapping, camping, canoeing and snowmobiling. In the 1980s traditional seasonal residents began to convert their cottages for year-round living, particularly along Round Lake and Golden Lake. This trend continues today.

2.7 FLORA AND FAUNA

The Bonnechere River supports a rich variety of plant and animal life. The variety of habitats within and adjacent to the river (wetlands, farmlands, woodlands) allows for such diversity.

Black bear, moose, white-tailed deer, beaver, fisher,

mink and otter are among the mammals commonly observed. Hawks, owls and a multitude of songbirds make their homes along the river. Wetlands are teeming with waterfowl and *marsh* birds such as wood ducks and American bitterns. Adjacent fields and farmlands provide habitat for open-country birds such as the Eastern bluebird and Savannah sparrow.

A wide variety of reptiles (snakes and turtles) and amphibians (frogs, toads and salamanders) also make the Bonnechere River their home. Northern leopard frogs, eastern milk snakes and Blanding's turtles are just a few of the amphibians and reptiles that can be encountered.

See Appendix 7 for a table of common breeding birds, mammals and herptiles on the watershed.

Plant life is diverse and abundant throughout the watershed. White and red pine, spruce, cedar, maple and oak trees are common on the landscape. Black maple, an uncommon species, occurs in several locations. Cherries, blueberries, raspberries and hawthorns, to name a few, produce fruits that feed the abundant wildlife. Wildflowers, such as orchids, lilies and Queen Anne's lace, abound throughout.

The river also supports a variety of fish species (see Table 4) some of which can be impacted by water levels and flows.

Table 4: General Inventory of Fish Species by Reach

The following is an alphabetical listing of all the fish species that are or were known to occur within the Bonnechere River watershed. This table is meant to indicate presence (current or historical), and does not reflect abundance. The letter 'P' indicates that the species is currently present in a specific reach. The letter 'E' indicates that the species was present (either historically or through stocking) but is no longer present (*extirpated*). The letter 'S' indicates a species that was introduced to the watershed through a stocking program. The information in this table was collected from various sources (e.g. lake and stream surveys, historical records, local knowledge) and is not considered complete or conclusive. No data is provided for Reach 10 as this area is managed by Algonquin Provincial Park and is not impacted in any way through the implementation of this water management plan.

	P = Presence			S = Introduced Through Stocking			E = Extirpated (no longer present)		
	REACH								
	1st Chute to Ottawa R.	Renfrew 2 to 1st Chute	Douglas to Renfrew 2	4th Chute to Douglas	Eganville to 4th Chute	Wilber Lake	Golden Lake	Round Lake	Alg. Park to Jack Chute
SPECIES	1	2	3	4	5	6	7	8	9
American eel	P							E	
banded killifish	P								
black crappie	P								
blackchin shiner	P		P			P			
blacknose dace								P	
blacknose shiner			P	P					
bluntnose minnow	P	P	P	P		P	P		P
brassy minnow	P	P							
brook trout			P		P	P		SE	
brown bullhead	P	P	P	P	P	P	P	P	P
brown trout				SP	SP				
burbot (ling)					P		P	P	P
central mudminnow			P			P			
channel catfish	P								
common shiner	P	P	P	P	P	P	P	P	P
creek chub		P	P		P	P	P		
emerald shiner	P	P							
fallfish	P	P	P	P	P	P	P	P	P
golden shiner	P	P	P	P		P	P		P
greater redhorse	P		P						
Iowa darter			P			P	P	P	P
johnny darter	P	P	P		P				
lake herring (cisco)							P	P	P

Table 4: CONTINUED									
	P = Presence			S = Introduced Through Stocking			E = Extirpated (no longer present)		
	REACH								
	1st Chute to Ottawa R.	Renfrew 2 to 1st Chute	Douglas to Renfrew 2	4th Chute to Douglas	Eganville to 4th Chute	Wilber Lake	Golden Lake	Round Lake	Alg. Park to Jack Chute
	1	2	3	4	5	6	7	8	9
lake sturgeon	P								
lake trout								SP	E
lake whitefish							P	P	P
largemouth bass	P		P			P	P	P	P
logperch	P	P	P			P	P	P	P
longnose dace		P		P	P				
longnose gar	P								
mimic shiner	P	P	P	P					
muskellunge	P						P		E
northern pike	P		P	P	P	P	P	P	P
pearl dace								P	
pugnose shiner					P				
pumpkinseed	P		P	P	P	P	P	P	P
rainbow smelt	P							P	
rainbow trout								SE	
river redhorse	P								
rock bass	P	P	P	P	P	P	P	P	P
rosyface shiner	P	P	P	P					
sand shiner	P								
shorthead redhorse	P		P	P			P		
silver redhorse	P					P			
smallmouth bass	P	P	P	P	P	P	P	SP	P
spottail shiner		P							
trout-perch							P		P
walleye	P		P	P	P	P	SP	SP	P
white sucker	P	P	P	P	P	P	P	P	P
yellow perch	P		P	P	P	P	P	P	P

3.0 SOCIO-ECONOMIC DESCRIPTION AND PROFILE

3.1 COMMUNITIES

The Bonnechere River flows through several municipalities from its headwaters in Algonquin Park to the Ottawa River. All of these municipalities, with the exception of the Town of Renfrew, include significant rural residential populations.

The population for the watershed by municipality (Statistics Canada):

- Madawaska Valley (Township of, Reach 9)
  Population: 4,406
  Private dwellings: 2,724
- Round Lake (Killaloe-Hagarty-Richards Township, Reach 8)
  Population: 2,492
  Private dwellings: 1,572
- Pikwàkanagàn (First Nation Reserve on Golden Lake, Reach 7)
  Population: 443
  Private dwellings: 164
- Golden Lake (North-Algona-Wilberforce Township, Reach 7)
  Population: 2,729
  Private dwellings: 1,563
- Eganville (Township of Bonnechere Valley, Reach 6-5)
  Population: 1,230
  Private dwellings: 579
- Douglas (Admaston-Bromely Township, Reach 4-3)
  Population: 2,824
  Private dwellings: 1,171
- Renfrew (Town of, Reach 2-1)
  Population: 7,942
  Private dwellings: 3,562
- Horton (Township of, Reach 1)
  Population: 2,567
  Private dwellings: 1,200

3.2 HYDROELECTRIC GENERATION

There are two types of waterpower generating stations. A generating station with minimal control over water storage in the *forebay* is a run-of-the-river facility. A generating station with significant control over the amount of water stored behind the dam or the ability to release water from an upstream reservoir to produce power is a peaking system (MNR, 2002). Both systems are used on the Bonnechere River.

There are two water control structures (dams with no waterpower generation facility) on the main channel of the Bonnechere:

- Tramore Dam, at the lower end of Reach 8
- Golden Lake Dam, at the lower end of Reach 7

Table 5: Waterpower Dam Descriptions

Site	Waterway	Owner/ Operator	Installed Capacity (kW)	Nominal Head (m)	Maximum Flow Through Power Plant (cms)
Old Killaloe Mill	Brennans Creek	Vornweg Waterpower	50	5	1.4
Eganville	Bonnechere	Eganville Generation Corporation	840	5.5	19.7
Douglas	Bonnechere	Multistream Power Corporation	600	7	11.5
Renfrew 1	Bonnechere	Renfrew Power Generation	1000	12	9.9
Renfrew 2	Bonnechere	Renfrew Power Generation	1000	11.9	10.2

Table 6: Control Structure Descriptions					
Site	River	Owner/ Operator	Description of Dam	Control Structure Details	Drainage Area (km^2)
Tramore Dam Round Lake	Bonnechere	Renfrew Power Generation Inc.	sluice and weir wall	• 3-4.3 m (14') log sluices (8 logs per spillway) • 1-8.1 m (26'5") weir sill	1069
Golden Lake	Bonnechere	Renfrew Power Generation Inc.	sluice and weir wall	• 5-6.1 m (20') log sluices • 2 weir sills on both sides of dam	1450
Lake Clear	Bonnechere	Renfrew Power Generation Inc.	sluice and weir wall	• 2-4.9 m (16') log sluices • 1-16.2 m (53') weir sill	103

Other control structures on the Bonnechere River watershed include:

- Lake Clear Dam on Hurds Creek owned and operated by RPG
- The Killaloe Station Dam on Brennans Creek (not currently operated) owned by the Township of Killaloe, Hagarty and Richards

There are five electrical generation facilities on the Bonnechere River and its tributaries:

- Eganville Dam, owned by the Municipality of Bonnechere Valley and operated by the Eganville Generation Corporation
- Douglas Dam owned by Multistream Generation Corporation
- Renfrew Station 1, operated by Renfrew Power Generation, and owned by the Town of Renfrew
- Renfrew Station 2, operated by Renfrew Power Generation and owned by the Town of Renfrew
- Old Killaloe Mill station on Brennans Creek, a tributary that flows into Golden Lake on Reach 7, owned and operated by Vornweg Waterpower

See Tables 5 and 6 for summary information about these waterpower dams and control structures.

There are additional, small control structures on Smiths Creek, Brennans Creek and McGees Creek. These structures do not significantly impact flows or levels on the main channel of the Bonnechere River and are not included in this water management plan.

3.3 MUNICIPAL WATER FILTRATION AND SEWAGE TREATMENT

The river, its main tributaries and lakes are important sources of raw water for municipal supplies and assimilation of treated municipal waste-water discharges. The water control structures along the system can have a direct impact on municipal water withdrawal and affect the ability of the receiving stream to provide adequate *polishing* of treated *effluent*.

The central core of the Village of Killaloe draws ground water from one drilled bedrock well. The rest of the village is on private wells. The Killaloe Sewage Treatment Plant (STP) treats and discharges effluent into Coles Creek, which flows into Brennans Creek, which flows through the Killaloe Swamp, and into Golden Lake. The sewage treatment plant is not impacted by water levels on the Bonnechere River or Golden Lake.

Residents of Pikwàkanagàn are on individual wells and septic systems.

The village of Eganville draws water from the river, upstream of the dam, for municipal consumption. Treated sewage effluent is released downstream of the Eganville generating station.

Residents in the hamlet of Douglas draw water from individual wells, and discharge sewage through individual septic systems.

The Town of Renfrew draws water directly from the Bonnechere River upstream of the bridge and waterpower

Table 7: Ministry of Environment Summary of Minimum Flows, and Discharge Criteria for Bonnechere River Watershed Water Pollution Control Plants (WPCPs)

Water Pollution Control Plant (WPCP)	Design Capacity (1000 m^3/d)	Minimum Flow (m^3/s)	Discharge Criteria (mg/L)			
			BOD_5	TSS	TP	Ammonia
Killaloe WPCP	0.518	unknown (see note 2)	25	25	1	none
Eganville WPCP	1.080	0.68	25	25	1	5
Renfrew WPCP existing (see note 1)	8.640	unknown (see note 2)	25	25	0.8	none
Renfrew WPCP proposed for upgrades	9.500	see note 3	25	25	0.75	3 (Jun - Sep) 15 (Oct - May)

NOTES:

1. The Town of Renfrew WPCP was constructed in 1968 as a conventional primary treatment plant. In its Class Environmental Assessment document, the town is proposing to upgrade the existing facility to provide secondary-level treatment.
2. No information on file to indicate minimum flow (i.e. no assimilation capacity study)
3. Monthly river flows (*7Q20* low flow statistic) used in the receiving stream assessment for the Renfrew WPCP proposed expansion.

	J	F	M	A	M	J	J	A	S	O	N	D
Upstream Flow from Renfrew WPCP	3.78	4.10	5.63	8.84	4.46	4.16	2.18	3.08	2.51	3.76	4.21	3.21

Table 8: Water Taking Permits on the Bonnechere River Watershed (February 2004)

Permit #	Liters/Day Max	Days/Year	Hrs/Day Max	Liters/Min	Purpose	Source
94-P-4006	288,000	365	24	200	Water Supply	Well
82-P-4029	1,473,120	185	12	2,046	Industrial	Well
83-P-4020	62,150	200	5	227	Water Supply	Round Lake
89-P-4012	18,184,000	365	24	13,638	Water Supply	Bonnechere River
90-P-4060	2,070,000	365	24	2,000	Water Supply	Bonnechere River
91-P-4062	112,320,000	365	24	78,000	Hydro-Electric	Brennans Creek
92-P-4022	2,954,900	185	24	2,046	Industrial	Well
95-P-4052	980,640	150	24	681	Irrigation	Sherwood Lake

dams. The water is treated and returned with sewage effluent to the river system through the sewage treatment plant located downstream of the RPG dams and generating stations.

Other than the municipal water withdrawals referenced above, there are no other major industrial or municipal water takings along the river system that would significantly impact the river's base flow. Maintaining adequate flows during drought conditions is crucial in order to protect and maintain the river's natural functions and provide water to polish treated effluent from municipal sewage discharges. Table 7 provides a summary of the discharge criteria and minimum river flows needed to provide adequate mixing of the final effluent for each of the municipal sewage treatment plants along the system.

3.4 AGRICULTURE: IRRIGATION AND WATERING

Agriculture is an important economic sector in the Ottawa Valley and a way of life for many residents. Water is a critical resource for agriculture. Total water use for agricultural practices in Renfrew County ranges between 1.5 and 3.0 trillion liters per year (data converted from 1998 figures, Low Water Task Force Sub-Committee, Krentzwiser and de Loe, 1998). About 73 percent of this water is taken for livestock use. In Renfrew County, over 1,500 farms were recorded in the 1996 Agricultural Census (Statistics Canada). These farms covered an area larger than 166,700 ha. Agricultural statistics specific to the Bonnechere River watershed are not available.

There are numerous large-scale farming operations along the waters of the Bonnechere. In the Township of Admaston-Bromley alone, about 31,000 ha of land are used for agricultural purposes. Thousands of cattle, sheep, horses and other livestock are watered along the Bonnechere River and its tributaries. Many farms rely on groundwater wells for water supplies.

Currently only a few farming operations have irrigation systems installed. These are small-scale operations, found mostly in the Township of Horton.

Commercial farming and irrigation systems that take more than 50,000 liters per day require Water Taking Permits issued by the Ministry of the Environment (see Table 8 for a table of active permits to take water in the Bonnechere watershed). Water Taking Permits are not required for water taken for non-commercial farming or gardening purposes.

The Bonnechere River Water Management Plan recognizes the importance of agricultural activities and the future surface water needs and expectations of the agricultural community. Any growth or change in water demands for irrigation on the system may need to be considered through future amendments to the plan.

3.5 TOURISM AND RECREATION

Canadian, American and overseas tourists bring millions of dollars into the economy of Renfrew County every year.

Tourism and recreation outfitters operate in several areas along the Bonnechere. There are six private campgrounds and tourist resorts on Round Lake alone, with over 200 camping sites, cottages and cabins (Ontario Parks, 2001). Camping, hunting, fishing, boating, kayaking, snowmobiling and other activities are dependent on the river's resources and attract tourists from all across North America. On an average summer day over 600 people visit Bonnechere Provincial Park. *Ecotourism* is growing in popularity and economic significance. Activities throughout the watershed, such as bird watching, photography, canoeing, cave exploration at Bonnechere Caves and nature interpretation, contribute significantly to the economies of local communities.

3.6 COTTAGES AND RIPARIAN PROPERTIES

The cottaging community (seasonal residents) is significant throughout the Bonnechere watershed. Areas around Paugh Lake, Round Lake, Golden Lake, Wilber Lake, Lake Clear, Hurds Lake and many river sections along the Bonnechere system have considerable seasonal residence development.

There are approximately 450 property owners on Round Lake alone. Many of these residents enjoy the recreational benefits of the river and lakes throughout the year (Ontario Parks, 2001). There are approximately 350 seasonal residences on Golden Lake. Property associations are in place on Round Lake, Golden Lake and Lake Clear. Many seasonal residences are being converted to year-round homes.

4.0 WATER MANAGEMENT PLAN

4.1 INTRODUCTION

The operating regimes established for the control structures on the Bonnechere River are the operational tools that will ensure achievement of the flow and level regulation objectives of this water management plan.

The water management plan and the operating regimes are also intended to address, in a balanced way, the issues identified through the public consultation process.

One of the most consistent issues raised through this process was the lack of water flow and level information available to the public and interest groups. This issue has been addressed to some extent through the planning process. Waterpower partners will also implement on-going communications initiatives aimed at improving public access to information on flow and level management on the Bonnechere (see Section 4.2.1).

The water management plan also takes into account other important issues, recommendations and solutions that were gathered over the course of the planning process. The following topics were at the forefront of discussions and were considered at all stages of development of the operating regimes for each of the control structures on the river:

- ecological and fish and wildlife habitat concerns
- human health and safety
- rights of holders of permits to take water
- riparian rights
- water needs for municipal and other large-scale uses
- agricultural activities
- stable production of waterpower

4.2 PLAN IMPLEMENTATION

This water management plan will be implemented immediately after approval and signing, with the following agencies responsible for specific elements of the implementation:

- Standing Advisory Committee (monitoring)
- Waterpower producers (operational implementation)
- MNR (monitoring, enforcement, amendment review)

4.2.1 COMMUNICATIONS INITIATIVES

Recognizing the need for improved communications and information distribution, the waterpower producers on the Bonnechere River will implement the following communications initiatives:

- Internet Web Site – Operating regime details for each control structure and current flow and level information (updated weekly or immediately in the case of major adjustments) will be provided through an Internet Web site.
- Phone Response – Waterpower operators will respond to and track all phone requests for flow and level information from the public.
- Waterpower producers will promote the Internet Web site and phone response system with the public and stakeholders on the Bonnechere River.
- This water management plan will be available in printed form and on CDROM from the waterpower producers and from MNR.

4.2.2 STANDING ADVISORY COMMITTEE

A public Standing Advisory Committee (SAC) will advise on the implementation of this water management plan and issue annual reports, identifying and addressing any implementation issues encountered. The SAC annual report will reference progress on any action items and associated information needs arising from the issues discussed in Section 5. The SAC will also take part in the amendment process for the water management plan.

4.2.3 EFFECTIVENESS MONITORING

Waterpower producers will ensure that their operations at all water control structures and generating facilities comply with the operating regimes described in Section 4.6 of this WMP. Operations for each waterpower and control structure will be monitored to ensure that the new operating regimes meet the goals and objectives of the WMP.

In some very specific locations, for very specific purposes, flows and levels are closely managed and monitored. These are identified in the effectiveness monitoring plan (see Section 6.1).

Some of the issues identified in the planning process could not be addressed through effectiveness monitoring because of a lack of baseline data. These are addressed as information needs (see Section 6.2).

The owners of the waterpower facilities and water control structures will be responsible for conducting effectiveness monitoring, with technical support from MNR and other stakeholders (MNR, 2002). The monitoring program procedure, schedule and reporting methods will be agreed to by MNR and the waterpower producers and may involve recommendations of the SAC. Monitoring results will be assessed by MNR.

4.2.4 PLAN ENFORCEMENT & COMPLIANCE

Dam owners must ensure that their facilities are operated in accordance with the operating requirements of this water management plan. This legal requirement is set out in Section 23.1(7) of the *Lakes and Rivers Improvement Act* (LRIA).

The flow and level requirements in this water management plan are mandatory. Enforcement action may be taken where these requirements are not met.

Dam owners are also responsible for on-going self-monitoring, and are required to report any deviations from the WMP to MNR. The mandatory self monitoring requirements of this plan include:

- The dam owner will report any deviations from the operating requirements of the water management plan (e.g. any operations outside the operating regimes described in Section 4.6) to MNR (verbal report within 24 hours, and written report within 10 working days) providing details on the following:
  - the nature of the incident
  - why it happened
  - what is being done to bring the operation back into compliance with the plan
  - how long it will be before the operation is back in compliance
- The dam owner will maintain and retain records of all level and flow information, and will create and maintain a permanent archive of those records for future reference.
- The dam owner will provide level and flow records to MNR as set out in Section 4.6, and at any time upon request.
- The owner will submit an annual report summarizing the operational compliance history for the structure(s) within 30 days of the end of each year.
- All written flow and level compliance reports will be signed and dated by the dam owner or a designate.

MNR will also from time to time monitor compliance through periodic site inspections (as set out in Section 20 of the LRIA), audits and investigations of public complaints. Nothing in this WMP precludes the Minister from making further orders under the LRIA.

4.3 PLAN TERM, REVIEW AND AMENDMENTS

The original term of this plan was for a ten year period from September 2004 to September 2014, with a plan review to be initiated in 2012, two years prior to the plans expiry. The plan was extended in September 2014 for 18 months to ensure the plan provisions remain in effect, while providing time for draft policies under the *Lakes and Rivers Improvement Act* to be finalized.

An unscheduled plan review may be required at any time if an issue develops that justifies a comprehensive reassessment of the whole plan.

Amendments to the WMP can also be made during the term of the plan provided the outcomes remain consistent with the goals and objectives of the WMP. The SAC will review and advise on new information as it is gathered. If new information indicates that operating regimes need to be adjusted, using the formal amendment process, MNR will issue an order to amend the WMP (MNR, 2002). The SAC will be given an opportunity to comment on plan amendments.

Three categories of amendments are provided:

- administrative
- minor
- major

The amendment process involves:

(a) submission of a request for an amendment

(b) review of the request by the MNR District Manager, with advice from the Standing Advisory Committee

(c) acceptance or denial of the request by the Regional Director

(d) if acceptance, assignment of a category to the amendment by the Regional Director

(e) completion of all applicable planning requirements, including public consultation

(f) record-keeping requirements

4.3.1 AMENDMENT REQUEST

Any request must be accompanied by sufficient information to allow the MNR Regional Director 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

4.3.2 REVIEW OF AMENDMENT REQUEST AND CATEGORIZATION OF AMENDMENT

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

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

- whether there are legitimate time constraints which must be met for reasons of public safety, biological 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. The MNR Regional Director will prepare a written decision, and any disagreements with the categorization of the amendment, will be recorded in that written decision.

4.3.3 ADMINISTRATIVE AMENDMENTS

If the MNR Regional Director decides that a proposed amendment should proceed, and that the appropriate category of amendment is administrative, the MNR Regional Director 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

4.3.4 MINOR AMENDMENTS

If the MNR Regional Director 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, the MNR Regional Director will issue a Notice of Minor Amendment Inspection which indicates that the proposed minor amendment is available for inspection at the appropriate MNR area or district office.

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 Protection of 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 minor amendment.

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

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

If an issue arises during the preparation and review of the minor amendment, the issue and dispute resolution procedure described in Section 4.3.7 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 4.3.3), as well as documentation of the results of the formal public consultation opportunity for inspection of the amendment.

4.3.5 MAJOR AMENDMENTS

If the MNR Regional Director 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 the 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*
- 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 notice be place on the EBR's 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 approved by the MNR Regional Director.

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 notice be placed on the EBR's Environmental Registry.

If an issue arises during the preparation of a major amendment, the issue resolution procedure described in (Section 4.3.7) will apply, with whatever modifications are necessary in the circumstances.

Documentation requirements for major amendments include the same requirements as for administrative amendments (see Section 4.3.3), 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.

4.3.6 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.

4.3.7 ISSUE AND DISPUTE RESOLUTION

Anyone with an interest in the management of flows and levels on the Bonnechere River may raise an issue through the following issue and dispute resolution process.

(a) The concerned person must identify the issue with the waterpower industry representatives, preferably in writing, and offer a proposed solution

(b) The waterpower representative(s) will meet with the concerned person to attempt to resolve the issue. If they do not, the representative(s) will communicate the issue in writing to the lead MNR District Manager and the SAC

(c) The District Manager will arrange a meeting with the waterpower representative(s), the concerned person, and one or more SAC members

(d) If the meeting does not produce a solution, the waterpower representative(s), the concerned person, and the SAC will be asked to recommend a solution, normally within 30 days, and the District Manager will normally make a decision in a further 30 days

(e) If the concerned person and/or the waterpower representative(s) are dissatisfied with the decision, a request may be made for a review by the MNR Regional Director, who will carry out and render a decision, normally within 30 days

4.4 ISSUES AND RESPONSES

Through the consultation process, a series of issues have been identified. These issues are an important product of the review process and form a critical part of the water management plan. Identification and analysis of issues provides an opportunity to achieve collaborative results in the water management plan that are intended to ensure that all values on the river system are considered in the development and implementation of flow and level regimes.

Some of the issues raised point to concerns that are common across the entire watershed. Others are more specifically related to one reach or local area.

Some of the issues raised come from a lack of information about how and why water flows and levels are manipulated, or about the impact of specific water level or flow conditions.

Each of these issues has been discussed and analyzed in the review process and in the development of this water management plan. Each issue has been addressed through one or more of the following actions:

- a written response
- identification of an information need
- a direct action

Some issues have a combination of the above actions associated with them, for example a written response and a direct action.

Other issues raised, that are not related to water levels and flows and therefore could not be addressed in this plan, have been referred on to other agencies (e.g. water quality, boat speeds on lakes and rivers).

To document the issue analysis process and the results, the issues raised are included in Section 5 of this plan, structured as follows:

- 18 general issues common to three or more reaches on the watershed, numbered 0.1 to 0.18
- No issues specific to Reach 10
- No issues specific to Reach 9
- 8 issues specific to Reach 8, numbered 8.1 to 8.8
- 8 issues specific to Reach 7, numbered 7.1 to 7.8
- 4 issues specific to Reach 6, numbered 6.1 to 6.4
- 2 issues specific to Reach 5, numbered 5.1 to 5.2
- 1 issue specific to Reach 4, numbered 4.1
- 3 issues specific to Reach 3, numbered 3.1 to 3.3
- 2 issues specific to Reach 2, numbered 2.1 to 2.2
- No issues specific to Reach 1

4.5 DISSENTING OPINIONS

It is seldom possible to reach full agreement from all parties in a review of this nature, involving complex issues, overlapping or competing interests, and very strong views.

Understandably, some issues raised in the process of developing this water management plan, have not been addressed with the unanimous support of the Public Advisory Committee (PAC).

Table 9: Operational and Other Constraints for Each Dam and Control Structure

Waterpower Company + Dam or Facility		Constraints
Renfrew Power Generation Inc.		
	Tramore Dam	• upper flooding limit of Licence of Occupation (LO) • dam capacity, limited capacity to evacuate water quickly from Golden Lake • operations at Douglas Dam • manual operation
	Golden Lake Dam	• upper flooding limit of LO • bedrock bottleneck and restriction upstream of dam • operations at Douglas Dam • dam capacity • manual operation
	Renfrew Dam and Station 1	• dam capacity • town water intake • town sewage inputs
	Renfrew Dam and Station 2	• dam capacity • town water intake • town sewage inputs
	Lake Clear Dam	• upper flooding limit of LO • beaver dams and restriction at outflow from lake • limited drainage area • manual operation
Eganville Generation Corporation		
	Eganville Dam and Station	• operations at Douglas Dam • village water intake • village sewage outlet • limited storage capacity
Multistream Power Corporation		
	Douglas Dam and Station	• remotely controlled run-of-the-river operation
Vornweg Waterpower		
	Old Killaloe Mill	• limited storage capacity • seasonal variation in available flow

The PAC recognized during the planning process that there would likely be some issues that could not be resolved with full consensus. For that reason the PAC terms of reference (see Appendix 3) included a process for addressing dissenting opinions.

Dissenting opinions are included in Appendix 5 of this water management plan.

4.6 OPERATIONAL CONSTRAINTS, REACH DESCRIPTIONS AND OPERATING REGIMES

This section discusses the operational constraints, reach descriptions and new operating regimes used in the management of levels and flows on the Bonnechere.

It is important to note that there were no existing operating regimes for the control structures on the Bonnechere River prior to the development of this WMP. Flow and levels have historically been managed through the operating practices of control structure owners, primarily Renfrew Power Generation (RPG), which controls levels on Round Lake, Golden Lake and Lake Clear.

Operational constraints have increased and become more complex since the first major control structure was established on the Bonnechere in 1913, in response to increases in development along the river, the construction of pollution control (sewage treatment) plants, changes in Ontario's electricity system, growth in the recreation and tourism sector, and increased awareness of the need to protect ecological values.

Licences of Occupation have been issued to RPG, authorizing them to flood to certain elevations on these lakes.

RPG operates and maintains two dams and generating stations, as well as three water control structures which all influence water levels and flows on the Bonnechere River.

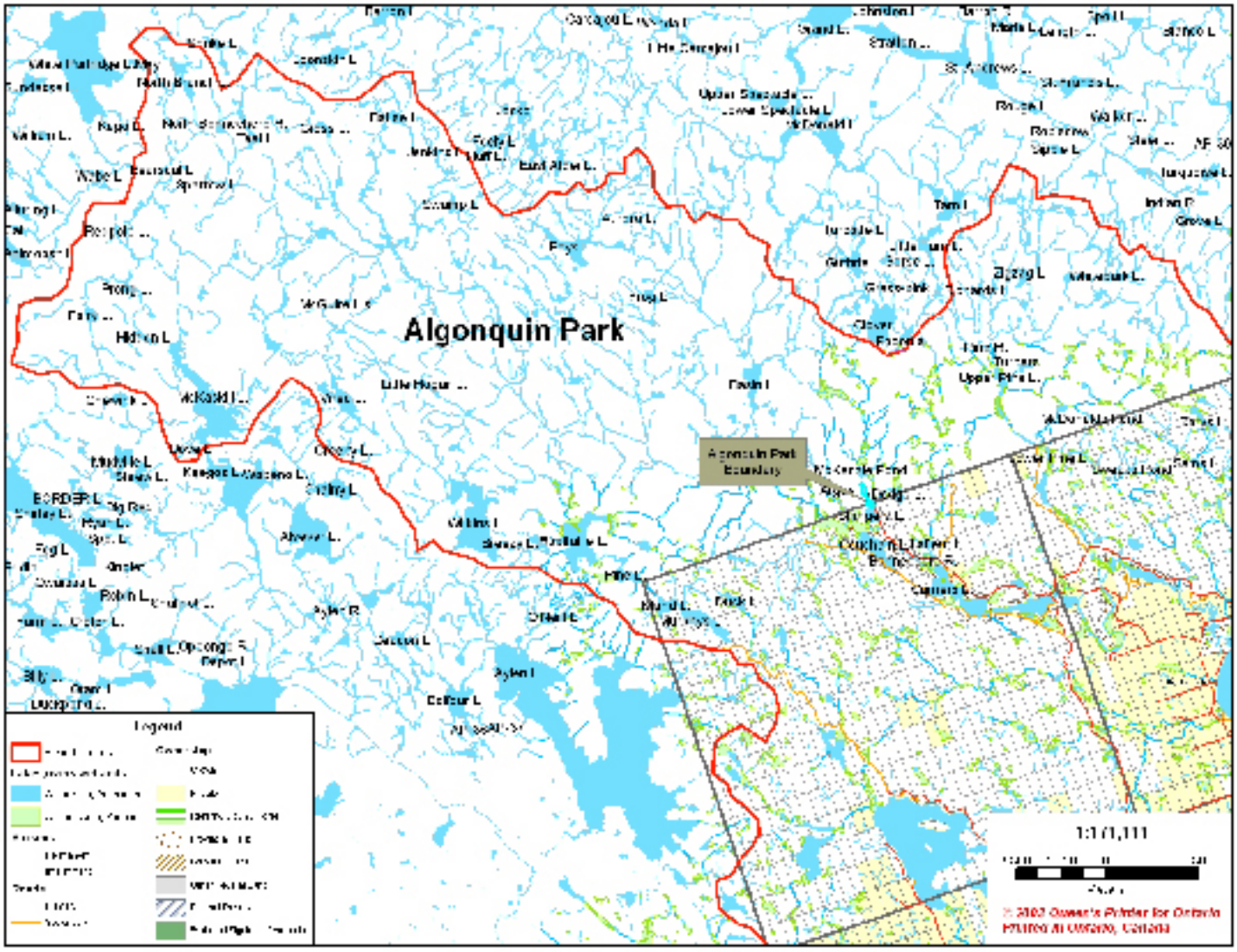
The other waterpower companies on the Bonnechere have never been granted Licenses of Occupation and operate as run-of-the-river facilities.

See Table 9 for a summary of operational and other constraints that influence how each dam and generating facility is managed.

See Appendix 2 for 13-year operating levels (1990 to 2002) on Round Lake and Golden Lake.

Figure 5:

Reach 10 — Algonquin Park



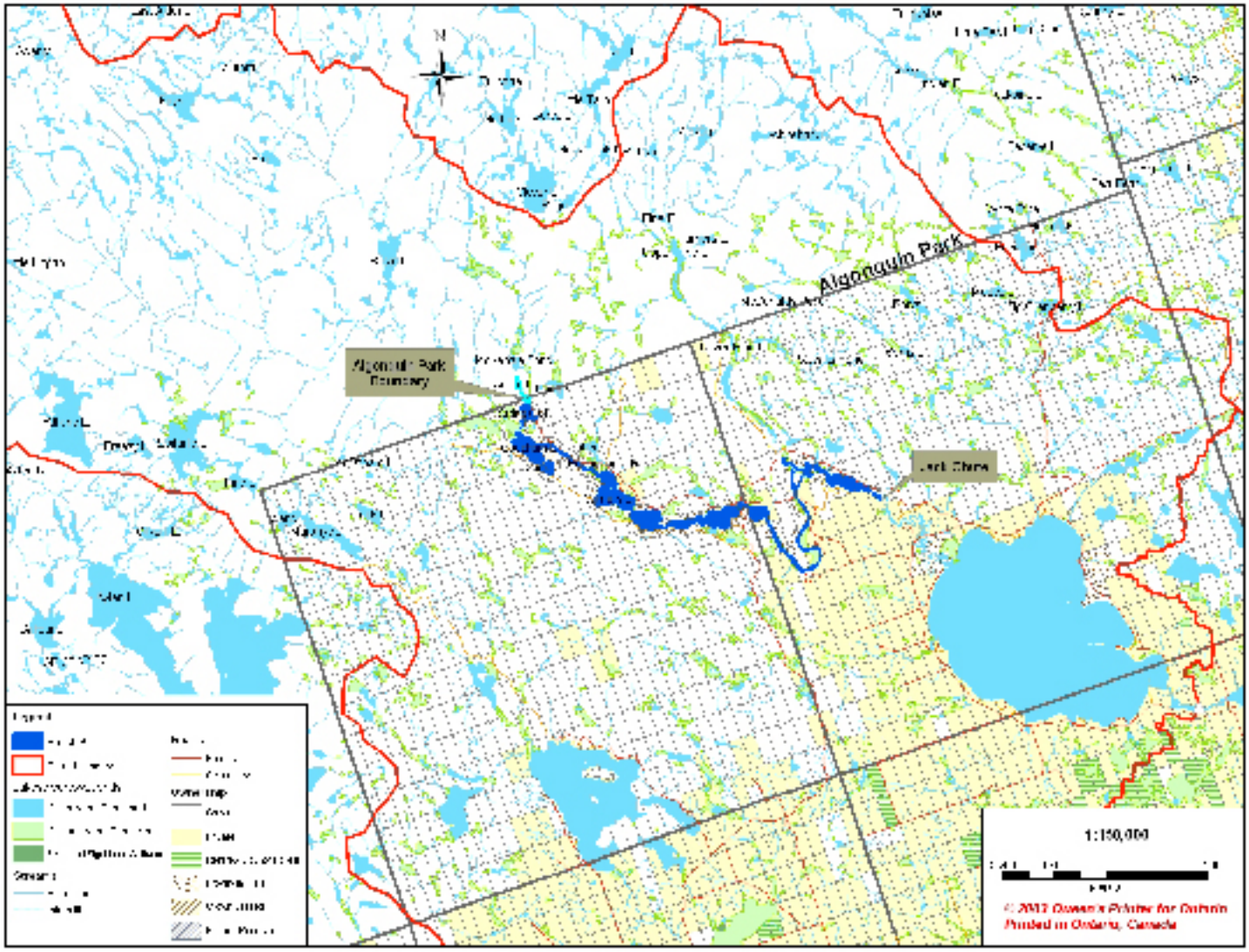
4.6.1 REACH 10: ALGONQUIN PARK

The headwaters which feed the Bonnechere River system find their source in Algonquin Provincial Park, including McKaskill Lake, Fairy Lake, Prong Lake, Basin Lake, Robitaille Lake and North Branch. This reach is very characteristic of the Canadian Shield where the shallow soils expose large areas of underlying bedrock. The lakes and streams are clean and cold, supporting self-sustaining brook trout populations. Further downstream, High Falls and other sets of small rapids are an impasse to canoeists, even in the spring. As the river collects and flows towards Basin Depot, once a thriving logging depot, the Bonnechere River becomes relatively shallow, narrow, even boggy. At Basin Depot there are remnants of a wooden dam which had been used to manipulate the water level on this stretch of the river during the spring log drives throughout the 1800s.

No other water control structures or dams are present. Currently there are no proposals for waterpower generation or other development relative to this water management plan. No issues were raised on this reach during the development of this water management plan. The undeveloped nature of this section of the Bonnechere will be maintained through Algonquin Provincial Park's management plan.

Issues & Information Needs
No issues were identified which apply exclusively to this reach of the river.
No information needs were identified for this reach of the river.

Figure 6: **Reach 9: Algonquin Park to Jack Chute**



4.6.2 REACH 9: ALGONQUIN PARK TO JACK CHUTE

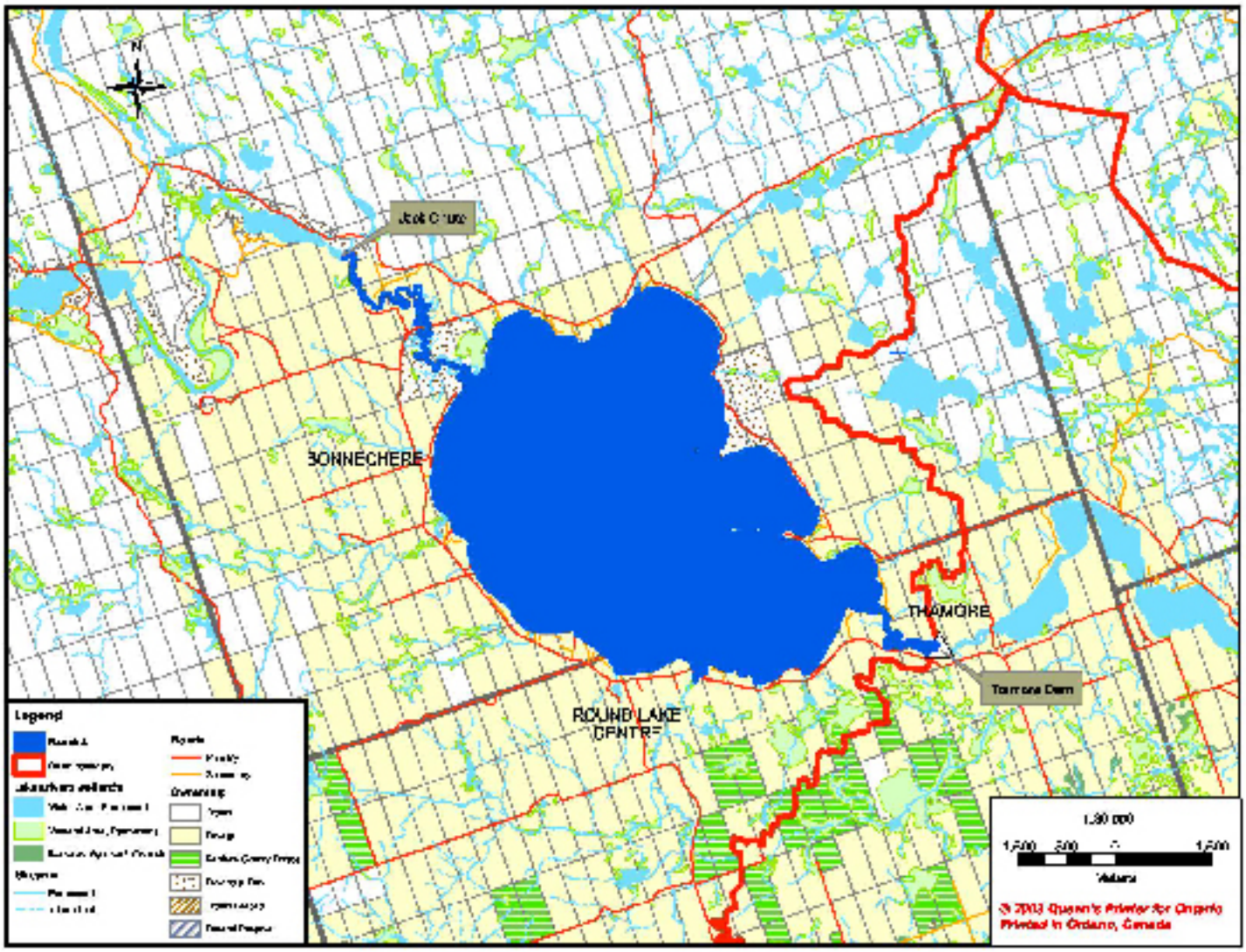
In this reach the Bonnechere River flows first through the geographic township of Burns, then Richards, from the border of Algonquin Provincial Park to Jack Chute Rapid. This section of the River takes slow turns across the surface of the *glacial spillway* and delta, believed to have been forming over the last two million years and especially around 10,000 years ago. Glacial processes left behind a legacy of natural features including Squaw Rock, the Couchain Lakes, numerous wetlands, the Pine River (a major tributary), Jack Chute Rapid, and numerous sandy beaches. Bonnechere River Provincial Park, a 1,200 ha waterway park is explored by foot, boat, and canoe by many tourists, and provides excellent camping.

Sport fish communities in these waters consist mainly of northern pike, small and largemouth bass (also see Table 4 for a list of fish species by reach). White-tailed deer in the surrounding deer yards cross the ice on the Bonnechere River during their annual winter migrations between Round Lake Centre and Algonquin Provincial Park.

Issues & Information Needs
No issues were identified which apply exclusively to this reach of the river.
No information needs were identified for this reach of the river.

Figure 7:

Reach 8: Round Lake



4.6.3 REACH 8: ROUND LAKE (JACK CHUTE TO TRAMORE DAM)

This reach stretches from Jack Chute Rapids, includes Round Lake, and ends at the Tramore Dam. This reach is also located on the Canadian Shield. The river meanders above Round Lake, through Bonnechere Provincial Park, and forms wetlands and oxbows before it spills into Round Lake. These areas of slowly moving water provide excellent habitat for various reptiles, amphibians, waterfowl and diverse vegetation, and are important fish nursery areas. Reserve Creek, Jacks Creek, Turners Creek, the Sherwood River (historically referred to as the Little Madawaska) and Byers Creek are the other main tributaries to the Bonnechere River and Round Lake. An expanse of 3074 ha, and boasting an average depth of 13.2 m (Ontario Parks, 2001), Round Lake is home to many cottagers and year-round residents. There is a mixed fish community in this river reach. Other notable fauna using the Bonnechere in this reach include: the green, mink and northern leopard frog, the bullfrog, American toad, gray treefrog, midland painted turtle, Blanding's turtle, common snapping turtle, northern water snake, red-bellied snake, beavers, loons, muskrat, and various ducks (Ontario Parks, 2001).

The Tramore Dam was installed in 1913 in response to a demand for waterpower during the summer months to supply industrial operations in the Town of Renfrew.

The management of Reach 8 and the Tramore Dam has evolved over many years. Operations have been influenced by growth in demand for waterpower on a provincial level, and by the needs and issues created through property development along the river and on Round Lake.

Table 10: Round Lake Operating Regime Information Table, as amended, December 2009

	Upper Limit	Lower Limit	Rationale
Weeks 1 to 7	171.08 to 170.9	170.1	• Gradual down-ramping is required to provide increased storage capacity for the spring freshet and to protect against ice damage to shorelines. • Gradual down-ramping also provides power production opportunities.
Weeks 8 to 13	170.9 to 170.77 to 171.08	170.1	• The water level during this period is driven by two critical issues: lake trout reproduction, and the potential for spring flooding. • The intent of the lower limit during this period is the proteciton of incubating lake trout eggs. Drawdown below 170.1 will impact an increasing number of incubating eggs (see Issue 8.8 in Section 5.1).
Weeks 14 to 27	171.08 to 171.23	170.1 to 170.62	• There will be an increase in the water level during this period, based on spring freshet conditions. • This is a critical period for collecting the water in Round Lake that will provide adequate levels and flows for all users on the lake and downstream both during this period and for the following summer months. For this reason, the upper level of the operating regime, which is set at 171.08 from weeks 14 to 17, rises to 171.23 between weeks 18 and 27. • The operating regime for weeks 12-25 is designed to provide adequate water flow over Tramore Dam to ensure protection of walleye spawning beds.
Weeks 28 to 37	171.23 to 171.08	170.62	• This is a period of reduced precipitation during which the water levels on Round Lake are gradually lowered to meet the needs of all users on the lake and downstream.
Weeks 38 to 52	171.08 to 170.83 to 171.08	170.62 to 170.47 to 170.1	• Starting at week 38 the lower limit on the operating regime drops from 170.62 to 170.47 and then to 170.1 to provide capacity for fall rains, and to prepare for winter down-ramping. • In weeks 38 to 44, there is a gradual drop in the upper limit on the operating regime to create capacity for fall rains. • After week 44 the upper limit increases gradually to collect water for winter power generation.

All Level References are meters above sea level (asl)

The new operating regime for Reach 8 attempts to accommodate a wide range of river values, such as environmental and ecological values, growing concerns of residents and communities, and a need for continued sources of sustainable energy.

Typical Operating Line

There is a Typical Operating Line associated with the operating regime for this reach. This line was developed using average historical data and plan objectives and is included with this operating regime to provide an indication for the public of where water levels may be under typical conditions.

The Typical Operating Line is not a mandatory or enforceable operating requirement in this water management plan.

Reach 8 Issues
There are 15 general issues that apply to this reach of the river. See Section 5.1.
There are eight issues that apply specifically to this reach of the river. See Section 5.4.
Reach 8 Information Needs
Five general information needs have been identified that apply to this reach of the river. See the Information Needs Table in Section 6.2.
Ten information needs have been identified that apply specifically to this reach of the river. See the Information Needs Table in Section 6.2.

Figure 8: Round Lake Operating Regime, as amended, December 2009

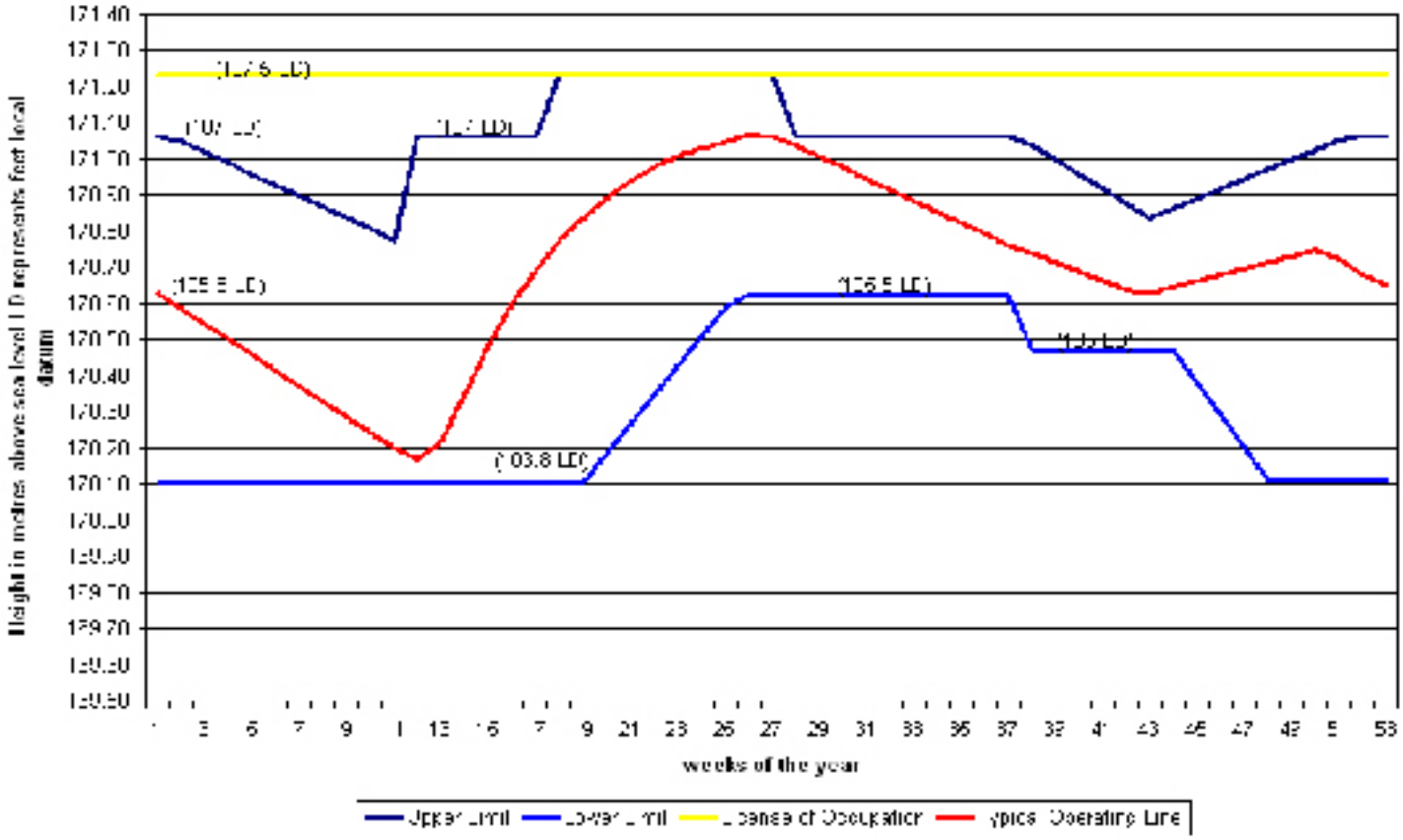


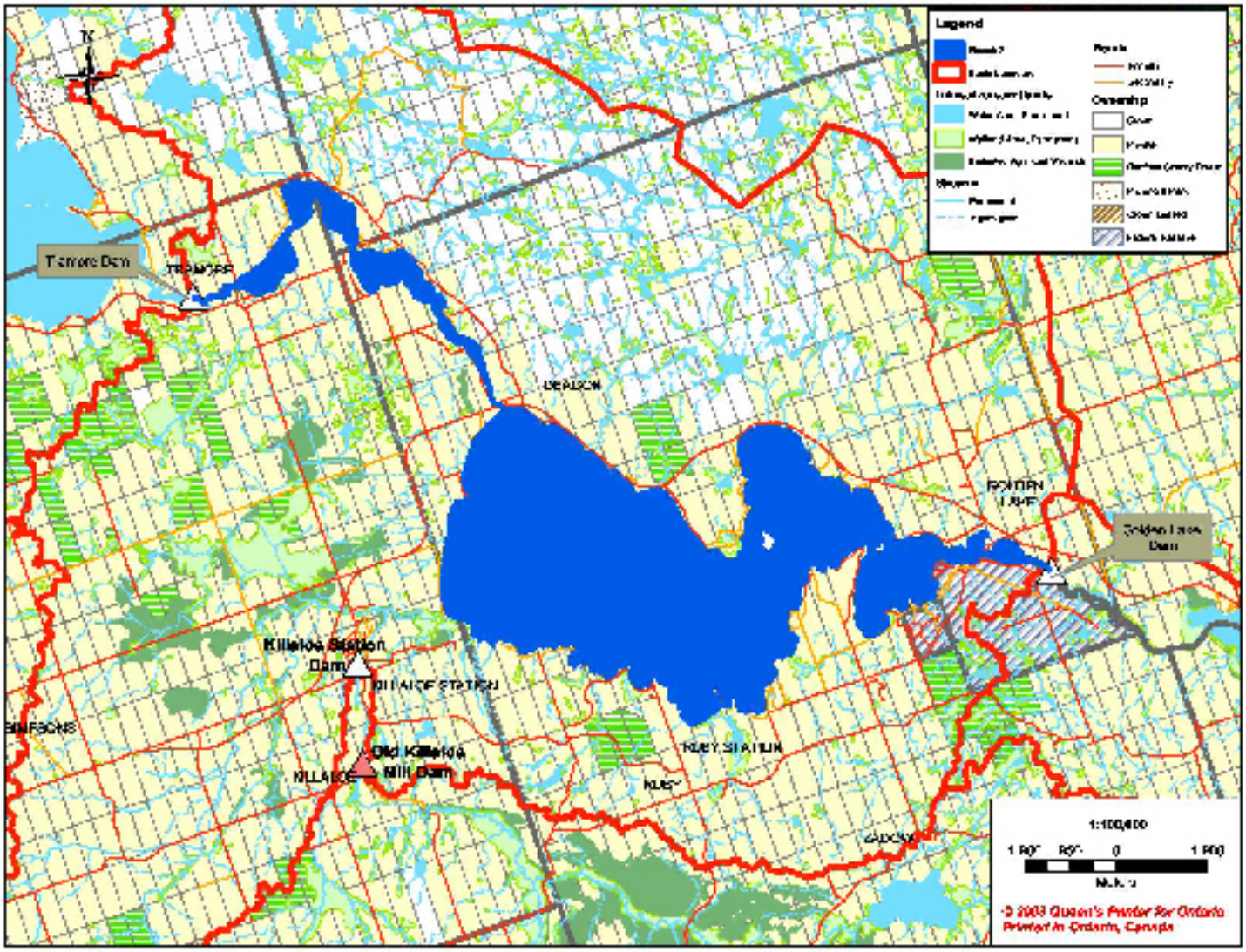
Table 11: Reach 8 Tramore Dam Operating Requirements Table		
Operating Requirements		
	Operating Regime Upper and Lower Limits The operator will manage flows and levels to stay within the upper and lower limits of the operating regime for this reach.	Mandatory
	Minimum Flows The operator will maintain minimum flows at all times by ensuring that historic flows are continued through each structure, through flow manipulations or leakage.	Mandatory (see Sect. 2.5.3)
Monitoring and Reporting Requirements		
	Daily monitoring and recording of water levels (daily reading is an average of all values recorded in a 24 hour period) on the upstream side of the Tramore Dam through an electronic gauge located on the structure.	Mandatory
	Daily monitoring and recording of water flows through the Tramore Dam.	Best Practice
	Reporting of any deviations from the operating requirements of the water management plan to MNR within 24 hours, providing details on the following: - the nature of the incident - why it happened - what is being done to bring the operation back into the approved operating range - how long it will be before the operation is back into the approved operating range	Mandatory
	Weekly reporting to MNR in electronic format (spreadsheet by e-mail), records of all daily level readings as well as flows where monitored in the operations of the Tramore Dam.	Mandatory

Tramore Dam

Assessing fisheries on Round Lake

Figure 9:

Reach 7: Golden Lake



4.6.4 REACH 7: GOLDEN LAKE (TRAMORE DAM TO GOLDEN LAKE DAM)

The Golden Lake reach begins below Tramore Dam, includes several bays along the river and Golden Lake, and ends at the Golden Lake Dam, near the Algonquin community of Pikwàkanagàn. As early as 1857, representatives of the Algonquin people petitioned for land grants along Golden Lake, where the current Algonquin community is located (Mackay, 1996). The Algonquins of Ontario rely on the Bonnechere River and its lakes for wild rice, fish and waterfowl, and on its shores for continuing a variety of cultural activities. Golden Lake, one of the largest lakes in Renfrew County, has a severely declining walleye population. A total walleye sportfishing and harvest closure was put in place for 2002-2006 inclusive. There are several sport fish in this reach (see Table 4). Other than the main channel of the Bonnechere, the main streams that feed this flat, *post glacial lake* are Coles Creek, Brennans Creek, Browns Creek and Cochrane Creek. The Deacon Escarpment (an Area of Natural and Scientific Interest) is on the northern shore. Herring and ring-billed gull colonies flock to islands on Golden Lake. White-tailed deer seek winter shelter in deer yards on the north shore. A Provincially Significant Wetland (PSW), Killaloe Swamp, is located on the western shore of Golden Lake. The village of Killaloe draws drinking water from communal wells. The Killaloe sewage treatment facility discharges effluent into Cole's Creek.

There is a water control structure at Killaloe Station, owned by the Township of Killaloe, Hagarty and Richards. This structure is not operated and has no impact flows and levels on the main channel of the Bonnechere River.

Table 12: Golden Lake Operating Regime Information Table as amended in 2009

	Upper Limit	Lower Limit	Rationale
Weeks 1 to 9	169.41 to 169.21 ↘	168.71 →	• Gradual down-ramping of the upper limit is required to provide increased storage capacity for the spring freshet and to protect against ice damage to shorelines.
Weeks 10 to 21	169.21 to 169.44 ↗	168.71 →	• The water level during this period is driven by the potential for spring flooding. • Water level manipulations (in consultation with MNR) may be required during this period to promote walleye spawning upstream and downstream of the Golden Lake Dam and downstream of the Tramore Dam.
Weeks 22 to 28	169.44 to 169.41 ↘	168.71 to 169.1 ↗	• There will be an increase in the water level during this period, based on spring freshet conditions. • This is a critical period for collecting the water in Golden Lake that will provide adequate levels and flows for all users on the lake and downstream both during this period and for the following summer months. For this reason, the upper level of the operating regime rises to 169.44 between weeks 9 and 27.
Weeks 29 to 43	169.41 →	169.1 to 168.71 ↘	• This is a period of reduced precipitation during which the water levels on Golden Lake are gradually lowered to meet the needs of all users on the lake and downstream. • By week 44 the lower limit on the operating regime drops from 169.1 to 168.71 to provide capacity for fall rains and to get through the critical end-of-summer dry season.
Weeks 44 to 52	169.41 →	168.71 →	• Maintenance of the 168.71 for the fall leading into the winter provides for increased storage capacity for the spring freshet.

All Level References are meters above sea level (asl)

Golden Lake Dam

The existing Golden Lake Dam was constructed in 1932 with an objective of increasing storage capacity to the system for the purpose of power generation.

The outlet of Golden Lake is a natural (shallow) constriction on the Bonnechere system. This constriction influences operating regimes both upstream and downstream because of the limited ability to release water quickly.

The new operating regime for this reach attempts to address the issues created by the flow constriction through changes to typical spring operations. Water levels in late winter and early spring will be lower than traditional levels.

Typical Operating Line

There is a Typical Operating Line associated with the operating regime for this reach. This line was developed using average historical data and plan objectives and is included with this operating regime to provide an indication for the public of where water levels may be under typical conditions. The Typical Operating Line is not a mandatory or enforceable operating requirement in this water management plan.

Reach 7 Issues
There are 15 general issues that apply to this reach of the river. See Section 5.1.
There are eight issues that apply specifically to this reach of the river. See Section 5.5.
Reach 7 Information Needs
Five general information needs have been identified that apply to this reach of the river. See the Information Needs Table in Section 6.2.
11 information needs have been identified that apply specifically to this reach of the river. See the Information Needs Table in Section 6.2.

Figure 10: Golden Lake Operating Regime as amended in 2009

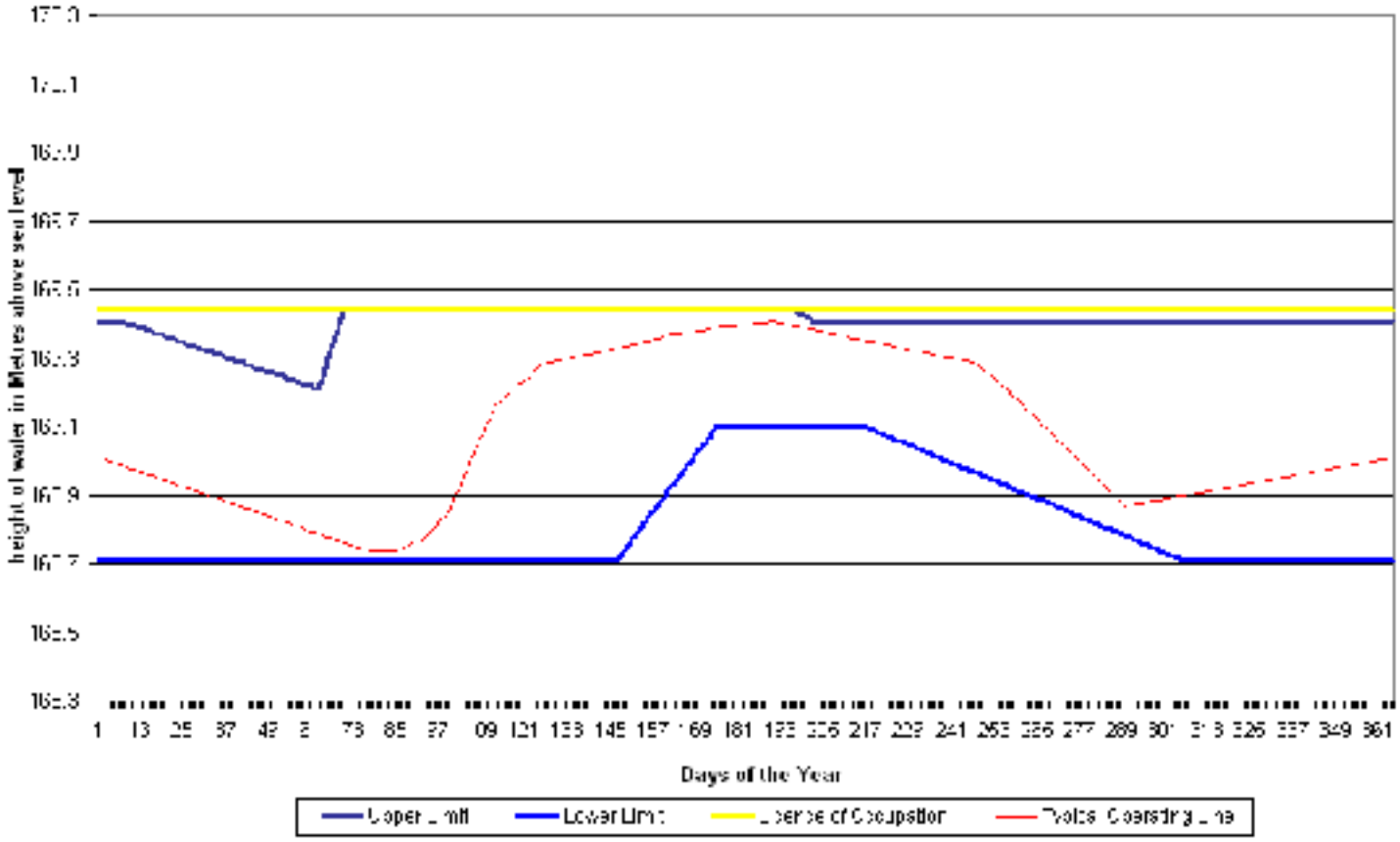


Table 13: Reach 7 Golden Lake Dam Operating Requirements Table		
Operating Requirements		
	Operating Regime Upper and Lower Limits The Operator will manage flows and levels to stay within the upper and lower limits of the operating regime for this reach.	Mandatory
	Minimum Flows The operator will maintain minimum flows at all times by ensuring that historic flows are continued through each structure, through flow manipulations or leakage.	Mandatory (see Sect. 2.5.3)
Monitoring and Reporting Requirements		
	Daily monitoring and recording of water levels (daily reading is an average of all values recorded in a 24 hour period) on the upstream side of the Golden Lake Dam through an electronic gauge located on the structure.	Mandatory
	Daily monitoring and recording of water flows through the Golden Lake Dam.	Best Practice
	Reporting of any deviations from the operating requirements of the water management plan to MNR within 24 hours, providing details on the following: - the nature of the incident - why it happened - what is being done to bring the operation back into the approved operating range - how long it will be before the operation is back into the approved operating range	Mandatory
	Weekly reporting to MNR in electronic format (spreadsheet by e-mail), records of all daily level readings as well as flows where monitored in the operations of the Golden Lake Dam.	Mandatory

Old Killaloe Mill

This reach includes a small, independent power station on Brennans Creek run by Vornweg Waterpower (installed capacity 50 kW, see Table 5), located in Old Killaloe. This structure has minimal impact on levels and flows within Reach 7. The operating regime of this structure has historically followed seasonal fluctuations in water levels on the creek. The new operating regime for this station retains a dependence on seasonal flows but attempts to achieve a specific water level range at the dam and a minimum flow in the creek.

The Old Killaloe Mill Dam has been operated by Vornweg Waterpower since 1991. The headpond level is generally maintained within a one-metre range below the crest of the dam. In dry years and often through the summer, the headpond level drops (e.g. 12 to 24 mm daily) due to decreased inflows and increased evaporation. No fish and wildlife issues have been identified in connection with the operation of this facility.

Operating Regime:

Spring: In early spring logs are pulled in preparation for the freshet while the turbine runs at full capacity (45 kW). Water level remains high from April through June.

Summer: As water inflows slow down, logs are replaced and turbine output is adjusted (as low as 10 kW). The turbine runs on and off for several hours each day depending on water availability, until it is stopped altogether. A minimum flow is maintained through the dam and power house (see section 2.5.3).

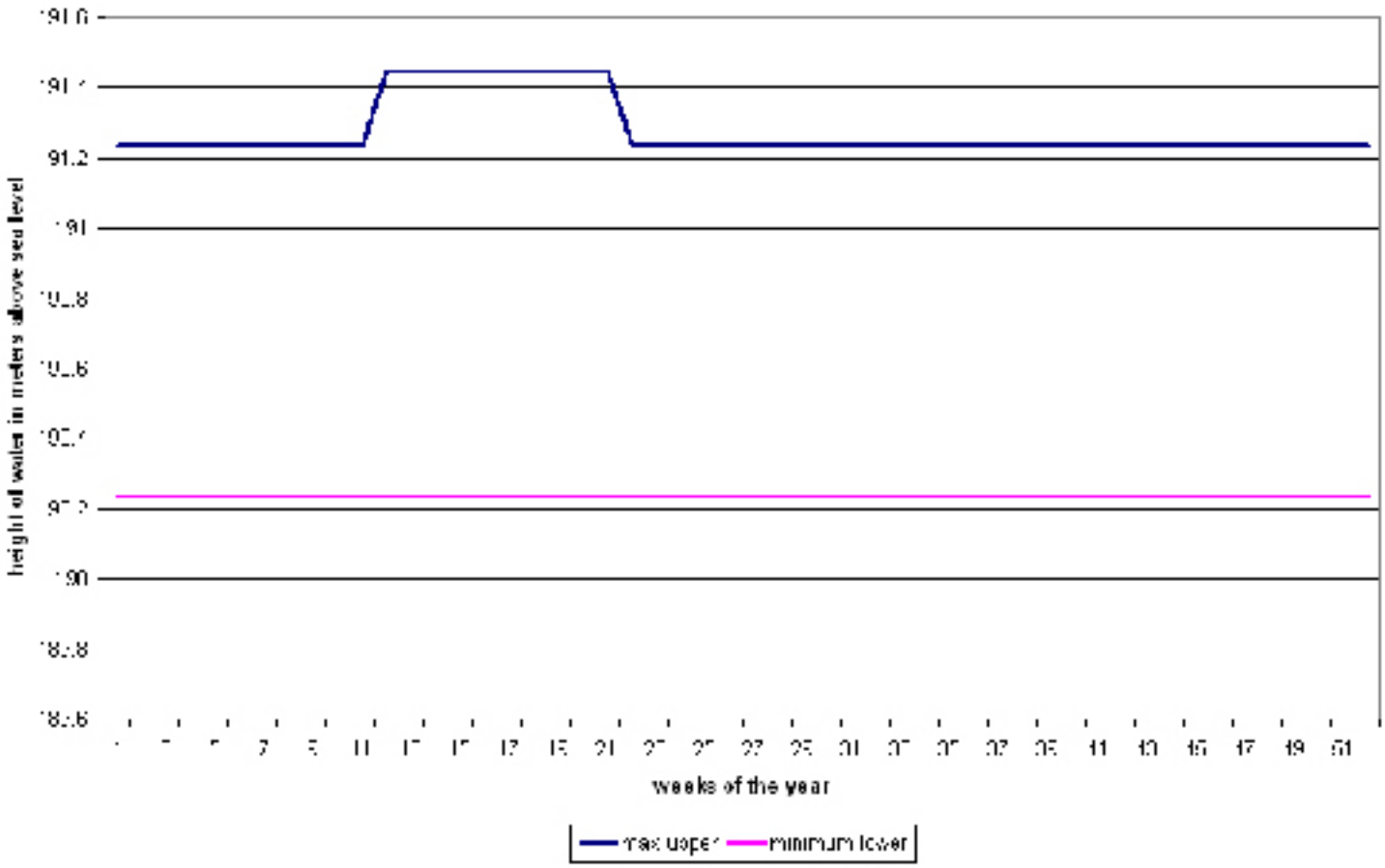
Fall: As fall rains refill the headpond, the turbine is run at approximately half its maximum capacity (20 kW) and the headpond is maintained approximately .6 m below the crest of the dam.

Winter: As water flow decreases through the winter, turbine output is adjusted and the pond level drops to approximately 1 m below the crest of the dam.

The Vornweg Dam does not currently have the potential to significantly influence water levels and flows on the main channel of the Bonnechere River. For this reason, the monitoring and reporting requirements for this structure are lower than those associated with the main-channel structures.

Table 14: Reach 7 Vornweg Dam and Power Station Operating Requirements Table		
Operating Requirements		
	Operating Regime Upper and Lower Limits The operator will manage flows and levels to stay within the upper and lower limits of the operating regime for this reach.	Mandatory
	Minimum Flows The operator will maintain minimum flows at all times by ensuring that historic flows are continued through each structure, through flow manipulations or leakage.	Mandatory (see Sect. 2.5.3)
Monitoring and Reporting Requirements		
	Weekly monitoring and recording of water levels on the upstream side of the Vornweg Dam and Power Station.	Mandatory
	Reporting of any deviations from the operating requirements of the water management plan to MNR within 24 hours, providing details on the following: - the nature of the incident - why it happened - what is being done to bring the operation back into the approved operating range - how long it will be before the operation is back into the approved operating range	Mandatory
	Monthly reporting to MNR in electronic format, records of all monitored flow and level values in the operations of the Vornweg Dam and Power Station.	Mandatory

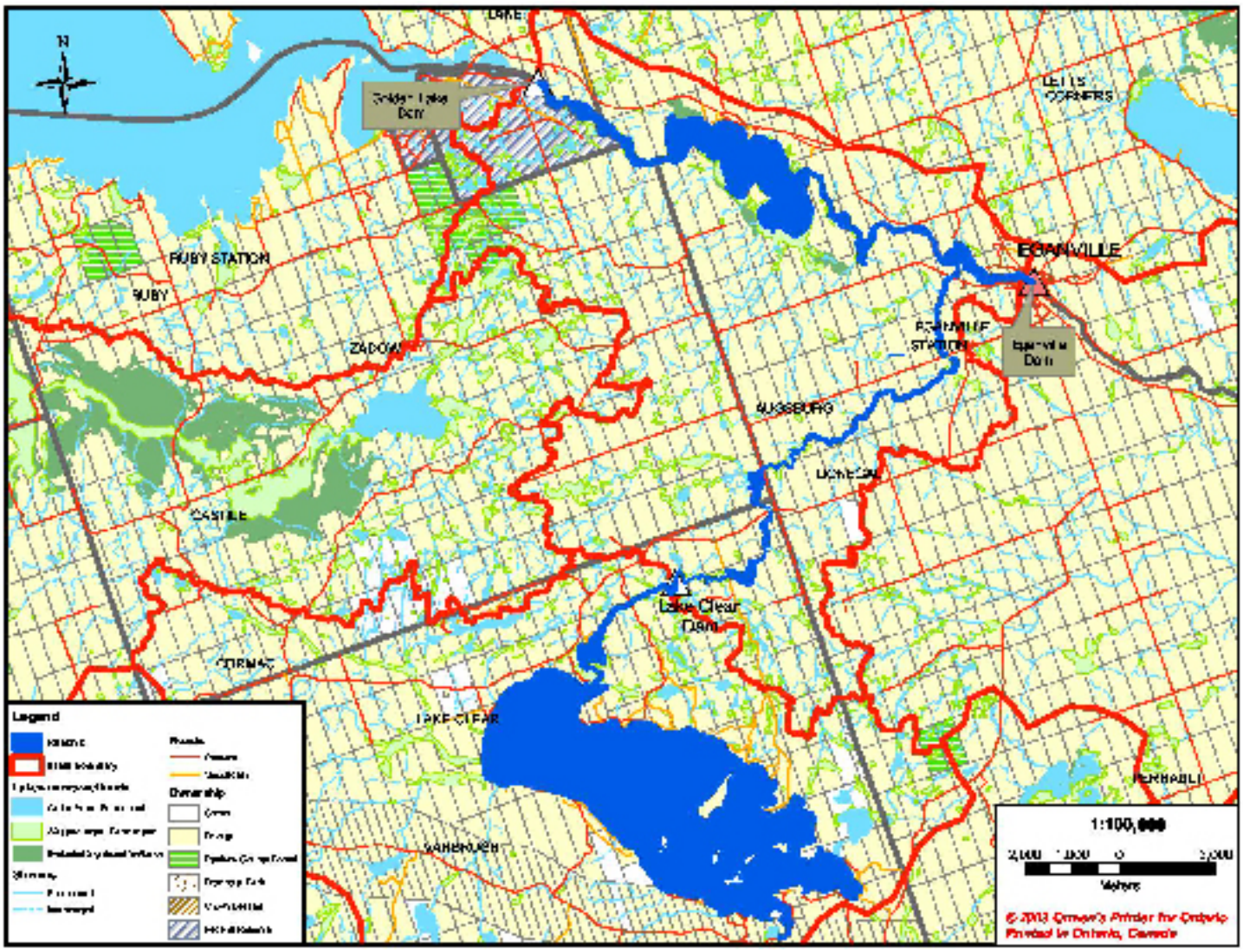
Figure 11: Vornweg Dam Operating Regime



Golden Lake Dam

Figure 12:

Reach 6: Wilber Lake



4.6.5 REACH 6: WILBER LAKE (GOLDEN LAKE DAM TO EGANVILLE DAM)

This reach stretches from the Golden Lake Dam to the Eganville Dam. A large portion of Wilber Lake (400 hectares) is classified as a Provincially Significant Wetland (PSW). The wetland is known to support regionally significant species including Labrador tea, leather leaf and sheep laurel. It is shallow, with a mean depth of 1.0 m, maximum depth of 2.5 m and a slow current. Approximately 34 percent of the PSW is privately owned. Wilber Lake provides habitat to various waterfowl, a monitored population of bullfrogs and walleye, and includes spawning areas for northern pike and bass.

Within this reach the predominant land-use changes, from recreational, cottaging, camping and logging, to agricultural and residential. The operations of the Eganville Dam do not affect water levels on Wilber Lake. The village of Eganville, known as the 'Jewel of the Bonnechere,' (Bennett, 1992) straddles the river below Wilber Lake, boasting a population of 1,230 residents. A public beach and the Eganville water filtration plant are located upstream of the Eganville bridge and dam.

Eganville Dam and Generating Station

The Eganville Dam and Generating Station (installed capacity 840 kW, see Table 5) was upgraded in 2001. Detailed historic operations data is not available for the Eganville station. The new operating regime attempts to maintain a run-of-the-river operation with minimum impact on other operational facilities upstream and downstream. The operating regime also addresses the need of municipal water for the village of Eganville.

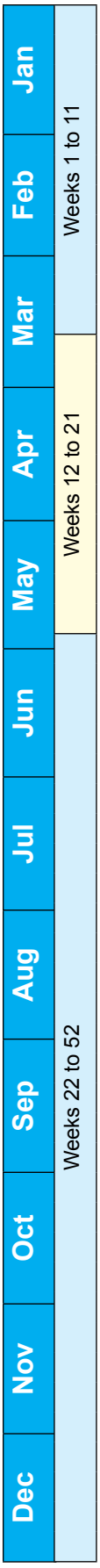


Table 15: Eganville Dam Operating Regime Information Table (as amended in 2005)

General Notes:

- Very little water level manipulation occurs at the Eganville Dam. As a run-of-the-river facility, at all times, flows are maintained to provide adequate water to all users downstream.

	Upper Limit	Lower Limit	Rationale
Weeks 1 to 11	162.04 →	161.71 →	• The level range of the operating regime during this period is from 161.71 to 162.04.
Weeks 12 to 21	162.04 to 162.10 ↗	161.71 →	• The level range of the operating regime during this period is from 161.71 to 162.10. This higher upper level addresses increased flows due to spring freshet. Log manipulation is also employed in this period to respond to spring freshet.
Weeks 22 to 52	162.10 to 162.04 ↘	161.71 →	• The upper level of the operating regime drops to 161.04 at the beginning of this period, bringing the operating range back to 161.71 to 162.04.

All Level References are meters above sea level (asl)

Figure 13: Eganville Dam Operating Regime

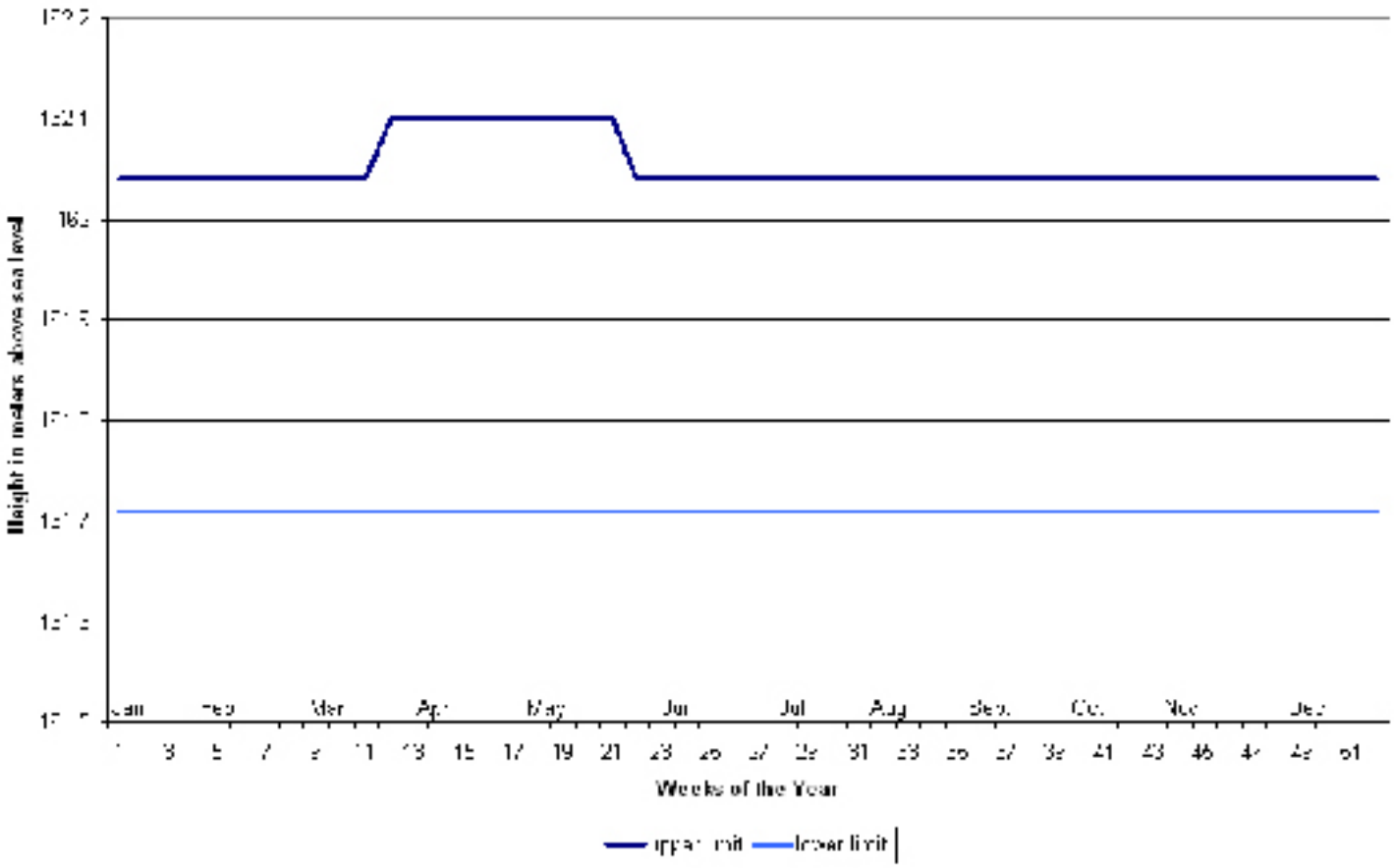


Table 16: Reach 6 Eganville Dam and Power Station Operating Requirements Table		
Operating Requirements		
	Operating Regime Upper and Lower Limit The operator will manage flows and levels to stay within the upper and lower limits of the operating regime for this reach.	Mandatory
	Minimum Flows The operator will maintain minimum flows at all times by ensuring that historic flows are continued through each structure, through flow manipulations or leakage.	Mandatory (see Sect. 2.5.3)
Monitoring and Reporting Requirements		
	Daily monitoring and recording of water levels on the upstream side of the Eganville Dam and Power Station.	Mandatory
	Daily monitoring and recording of water flows through the Eganville Dam and Power Station.	Best Practice
	Reporting of any deviations from the operating requirements of the water management plan to MNR within 24 hours, providing details on the following: - the nature of the incident - why it happened - what is being done to bring the operation back into the approved operating range - how long it will be before the operation is back into the approved operating range	Mandatory
	Weekly reporting to MNR in electronic format (spreadsheet by e-mail), records of all monitored flow and level values in the operations of the Eganville Dam and Power Station.	Mandatory

Amendments to Eganville Operating Regime

During the public review of the draft Bonnechere River Water Management Plan and after the selection of alternative 1 (see Section 1.2) and the establishment of the associated operating regimes, Eganville Generation Corporation (EGC) requested a modification to the operating regime for the Eganville facility. The Public Advisory Committee responded to the modification request with a recommendation that EGC submit their proposal in the form of an amendment once the plan is implemented. The amendment request was approved in March 2005. This is the amended version of the plan.

Hurds Creek and the Lake Clear Dam

Hurds Creek, which drains Lake Clear, flows into the Bonnechere River less than one kilometer upstream of Eganville. Walleye and lake trout are present in Lake Clear. Hurds Creek supports brook trout.

The Lake Clear Dam on Hurds Creek was constructed in 1932 to control water levels on Lake Clear and in the creek. The original intention was to have Lake Clear provide an effective "vertical storage" capacity for the Bonnechere system. However, Lake Clear, at this time, is not an effective reservoir.

The operating regime for the Lake Clear Dam attempts to maintain traditional levels on the lake and document the flooding limits in place under the existing Licence of Occupation. There is no lower limit identified in the Lake Clear Dam operating regime. The lower limit on Lake Clear is determined by a restriction at the outflow from the lake, above the Lake Clear Dam. The elevation of this restriction will be established (by RPG) through surveying and added to the operating regime for the dam within one year of the implementation of this plan.

As the demands for waterpower in Ontario increase, and it becomes economically viable, Renfrew Power Generation (RPG) has expressed an interest in looking at developing Lake Clear's reservoir potential. This will require an application for an amendment to this water management plan.

The historical operations and the new operating regime for the Lake Clear Dam are fairly simple. In the latter part of June both spillways are filled with five logs each. Once the lake has reached a stable level, one 12-inch log is replaced with one 6-inch log. This has proved in the past to be sufficient to provide flow to the creek and address the water level concerns of local cottagers. In mid-October, all stop logs are removed from the structure to provide capacity for spring freshet.

Lake Clear has a relatively small drainage area. Dam operations do not significantly influence water levels and flows on the main channel of the Bonnechere River. For this reason, the monitoring and reporting requirements for this structure are lower than those associated with the main-channel structures.

Eganville Dam and Power Station

Reach 6 Issues
There are 15 general issues that apply to this reach of the river. See Section 5.1.
There are four issues that apply specifically to this reach of the river. See Section 5.6.
Reach 6 Information Needs
Five general information needs have been identified that apply to this reach of the river. See the Information Needs Table in Section 6.2.
Two information needs have been identified that apply specifically to this reach of the river. See the Information Needs Table in Section 6.2.

Figure 14: Lake Clear Dam Operating Regime

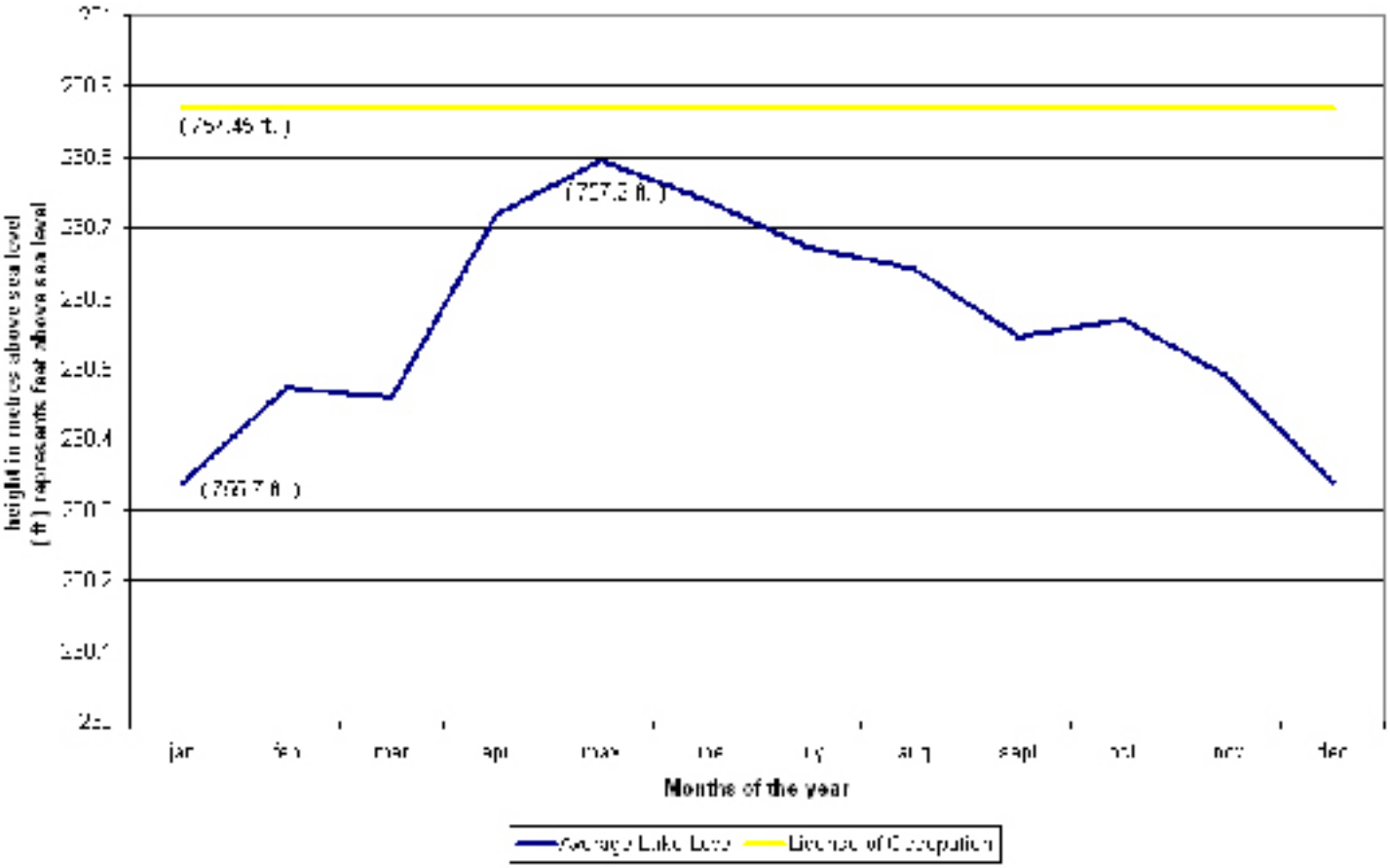
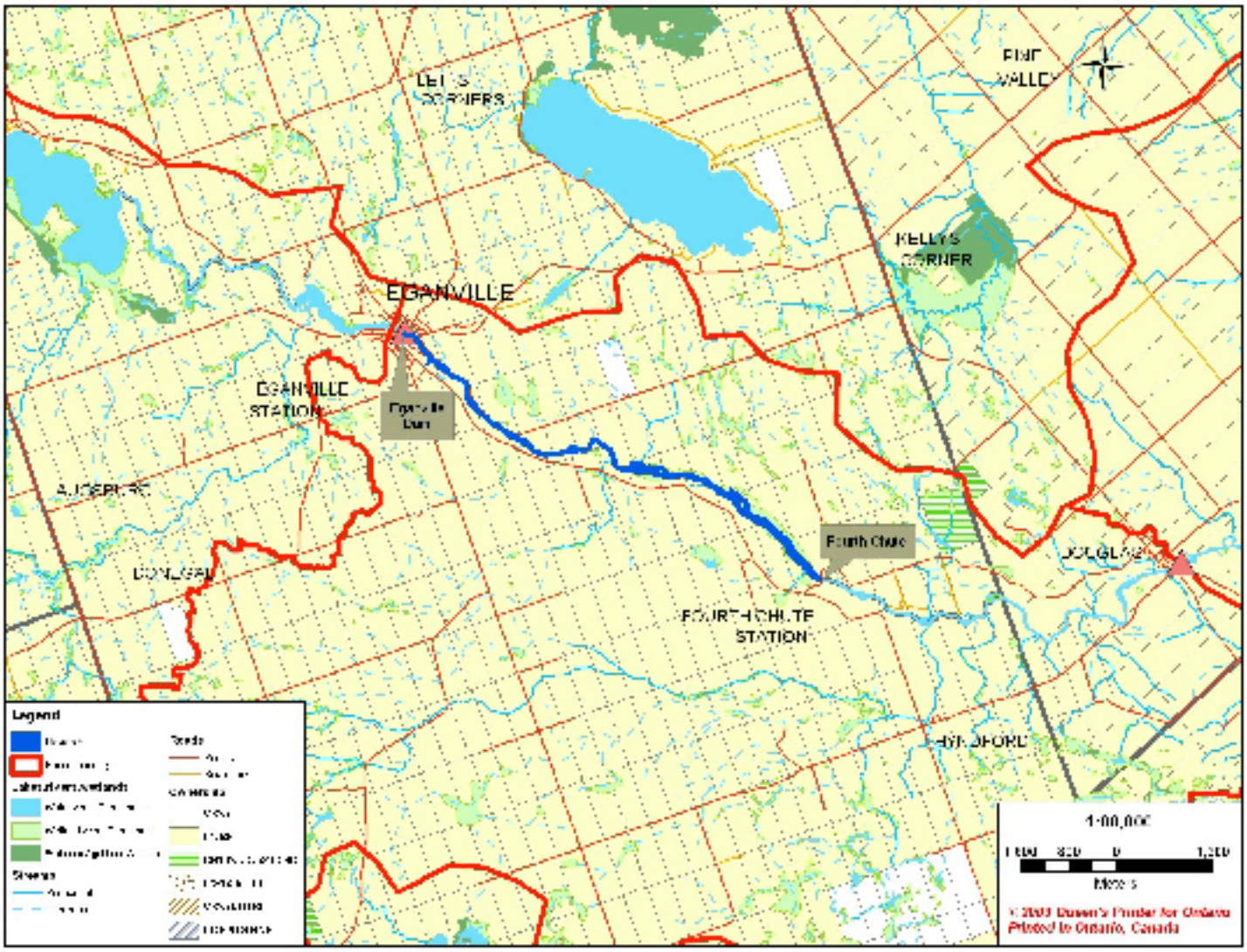


Table 17: Reach 6 Lake Clear Dam Operating Requirements Table		
Operating Requirements		
	Operating Regime Upper Limit The operator will manage flows and levels to stay within the existing Licence of Occupation for this reach. Note, no lower limit has been established for the Lake Clear operating regime.	Mandatory
	Minimum Flows The operator will maintain minimum flows at all times by ensuring that historic flows are continued through each structure, through flow manipulations or leakage.	Mandatory (see Sect. 2.5.3)
Monitoring and Reporting Requirements		
	Weekly monitoring and recording of water levels on the upstream side of the Lake Clear Dam.	Mandatory
	Reporting of any deviations from the operating requirements of the water management plan to MNR within 24 hours, providing details on the following: - the nature of the incident - why it happened - what is being done to bring the operation back into the approved operating range - how long it will be before the operation is back into the approved operating range	Mandatory
	Monthly reporting to MNR in electronic format, records of all monitored flow and level values in the operations of the Lake Clear Dam.	Mandatory

Figure 15: **Reach 5: Eganville Dam to Fourth Chute**

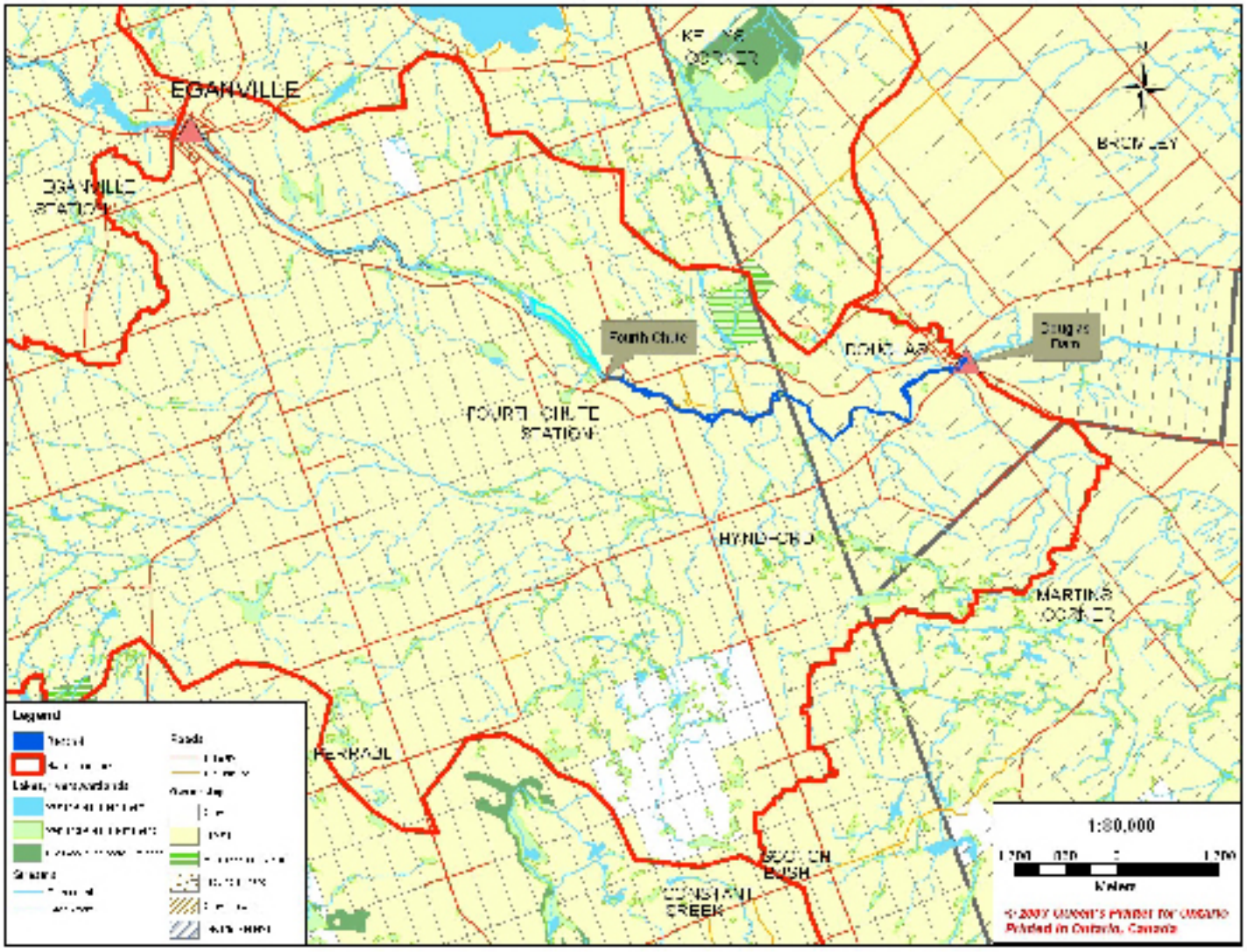


4.6.6 REACH 5: EGANVILLE DAM TO FOURTH CHUTE

This reach is created by a natural constriction in the Bonnechere River at the site of an old (non-operational) dam called Fourth Chute, 9 km downstream from the community of Eganville. A minimum flow of water through the Eganville facility is required for sewage treatment in the village of Eganville. This reach is sparsely populated with small agricultural operations along the vegetated shores. There are several small rapids and habitat for various fish, birds and other wildlife species. This stretch of the river is used recreationally for swimming, fly-fishing and canoeing. In the summer hundreds of tourists visit the village of Eganville and the Bonnechere Caves located at Fourth Chute.

Reach 5 Issues
There are 15 general issues that apply to this reach of the river. See Section 5.1.
There are two issues that apply specifically to this reach of the river. See Section 5.7.
Reach 5 Information Needs
Five general information needs have been identified that apply to this reach of the river. See the Information Needs Table in Section 6.2.
One information need has been identified that applies specifically to this reach of the river. See the Information Needs Table in Section 6.2.

Figure 16: **Reach 4: Fourth Chute to Douglas Dam**



4.6.7 REACH 4: FOURTH CHUTE TO DOUGLAS DAM

This reach covers the area from the Fourth Chute falls to the Douglas Dam and generating station (installed capacity 600 kW, see Table 5). The river is quite scenic as it flows through Fourth Chute. Ancient cedar and other diverse habitats enrich the limestone banks near the top of this reach. Wetlands, pastured fields, homesteads and barns dot the landscape. The water in this reach begins to take on a more murky quality because the surrounding soil type is primarily clay. The reach ends in the hamlet of Douglas.

Issues have been raised involving the operation of the Douglas waterpower facility. The section of the river immediately upstream of the Douglas Dam has been subjected to significant seasonal fluctuations, which has impacted fish and wildlife habitat. The new operating regime attempts to limit these significant seasonal fluctuations.

Amendments to Douglas Operating Regime

After the public review of the draft Bonnechere River Water Management Plan and the approval of the operating regimes by the Public Advisory Committee, Multistream Power Corporation requested a modification to the operating regime for the Douglas facility. The amendment request was approved in March 2005. This is the amended version of the plan.

Table 18: Douglas Dam Operating Regime Information Table (as amended in 2005)

General Notes:

- Very little stop-log manipulation has traditionally occured at the Douglas Dam. As a run-of-the-river facility, at all times, flows are maintained to provide adequate water to all users downstream.
- Levels referenced in this table relate to cm above or below the top of the weir wall.
- There is a maximum daily fluctuation limit of 30 cm on this facility during weeks 11 to 22. This is a daily operating restriction intended to reduce the potential for repetitive, substantial fluctuations in flows and levels.

	Upper Limit	Lower Limit	Rationale
Weeks 1 to 11	30 cm →	-30 cm →	• The level range of the operating regime during this period is from 30 to -30 cm.
Weeks 12 to 21	30 cm to 40 cm ↗	-30 cm →	• The level range of the operating regime during this period is from 40 to -30 cm. This higher upper level addresses increased flows due to spring freshet. • Stop logs (mostly in the two north spillways) will be operated prior to, during and after the spring freshet to prevent uncontrolled overtopping of the dam weir walls. This will provide greater flow regulation on the system and will enhance walleye spawning and spawning habitat.
Weeks 22 to 40	40 cm to 10 cm ↘	-30 cm →	• The level range of the operating regime during this period is from 10 to -30 cm.
Weeks 41 to 52	10 cm to 30 cm ↗	-30 cm →	• The level range of the operating regime during this period is from 30 to -30 cm to permit the passage of water from fall rains.

All Level References are Local Datum (LD)

Old Dam Structure at Fourth Chute

Reach 4 Issues
There are 18 general issues that apply to this reach of the river. See Section 5.1.
There is one issue that applies specifically to this reach of the river. See Section 5.8.
Reach 4 Information Needs
Five general information needs have been identified that apply to this reach of the river. See the Information Needs Table in Section 6.2.
One information need has been identified that applies specifically to this reach of the river. See the Information Needs Table in Section 6.2.

Figure 17: Douglas Dam Operating Regime (as amended in 2005)

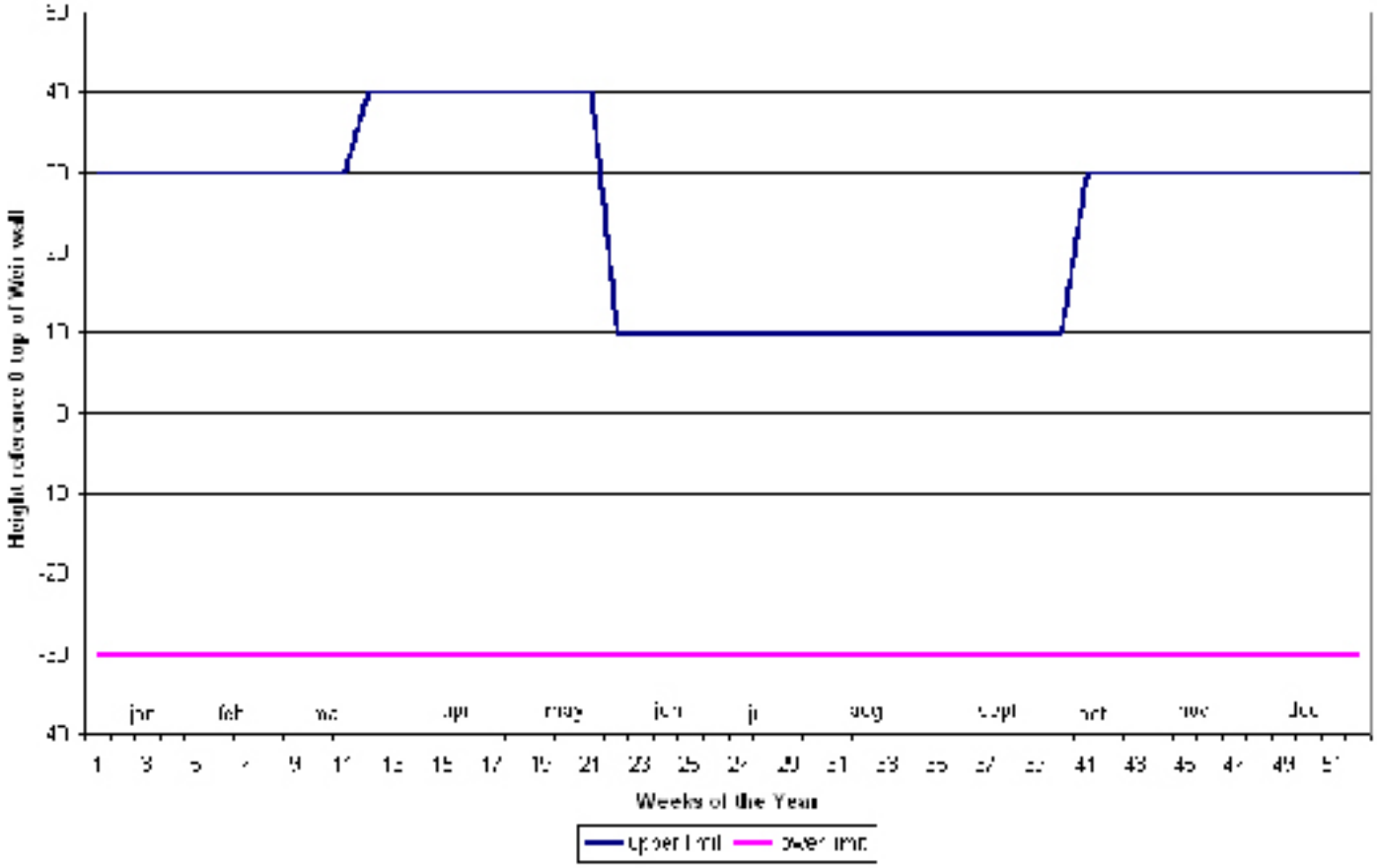
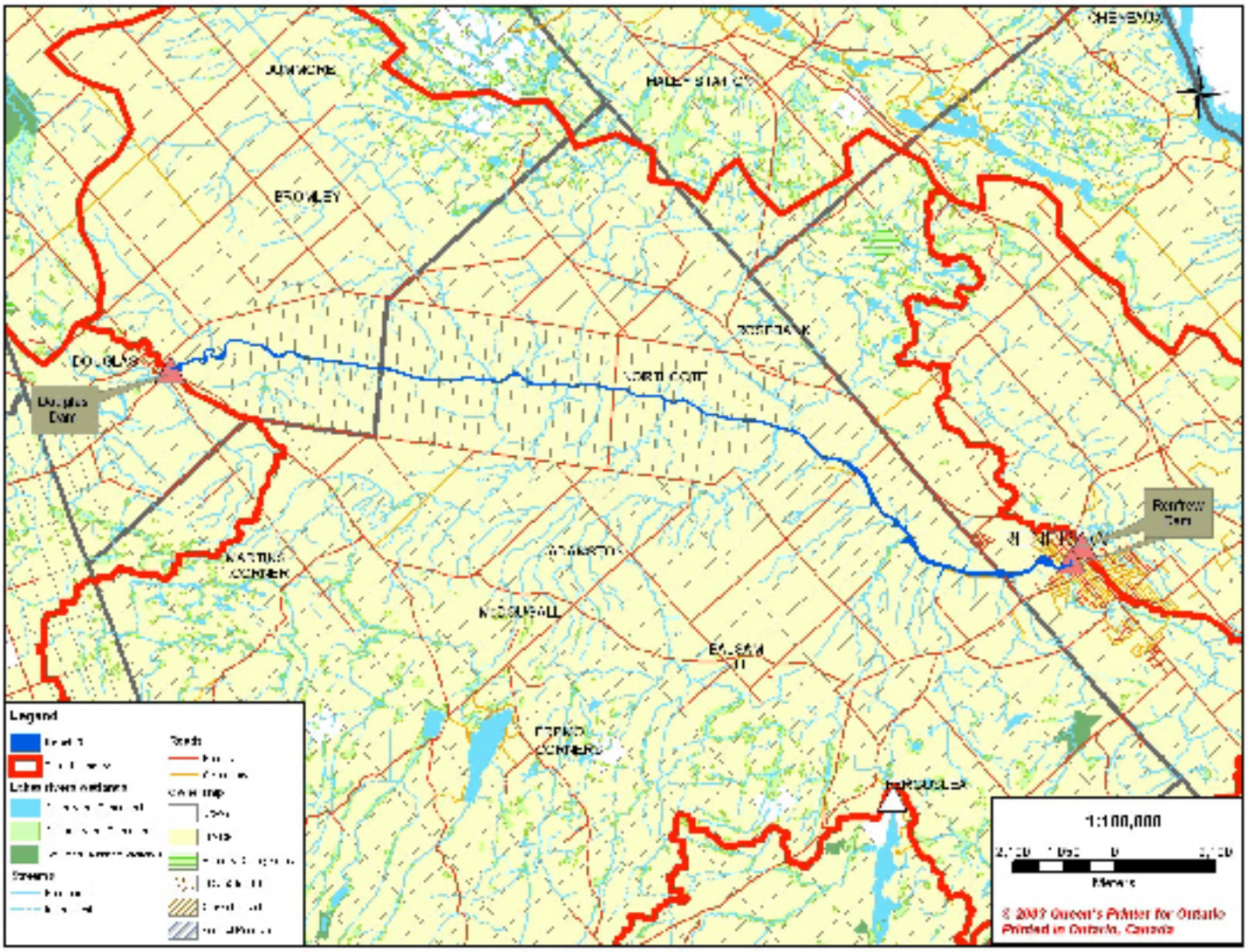


Table 19: Reach 4 Douglas Dam and Power Station Operating Requirements Table		
Operating Requirements		
	Operating Regime Upper and Lower Limits The operator will manage flows and levels to stay within the upper and lower limits of the operating regime for this reach.	Mandatory
	Minimum Flows The operator will maintain minimum flows at all times by ensuring that historic flows are continued through each structure, through flow manipulations or leakage.	Mandatory (see Sect. 2.5.3)
Monitoring and Reporting Requirements		
	Daily monitoring and recording of water levels on the upstream side of the Douglas Dam and Power Station.	Mandatory
	Daily monitoring and recording of water flows through the Douglas Dam and Power Station.	Best Practice
	Reporting of any deviations from the operating requirements of the water management plan to MNR within 24 hours, providing details on the following: - the nature of the incident - why it happened - what is being done to bring the operation back into the approved operating range - how long it will be before the operation is back into the approved operating range	Mandatory
	Monthly reporting to MNR in electronic format (spreadsheet by e-mail), records of all monitored flow and level values in the operations of the Douglas Dam and Power Station.	Mandatory

Douglas Dam and Power Station

Figure 18: **Reach 3: Douglas Dam to Renfrew Dam #2**



4.6.8 REACH 3: DOUGLAS DAM TO RENFREW DAM #2

This reach stretches from the Douglas Dam and generating station to the second or lower dam in Renfrew. From the Douglas Dam the river drops gradually along the limestone substrate. Leda clays are common in sections of this reach. Here the banks become steeper and the Bonnechere River meanders through small patches of private forest and pastures. Beef and dairy farming are common on this reach. Livestock have access to the river and its tributaries in some places. Small wetlands, tributary creeks and the river itself are used for fishing, hunting and trapping. Water is pumped from the river, provided to 10,000 residents in and around the Town of Renfrew, and returned to the river just downstream of the Renfrew power stations through the sewage treatment plant.

The river drops a total of 19.5 m as it passes through the two generating stations at Renfrew (Renfrew #1 installed capacity 1000 kW, Renfrew #2 installed capacity 1000 kW, see Table 5).

There is a historic suspension pedestrian bridge, originally constructed in the early 1800s, across the river between the two power stations.

The two dams and generating stations at Renfrew have been operated historically based on the electrical demands of the community. The new operating regime is based on past operations and attempts to provide more consistent flows to the downstream reaches.

Table 20: Renfrew Operating Regime Information Table as amended in 2009

General Notes:

- Very little water level manipulation occurs at the Renfrew dams.
- There is a maximum daily fluctuation limit of 30 cm on this facility. This is a daily operating restriction intended to reduce the potential for repetitive, substantial fluctuations in flows and levels.
- Minimum flows (through stop log spillways or turbine chutes) are being addressed through negotiations between the Town of Renfrew and the Ontario Ministry of the Environment relating to a proposed upgrade of the sewage treatment plant in Renfrew (see Issue 2.2).

	Upper Level	Lower Level	Rationale
Weeks 1 to 11	111.03 →	110.03 →	• The level range of the operating regime during this period is from 111.03 to 110.03
Weeks 12 to 21	111.03 to 111.19 ↗	110.03 →	• The upper level of the operating regime increases to 111.19 during this period to allow for spring freshet. • The increased upper water level also promotes upstream spawning of northern pike.
Weeks 22 to 52	111.19 to 110.86 ↘	110.03 →	• The upper level of the operating regime drops back to 110.86 during this period following spring freshet.

All Level References are meters above sea level (asl)

Bonnechere River above Renfrew Dam #2

Reach 3 Issues
There are 18 general issues that apply to this reach of the river. See Section 5.1.
There are three issues that apply specifically to this reach of the river. See Section 5.9.
Reach 3 Information Needs
Four general information needs have been identified that apply to this reach of the river. See the Information Needs Table in Section 6.2.
One information need has been identified that applies specifically to this reach of the river. See the Information Needs Table in Section 6.2.

Figure 19: Renfrew Stations 1 and 2 Operating Regime as amended in 2009. Note: There is a daily fluctuation limit of 30 cm associated with this facility.

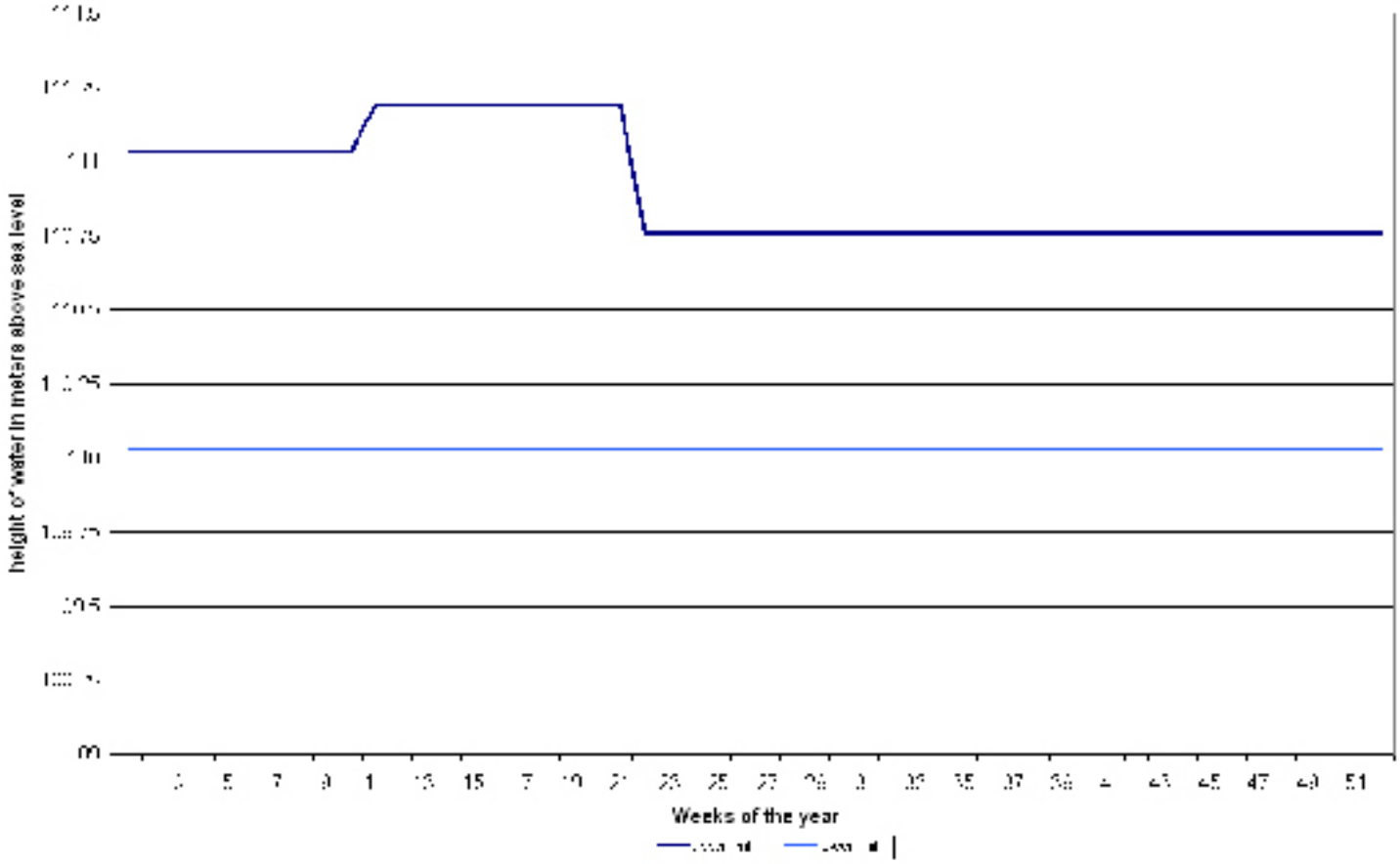
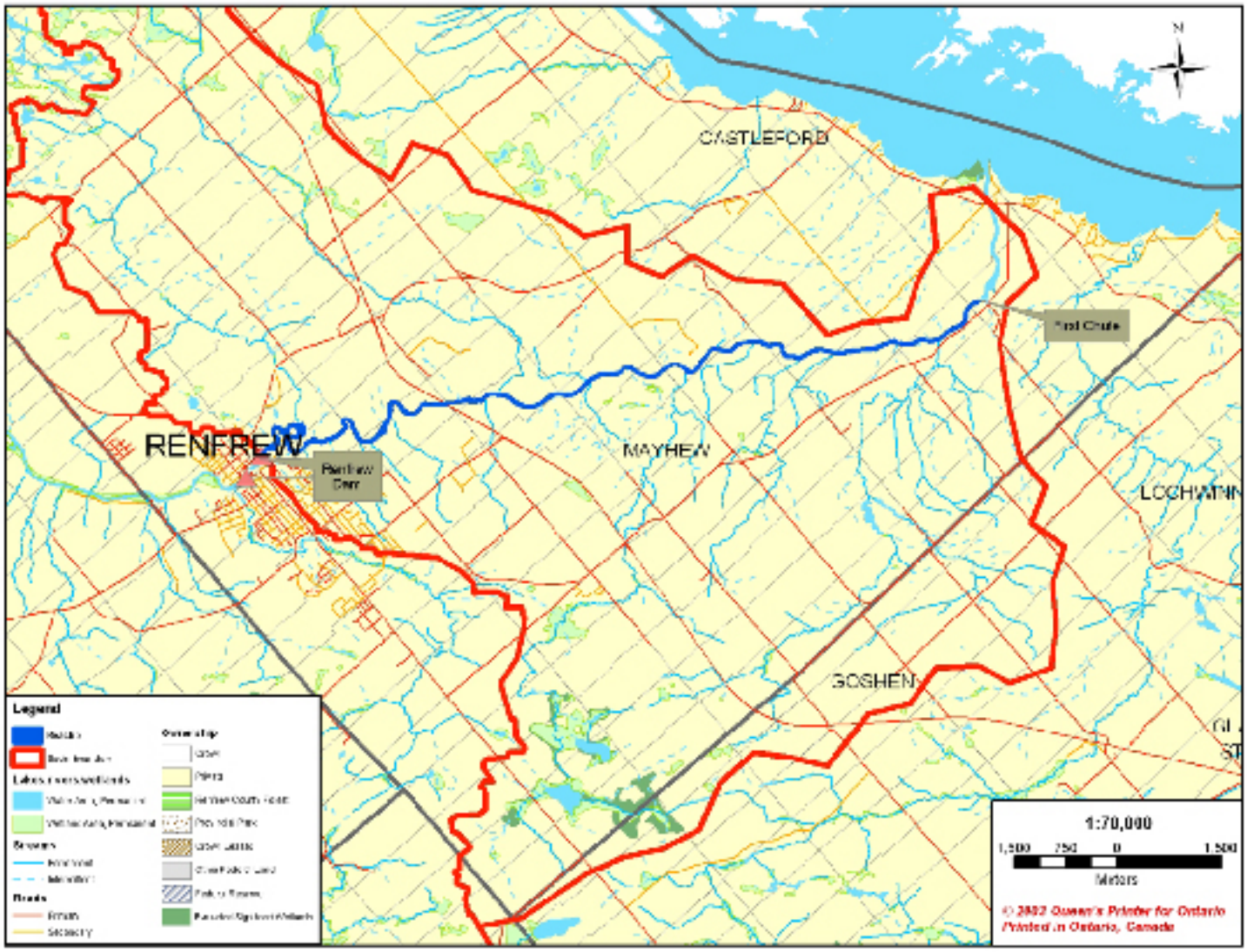


Table 21: Reach 3 Renfrew Stations 1 and 2 Operating Requirements Table		
Operating Requirements		
	Operating Regime Upper and Lower Limits The operator will manage flows and levels to stay within the upper and lower limits of the operating regime for this reach, with a daily fluctuation limit of 30 cm.	Mandatory
	Minimum Flows The operator will maintain minimum flows at all times by ensuring that historic flows are continued through each structure, through flow manipulations or leakage.	Mandatory (see Sect. 2.5.3)
Monitoring and Reporting Requirements		
	Daily monitoring and recording of water levels (daily reading is an average of all values recorded in a 24 hour period) on the upstream side of the Renfrew 1 Generating Station, through an electronic gauge located on the structure.	Mandatory
	Daily monitoring and recording of water flows through the Renfrew 1 and 2 Dams and Power Stations.	Best Practice
	Reporting of any deviations from the operating requirements of the water management plan to MNR within 24 hours, providing details on the following: - the nature of the incident - why it happened - what is being done to bring the operation back into the approved operating range - how long it will be before the operation is back into the approved operating range	Mandatory
	Monthly reporting to MNR in electronic format (spreadsheet by e-mail), records of all daily readings and monitored flow values in the operations of the Renfrew 1 and 2 dams and power stations.	Mandatory

First Chute Falls

Figure 20: **Reach 2: Renfrew Dam #2 to First Chute**

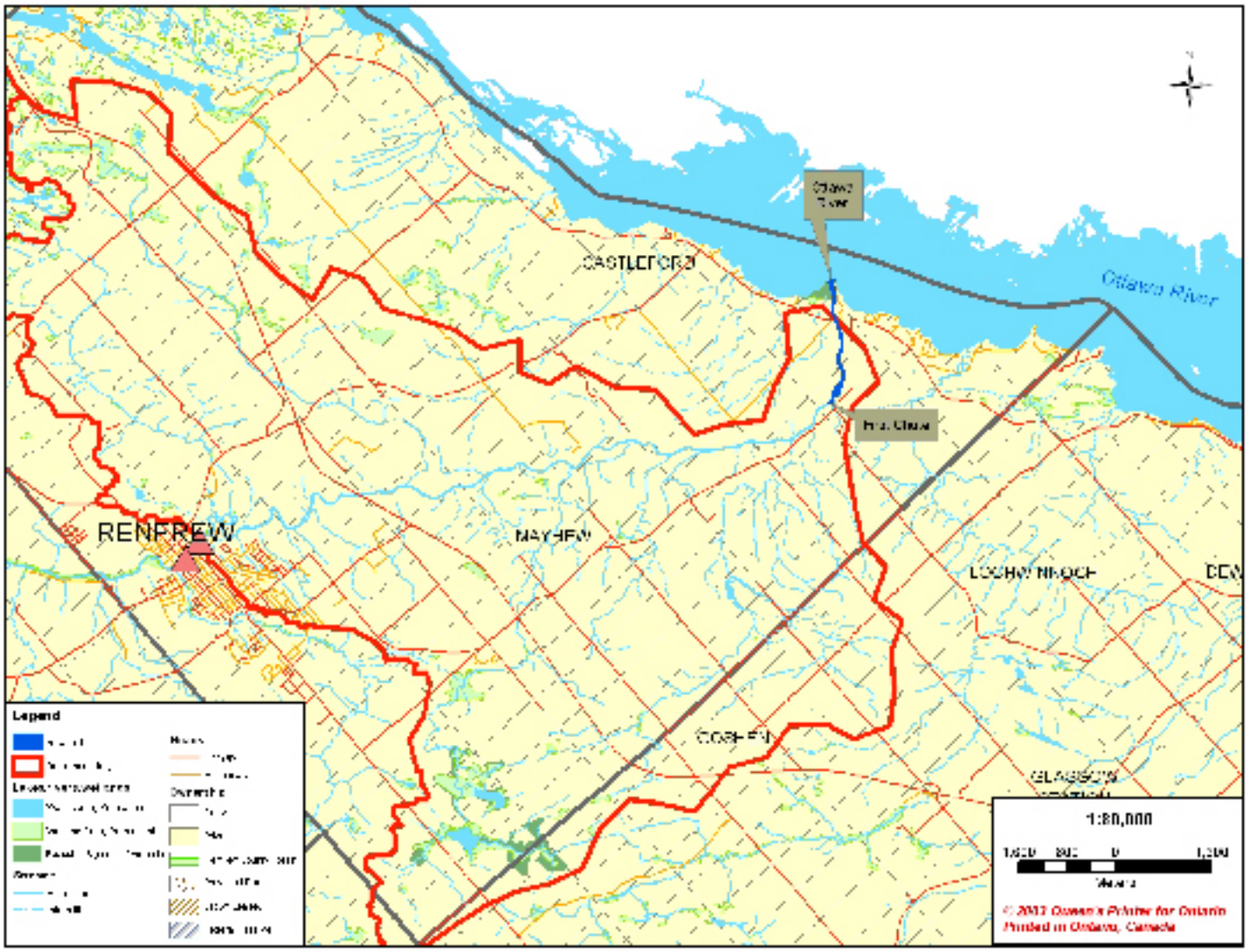


4.6.9 REACH 2: RENFREW DAM #2 TO FIRST CHUTE

This reach is created by a natural constriction in the Bonnechere River at a place called First Chute. The Renfrew sewage treatment plant returns treated water to the river at the upper end of this reach. The water flow requirements of this sewage treatment plant impact the waterpower production potential of the two Renfrew generating stations. Discussions between Renfrew Power Generation (RPG) and the Town of Renfrew may result in a minimum flow agreement that will meet the sewage treatment needs of the community. A future minimum flow agreement may require an amendment to this plan.

Reach 2 Issues
There are 15 general issues that apply to this reach of the river. See Section 5.1.
There are two issues that apply specifically to this reach of the river. See Section 5.10.
Reach 2 Information Needs
Five general information needs have been identified that apply to this reach of the river. See the Information Needs Table in Section 6.2.
One information need has been identified that applies specifically to this reach of the river. See the Information Needs Table in Section 6.2.

Figure 21: **Reach 1: First Chute to Ottawa River**



4.6.10 REACH 1: FIRST CHUTE TO OTTAWA RIVER

This reach includes the section of the Bonnechere River from First Chute (a 9-m waterfall) to the mouth of the river where it flows into the Ottawa River near Castleford. First Chute was the site of a historic grist mill and sawmill, remnants of which can still be seen today. There are many large farming operations on this reach. The high (leda clay) banks are sparsely vegetated and erode easily. The Bonnechere River empties into the Ottawa River through a Provincially Significant Wetland (PSW) which provides diverse habitat for fish and wildlife. Approximately 25 percent of this reach is influenced by water level fluctuations in the Ottawa River.

Reach 1 Issues
There are 15 general issues that apply to this reach of the river. See Section 5.1.
There are no issues that apply specifically to this reach of the river.
Reach 1 Information Needs
Five general information needs have been identified that apply to this reach of the river. See the Information Needs Table in Section 6.2.
One information need has been identified that applies specifically to this reach of the river. See the Information Needs Table in Section 6.2.

SECTION 5
BONNECHERE RIVER WATER MANAGEMENT PLAN
ISSUES AND RESPONSES

5.0 ISSUES AND RESPONSES

All of the issues raised through the Bonnechere River Water Management Review process have been discussed and analyzed during the development of this water management plan. All issues raised, that relate to water levels and flows, are documented in this section of the plan.

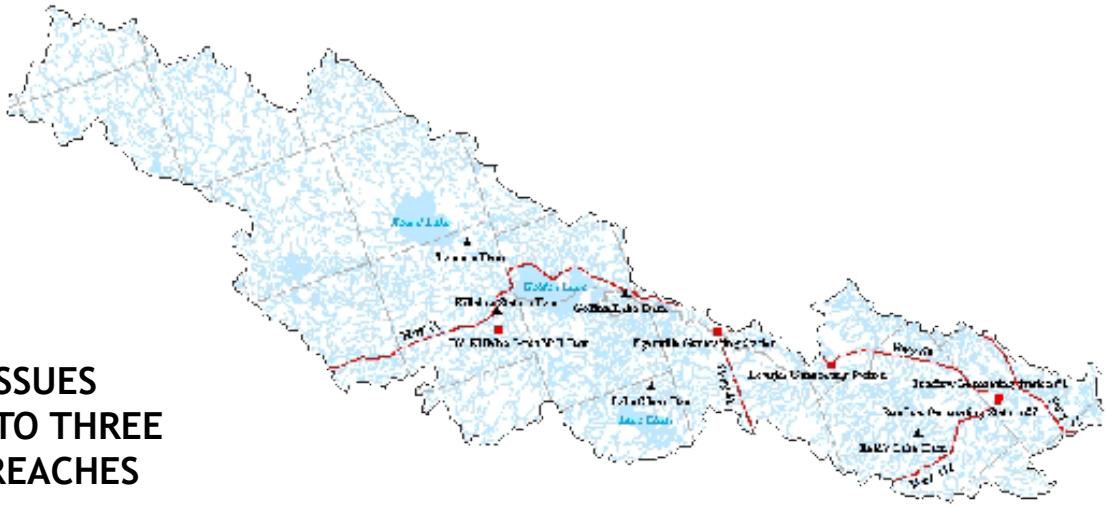
The identification of an issue and the inclusion of an issue here, is not meant to suggest that all issues raised were valid and required specific action through this water management plan. On investigation, it was clear that some issues raised were based on a lack of information or perceptions related to inaccurate information. These are addressed through the responses to each issue. Other issues raised, which are not related to water levels and flows and could not be addressed through this process or in this plan (e.g. water quality, boat speeds on lakes and rivers), have been referred on to other agencies (see Appendix 4).

Each issue has been addressed through one or more of the following actions:

- a written response
- identification of an information need
- a direct action

Some issues have a combination of the above actions associated with them, for example a written response and a direct action.

The issues documented in this section of the Bonnechere River Water Management Plan are organized numerically, by reach. For example, general issues (issues that relate to three or more reaches) are numbered from 0.1 to 0.19, and issues related to Reach 8 are numbered 8.1 to 8.8.



5.1 GENERAL ISSUES RELATING TO THREE OR MORE REACHES

Issue 0.1:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Fair Sharing of the Water Resource Across Reaches

The water resource needs to be shared equitably between reaches of the river throughout the year. Water management by the waterpower producers and MNR needs to reflect fair allocation and sharing of levels and flows across all reaches, user groups and interests, under normal and extreme weather events (e.g. low water conditions in the summer).

Response:

During the process of drafting, modeling and negotiating the operating regimes contained in the water management plan (WMP), MNR, waterpower producers and members of the public advisory committee (PAC) made every attempt to share water flows equitably between reaches throughout the four seasons. The WMP applies under normal environmental conditions. In drought conditions, the Ontario Low Water Response Program and associated Water Response Teams will take measures to allocate water throughout the watershed. Under flooding conditions, applicable municipal Emergency Response Plans will apply (See Section 2.5.2).

Issue 0.2:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Public Information and Communication of Flows on the River System

The public is concerned about a general lack of readily available information on level and flow management on the river. More information should be made available to the public on dam operators, operating regimes, season flows and levels. The public also needs to be able to access information about drastic lowering or raising of water levels and flows. Licenses of Occupation (LOs) should be readily available to the public. This issue was brought forward by members of the public in Reach 8 - Round Lake, Reach 7 - Golden Lake, and Reach 4 - Fourth Chute to Douglas Dam.

Response:

Several methods are being used to distribute information about water levels and flows on the river. Renfrew Power Generation (RPG) provides weekly water level information to stakeholder groups and MNR. RPG and MNR have full-time staff available to respond to public questions and concerns by phone and in person. MNR and RPG also attend and participate in meetings with stakeholder groups. As part of the development of this water management plan, RPG developed a Web site which provides information to the public. Progress reports and copies of the draft WMP have been made available through the waterpower producers, MNR, municipal offices and in public libraries. The Standing Advisory Committee will also advise on and review communications efforts during the implementation of this plan (see Section 4.2.1).

Action:

The waterpower producers will develop an Internet Web site and will respond to all phone requests, providing current flow and level information to the public (see Section 4.2.1). MNR and the waterpower producers will promote public use of the Web site and phone response system.

Issue 0.3:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Control and Responsibility over Extreme Fluctuations

More control needs to be exhibited by the waterpower producers along several river reaches. The public perceives that fluctuations in water levels and flows are an issue on most reaches of the Bonnechere. Extreme fluctuations can increase the potential for and the severity of other natural and human-induced impacts on the river, private property and habitats (e.g. vegetation is de-rooted, soil slumps, river bank is eroded). Some reaches experience low water levels in the summer time. For example, more control needs to be demonstrated by Eganville Generation Corporation (EGC) below the Eganville Dam where water levels reach extreme lows in the summer. More control also needs to be exhibited by Multistream Power Corporation above and below the Douglas Dam where levels fluctuate drastically.

Response:

Some degree of water level and flow change, along with erosion or other physical impacts, involve natural processes within aquatic ecosystems. Waterfront landowners need to safeguard their property from potential damage by reinforcing or stabilizing their shoreline. All dams need to operate with minimum flows to ensure that fish and habitat will not become de-watered under normal environmental conditions.

Issue 0.4:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Consideration of Various Uses and Groups

Fluctuations in water levels and flows should be adjusted to provide for a range of water uses (e.g. public safety, generation of electricity, fish and wildlife needs, municipal, rural and industrial water withdrawals, tourism and recreational values).

Response:

Public safety is of primary concern. The new operating regimes for the control structures on the Bonnechere River are designed to meet the balanced needs of aquatic ecosystems and all river users. Working Group, PAC and Steering Committee discussions, and comments from the public, helped shape and balance the decisions that resulted in the operating regimes set out in this plan.

Issue 0.5:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Proactive Contingency and Emergency Plans in Flood and Drought Conditions

During dry summers and spring flooding periods, managing levels to meet the needs of riparian landowners and other water users on Golden Lake and downstream reaches will be impacted by the operation of the Tramore Dam and flows from Round Lake. Any potential future conflicts over the water resource should be handled proactively. Contingency plans should be developed to deal with abnormally low and high water levels.

Response:

Seasonal high and low water levels are the result of natural processes. The potential for weather-dependent flood and drought events cannot be eliminated through the implementation of a water management plan. As stated in the response to Issue 0.1, contingency plans to deal with drought and flood conditions on the watershed will be developed through the Water Response Program and through Municipal Emergency Response Plans. Waterpower producers will be represented on these teams and will manage water flows in the watershed accordingly.

Issue 0.6:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Livestock Access and Water Level and Flow Fluctuations Cause Erosion

Unrestricted cattle access to parts of the Bonnechere River has impacted riparian vegetation, wildlife habitat and bank stability, causing river sedimentation and re-suspension of sediments. Extreme fluctuations in levels and flows can increase the potential for and the severity of impacts created by livestock access to the river.

Response:

MNR encourages property owners to fence their livestock and keep them away from water courses (rivers, creeks, lakes). Restricted access routes for livestock watering from these sources, or alternative watering methods (e.g. pumping water to ponds inland), reduces the potential for shoreline erosion. Property owners are also encouraged to plant native vegetation and shrubs with anchoring root systems.

MNR will work with the Bonnechere River Watershed Project committee to identify this issue in its annual work plan, and to encourage landowners to restrict cattle access to the river and address shoreline erosion concerns.

Action:

As part of the response to this issue, MNR and waterpower producers will support local stewardship initiatives and provide a communication link between agencies, landowners and stewardship groups. Landowners are encouraged to adopt best management practices along their shorelines. See response to Issue 8.2.

Issue 0.7:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Flooding Out of Reptile Nests in Late Spring Due to Sudden Fluctuations in Water Level

Certain species of reptiles (e.g. various turtles) bury eggs in sandy and gravelly substrate sometimes close to the shoreline in late May and June. A sudden increase in water level during these times may cause reptile nests to be flooded out with severe implications to rare species.

Response:

This does not appear to be a significant issue. The change in water levels during the nesting period is not drastic. Reptile species typically do not nest at the water's edge and therefore are not likely impacted by water level fluctuations. Only anecdotal information exists on the specific location and abundance of amphibian and reptile species on the watershed.

Information Need #1:

Status of Amphibian and Reptile Populations: Only anecdotal information exists on the location and abundance of amphibian and reptile species (turtles are of special concern). Research needs to be expanded in this area. This is a system-wide information need that could be addressed in conjunction with fur-bearer research.

Issue 0.8:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Freezing of Amphibians and Reptiles in the Winter Due to Lowering of Water Levels

In mid-fall amphibians and reptiles (e.g. turtles, frogs) bury themselves into the mud underlying lakes, streams, wetlands and the river for winter hibernation.

When water levels are lowered significantly during the winter drawdown, amphibians and reptiles in the mud in riparian areas may be exposed and frozen.

Response:

There is no evidence that the lowering of water levels during the winter has a measurable impact on amphibian or reptile populations. Many amphibians and reptiles locate their wintering hibernacula deep enough under water to avoid freezing (e.g. as far as three vertical feet into the water relative to the shoreline). Areas of concern such as shallow wetlands could be investigated to assess the status of these populations. The winter drawdown is a necessary part of yearly waterpower operation as it allows for production of power when demand is high, provides water to downstream reaches, and lowers lake levels in preparation for the spring freshet. On Round Lake, measures taken in the new operating regime to protect lake trout may also address this issue to some extent. See issue 0.7 and Information Need #1.

Issue 0.9:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Freezing out of Fur-Bearers in the Winter Due to Lowering of Water Levels

The mid-winter drawdown has negative implications for fur-bearers (e.g. beaver, muskrat, otter and mink) in several reaches. Fur-bearers build houses and holes just below the surface of the water in late fall, with access to vegetation and other food sources available under water. After freeze-up, when water levels are lowered substantially and the ice drops with it, houses and holes are left well above the ice and fur-bearers have no access to important food sources now under the ice. Mink and otter lose part of their food supply. Overwintering habitat and food is now scarce, and the fur-bearers experience an increased risk of predation and exposure to extreme elements. This effect may be more pronounced on specific reaches of the river.

Response:

There is no evidence that the lowering of water levels during the winter has a measurable impact on fur-bearer populations. The winter drawdown is a necessary part of water level manipulations to prepare for spring freshet, and yearly waterpower operation allowing for production of power when demand is high.

Information Need #2:

Status of Fur-Bearer Populations: Only anecdotal information exists on the location and abundance of fur-bearer species. Research could be expanded in this area. This is a system-wide information need that could be addressed in conjunction with amphibian and reptile research.

Issue 0.10:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Fur-Bearer Mortality Due to Rise in Water Levels

As water levels rise rapidly in the spring and water is evacuated from the system, fur-bearers on most river reaches are forced out of their habitat.

Response:

Although this issue has been considered, it is not possible to mitigate this effect by adjusting the operating regime. As water volumes increase dramatically during the spring freshet, these flows need to be passed through the system to avoid flooding of riparian properties. This effect also takes place on unregulated river systems. High flows and levels in the spring are a result of natural processes.

Issue 0.11:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Disturbance of Waterfowl Nests in Late Spring and Early Summer Due to Sudden Fluctuations

Certain waterfowl (e.g. loons) build nests and lay eggs in vegetated sections of the shoreline and bays from mid May through June. Sudden water level fluctuations are known to flood waterfowl nests. These fluctuations may also impact on other species.

Response:

The operating regime cannot address this issue at this time. See action item below.

Action:

Active nesting locations for aquatic birds will be inventoried as part of reproductive success assessment of aquatic birds in wetland areas (e.g. outlet of Killaloe Swamp). MNR and waterpower producers will work with local stewardship partners to install floating nesting platforms for loons at key locations. This approach has proven to be successful on many waterbodies across North America.

Information Need #3:

Water Level Impacts on Near Shore Nesting Birds: Effects of high and low water levels on nesting locations (e.g. Killaloe Swamp, oxbows) should be investigated at different times of the year to see if the wetlands are dry enough in the summer and wet enough in the spring. There is a need to assess the operating regime impacts on the reproductive success of aquatic birds and vegetation in areas where this type of habitat occurs.

Issue 0.12:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Co-ordination with Relevant Initiatives

The Water Management Plan (WMP) needs to be co-ordinated with provincial response programs and any initiatives that may come into effect in the future. Waterpower producers should have contingency plans for operations under drought conditions.

Response:

In the event that extreme drought or flood conditions are officially recognized or declared on the watershed, local Water Response Teams will be formed. MNR will work in a support role on these Water Response Teams to determine the most appropriate response in these situations. Waterpower producers will be represented on these teams and will manage water flows in the watershed accordingly. See Section 2.5.2.

Issue 0.13:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Co-operation and Information Sharing

Co-ordination, co-operation and information sharing among waterpower operations and municipal facilities (e.g. water treatment and sewage treatment facilities) are very important.

Response:

Throughout the planning process the waterpower companies have been developing stronger working relationships with each other, with MNR, municipalities and the public. The waterpower companies co-operated and assisted in gathering data in the process of developing this water management plan. Water flow issues were discussed with municipal water and sewage treatment plants, and minimum flow requirements were negotiated where applicable. Progress reports were distributed during key phases of planning and many agencies on the Bonnechere mailing list were invited to attend public meetings and presentations. MNR will be promoting co-operation and collaboration among waterpower producers during the implementation of this plan.

Issue 0.14:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Timely Communication

Timely communication among waterpower producers on the whole river system and between the MNR and waterpower producers is very important.

Response:

Timely communication is key in ensuring that waterpower producers manage water levels and flows more proactively to satisfy all user-needs on the system. The lines of communication and level of co-operation between MNR biologists and planners, and waterpower partners have improved through the development of this plan. MNR staff will have remote access to level and flow information through RPG's gauging equipment along the river system.

Issue 0.15:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Recognition of Water Needs for Agriculture

The degree to which farming operations use water taken directly from the Bonnechere River for irrigation or livestock use is not documented. Water taking from the river for agricultural purposes may increase in the future, if drought spells and climatic variability continue. The WMP needs to recognize this important user group.

Response:

There are few commercially sized irrigation systems drawing from the river and its main tributaries (see Table 8 for details on 2004 active Water Taking Permits). It has been reported that in some cases water is taken directly from the river for livestock use. This is an important and legitimate use of water resources. MNR and the waterpower producers acknowledge the possibility that large water-taking systems for commercial farming may be installed in the future. These facilities will need to be added to the hydrologic model. The water management plan may need to be amended to reflect any associated changes in water flows.

Issue 0.16:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Recognition of User Groups, Municipal and Residential Use

Water needs of other groups in the watershed need to be recognized and considered (e.g. fire fighting, residential watering, gardening).

Response:

Fire fighting is recognized as a critical water-use along the river and will be accommodated. Currently there are no dry hydrants in the watershed that could be impacted by level and flow changes associated with waterpower operations on the river system.

Municipal water withdrawals for residential and commercial water use and for sewage treatment are addressed in this plan (see Section 3.3).

Issue 0.17:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Need to Communicate with and Involve Algonquin First Nation in Water Management Planning

Algonquins in Ontario reside in several areas and communities in the region. The largest Algonquin community on the Bonnechere watershed is Pikwàkanagàn at Golden Lake. MNR and waterpower operators need to establish and maintain effective lines of communication with Algonquin communities and leadership to keep them involved in and informed about water management decisions.

Response:

The Algonquins have been involved in and represented throughout the planning process by membership on the Steering Committee (See Table 1). The Algonquin representative has also participated in PAC and Steering Committee meetings. Algonquin input to the plan has been ongoing. MNR and the waterpower operators will continue to involve and inform the Algonquins as this plan is implemented and amended in the future.

Issue 0.18:

	10	9	8	7	6	5	4	3	2	1
Applies to Reach										

Shoreline Slope Stability and Leda Clays

The soil substrate along the lower stretches of the Bonnechere River consists predominantly of silts and clays. In some areas the banks are steep and vegetation is sparse. The presence of leda clays and natural erosive forces cause unstable slopes. Parts of the river bank have collapsed into the river. Extreme fluctuations and rain events may further promote the erosion of soil from the shoreline.

Response:

The Douglas Dam operations influence water flows below Reach 4. The Douglas Dam does not have the capacity to store and release large volumes of water and thus there should not be extreme fluctuations in flow on the reach below this facility. RPG and Eganville release water from upstream reaches to minimize drastic water flow changes. The level and flow changes are often a result of seasonal variation in watershed conditions.

Slope stability and erosion of Leda Clays is the result of many factors. The operating regime for the Douglas generating facility will assist in managing flows on the lower reaches. Riparian property owners on the lower reaches are encouraged to protect shoreline vegetation.

The operation of the Renfrew dams has little impact on shoreline erosion below First Chute. The falls control water volumes and associated impacts.

Action:

As part of the solution to this issue, MNR and RPG will support local stewardship initiatives and provide a communication link between agencies, landowners and stewardship groups. Landowners are encouraged to adopt best management practices along their shorelines. Also see response to Issue 8.2 (shoreline erosion on Round Lake).

Other Information Needs for the Bonnechere Watershed Include:

Information Need #4:

Minimum Flows: Specific minimum flows through each of the control structures on the Bonnechere River are required to maintain fish habitat and the overall health of the aquatic ecosystem. Those specific minimum flows need

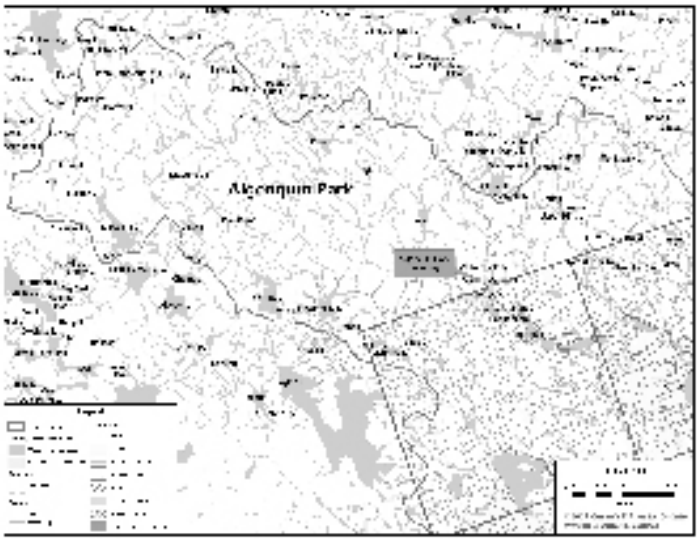
to be established and added to the operating regimes for the control structures on the river.

Information Need #5:

***Bathymetry* Data:** Bathymetry data, particularly for Round Lake, Golden Lake and Wilber Lake, need updating. This will assist with other information needs on the Bonnechere watershed, and fish and wildlife research on the river system.

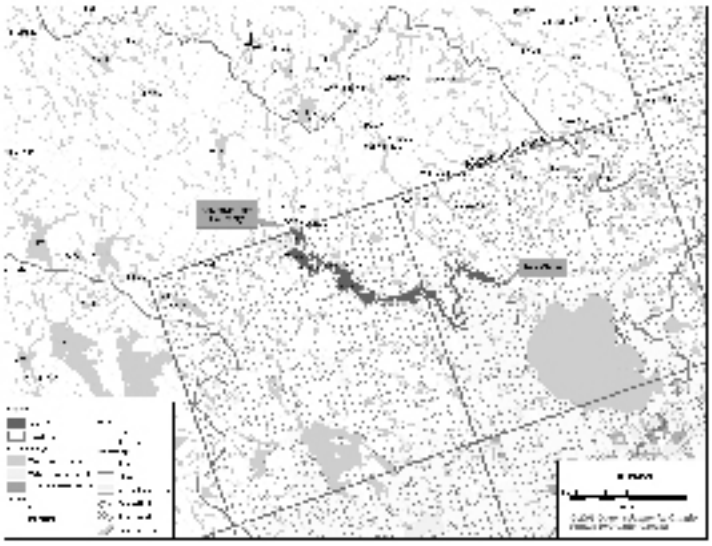
Information Need #6:

Monitor the Whole Fish Community: MNR has done some assessment of the fish community on the Bonnechere and will continue to monitor fish populations under the district fish and wildlife program. The whole fish community should be assessed (i.e. *NSCIN*) on Reaches 5, 4 and 2.



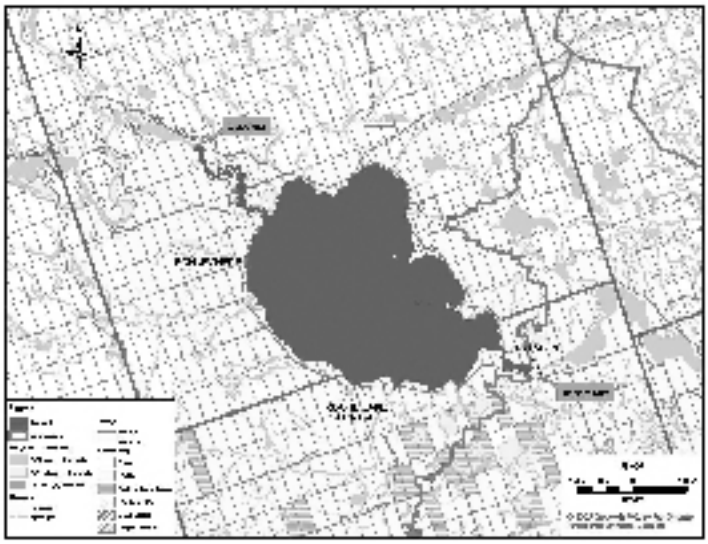
5.2 ISSUES SPECIFIC TO REACH 10: ALGONQUIN PARK

No issues were raised which apply exclusively to this reach of the Bonnechere River.



5.3 ISSUES SPECIFIC TO REACH 9: ALGONQUIN PARK TO JACK CHUTE

No issues were raised which apply exclusively to this reach of the Bonnechere River.



5.4 ISSUES SPECIFIC TO REACH 8: ROUND LAKE (JACK CHUTE TO TRAMORE DAM)

Issue 8.1:

Need to Develop an Operating Regime on Round Lake that Balances the Needs of User Groups Along the River System

There is concern that industrial, commercial, institutional or other operations and values on this reach and downstream may be impacted by a drastic lowering of water levels on Round Lake. A number of individuals in Reach 5 have expressed concerns about extremely low flows in late summer (critical water levels have not been identified).

Response:

Round Lake is the only significant reservoir on the Bonnechere system capable of providing consistent minimum flows for the needs of downstream water-users (e.g. water and sewage treatment, industrial, recreational or commercial users, environmental values). The new operating regime for Round Lake addresses the flow requirements of the Eganville and Renfrew water and sewage treatment plants. The gradual summer drawdown on recreational lakes incorporates fish and wildlife habitat needs in the reaches downstream of Round Lake. The effects on fish and wildlife need to be monitored by MNR in co-operation with waterpower partners.

Issue 8.2:

High Water Levels on Round Lake – Impacts on Shoreline Erosion

There is a need to recognize the potential for spring flooding on Round Lake properties. There are six tributaries feeding the lake and only one outlet releasing water. The ability to monitor incoming water volumes, particularly before and during the spring freshet and during periods of heavy rainfall, and to respond to this information accordingly is also important. One of the effects of high water levels on Round Lake is the increased erosion along some sections of the Round Lake shoreline. Erosion along certain areas of the lake is compounded by impacts from high water in combination with wind and wave action. Increased rates of erosion can lead to diminished setbacks that could potentially result in malfunctioning of septic systems.

Response:

The operating regime developed for this reach is designed to address the following concerns:

- Protection of fish habitat – The ability to pass an adequate amount of water over the Tramore Dam during and after the spring freshet is critical to the protection of the walleye population. The new operating regime will protect the spawning bed during the walleye spawning period. The *littoral zone*, a productive fish habitat area, is very important to lake and river ecosystem function. Landowners play a key role in ensuring that this habitat is safeguarded from point sources of pollution such as septic systems and from destructive alterations of the shoreline. Safeguarding water conditions and maintaining a healthy littoral zone in Round Lake are critical to human health, recreation and various fish communities that are valuable to the local economy. The operating regime allows for wetting of the littoral zone around the lake during the spring freshet.
- Support flows throughout the system – The new operating regime will ensure that an adequate amount of water is stored in Round Lake to accommodate the Bonnechere River system and the various uses, as flows and inflows decrease throughout the summer.
- Electrical Power Production – The new operating regime outlines an operational target that will enable waterpower producers to contribute to the electrical

demands of the community during those times of the summer when there is the greatest demand.

- Golden Lake's ability to react to increased flows – Round Lake will continue to be used as a reservoir during the spring freshet.

Septic systems must be above the 171.23 m asl (107.5 LD) elevation and at the minimum distance from the shoreline specified by the municipality.

As part of the response to this issue, RPG has hosted a shoreline protection workshop. Riparian landowners in the watershed were encouraged to attend. The workshop included general information on shoreline work and free introductory consultations with engineers familiar with various shoreline stabilization techniques. MNR and Fisheries and Oceans Canada provided landowners information on the work permit application process. Future workshops will be considered if needed.

Issue 8.3:

Control of Water Levels and Impacts of Ice Formation and Spring Thawing on Round Lake Shoreline

Ice cover on Round Lake has the potential to damage portions of the shoreline on the lake and at the mouths of tributaries. Ice movement impacts riparian properties and has the potential to damage spawning areas potentially used by pike. It is important that RPG proactively manage water levels in the late fall, during freeze up and during late winter, to minimize shoreline damage.

Response:

The new operating regime has been designed to minimize the potential for ice damage while protecting the native lake trout population (see Issue 8.8).

Fall water levels and impacts on ice damage - Ice damage on Round Lake results when water levels remain high in the fall, between weeks 38 and 50. The new operating regime has an upper limit of 170.83 m asl (106.2 LD) at week 44. The operating regime for this reach is intended to increase protection of shorelines from ice damage.

Issue 8.4:

Maintaining High Water Levels During Spring Pike Spawning and Incubation Period Based on Monitoring

Water levels on Round Lake are lowered before the snow melts, the ice and frozen ground thaws, and spring rains arrive. Northern pike are known to spawn early in the spring (often before complete ice melt) in riparian areas, bays, at the mouths of tributaries and in wetlands thick with vegetation. If water levels are not kept relatively high and consistent throughout the pike spawn and incubation period, eggs and juveniles may be left exposed.

Response:

Round Lake water levels are usually maintained relatively low during the pike spawning period to safely pass spring freshet volumes. Safety concerns (i.e. flood protection on Round Lake and Golden Lake) and ensuring adequate walleye spawning conditions downstream are higher priorities. In years with high volumes of spring rain, some pike spawning areas near an elevation of 171.08 m asl (107.0 LD) will be adequately covered.

Issue 8.5:

Maintaining Water Flow and Level for Walleye Spawning and Incubation Below Tramore Dam

There is a significant walleye spawning area downstream of the Tramore Dam. Walleye eggs need to remain covered by water for the duration of the walleye spawning and incubation period in the spring. There is concern that, in the past, water flow did not keep walleye eggs covered throughout the incubation period. Flows should be improved for walleye spawning.

Response:

Walleye have been declining on the Bonnechere River system. In 2002 the Golden Lake Walleye Rehabilitation Strategy put a walleye fishing moratorium in place until 2006 in response to declining populations. To improve available spawning habitat, a lower spawning shoal was constructed near the Tramore Dam in the summer of 2002. This will provide additional spawning habitat during dryer spring conditions. The operating regime for the Round Lake reach addresses the need for consistent water flow over the Tramore Dam spawning bed in the spring.

Issue 8.6:

Maintaining Suitable Water Levels for Safe Summer Recreational Water Uses on Round Lake

There is a need to maintain suitable water levels on Round Lake during the summer period to allow for safe recreational use (boating and swimming). When water levels are lowered during the summer, rocky shoals are exposed, boat launching is difficult and swimmers in sandy bays must wade far from shore to swim.

Response:

The operating regime cannot be so finely adjusted as to mitigate this impact.

The summer operating regime for Round Lake will more closely follow natural seasonal fluctuations (i.e. higher level in early summer, tapering off to lower late summer conditions). Prior to making recreational plans, lake users should familiarize themselves with the operating regime to avoid areas that may become unsafe for boating. The Round Lake Property Owners Association has been placing floating markers near shoals and boulders to help boaters avoid these areas. A map of these hazards is also available.

Issue 8.7:

Managing Water Levels to Prevent Stagnant High Summer Water Levels on Round Lake

In recent years, the summer water levels on Round Lake have been kept at a static level, usually between 170.93 and 171.05 m asl (106.5 and 106.9 LD). This prevents natural biological processes from occurring within the aquatic ecosystem, limiting the waterbody's biodiversity and health in the long term.

Response:

The range of the new operating regime provides for a more diverse and healthier aquatic ecosystem. During the open water months, the new operating regime follows a more natural pattern compared to the historical operations, partially addressing this issue. On a natural river and lake system, late summer levels during dry years would taper off substantially. Dryer end-of-summer conditions during drought years will address this issue further.

Issue 8.8:

Maintaining Winter Water Levels for Lake Trout Spawning and Incubation on Round Lake

The water level on Round Lake has traditionally been lowered in winter for power production and in anticipation of high volumes of water that result from spring rains, runoff and spring snow melt (i.e. spring freshet). This winter drawdown has the potential to severely impact lake trout egg survival if water levels are brought so low that spawning shoals are exposed or have only a minimal layer of water coverage below the ice. This can lead to freezing of the laid eggs, causing a long-term lack of recruitment and a lake trout population decline.

Response:

The new operating regime addresses this issue. The new lower limit of the operating regime in the winter/spring will ensure water coverage over a large proportion of the spawning shoal during this critical period. The lower end of the band is dynamic (see action item below). Also see responses to Issues 8.2 and 8.3.

Action:

MNR and RPG will monitor and assess ice thickness and water depth over the lake trout spawning shoal on Round Lake at critical times. A detailed survey of the spawning shoal will also be undertaken. This survey will establish the elevation and exact location of the spawning shoal. As part of this study, ice damage along the shore will also be monitored.

Information Need #7:

Status of Lake Trout Population on Round Lake: Little baseline information exists on the impacts of current waterpower operations on the long-term sustainability of the naturally reproducing lake trout population in Round Lake. Evidence suggests that there may be weak recruitment (i.e. very few young fish survive). The status of the population will be assessed (i.e. *SLIN* or *SPIN*) on an on-going basis to measure the population response to the new operating regime.

Other Information Needs for Reach 8 Include:

Information Need #8:

Lake Trout and Walleye Spawning Areas: Lake bathymetry data should be refined by identifying and assessing known and potential spawning areas for lake trout and walleye. Water temperature and depth of spawning would also be useful in refining the operating regime in this reach. A more in-depth shoal survey needs to be conducted at known lake trout spawning shoals to characterize their shape relative to water levels. This should be done in combination with a fall lake trout spawning assessment. Spawning fish and eggs should be located and compared to the characteristics of the shoal to confirm the depth of the critical spawning habitat.

Information Need #9:

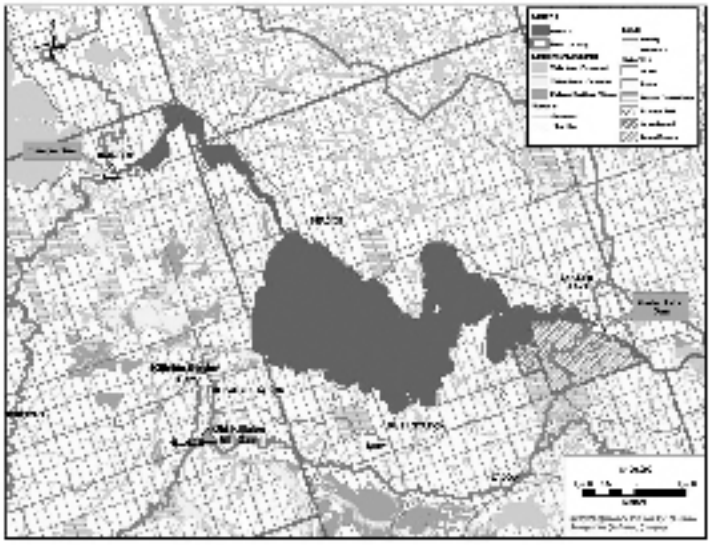
Lake Trout Spawning at Lower Levels: The feasibility of forcing or conditioning lake trout to spawn at lower water levels should be investigated. The outcome or result of this information may have an impact on the future operations.

Information Need #10:

Northern Pike Spawning Areas: It is recommended that this information be refined by identifying and assessing known and potential spawning areas for northern pike.

Information Need #11:

Ice Effect on Shoreline: Need to assess how movement of Round Lake ice impacts the shoreline environment.



5.5 ISSUES SPECIFIC TO REACH 7: GOLDEN LAKE (TRAMORE DAM TO GOLDEN LAKE DAM)

Issue 7.1:

Exposure and Flooding of Shoreline Due to Water Level Fluctuations

Relatively high and low water levels are common on this reach and are an issue since they impact various user groups. For instance, relatively small level and flow adjustments on the part of RPG leads to the exposure or flooding of significant areas of the shoreline around Golden Lake. This impact is related to the gradual slope of the shoreline. Typically, people do not complain about exposure or flooding of shoreline while levels are maintained between 169.22 and 169.35 m asl during the summer months. Precise water levels where impacts are felt have not been reported by user groups.

Response:

In the summer months, the operating regime cannot maintain a level within an 8 to 10 cm range. The low water concern is system-wide, based on seasonal inflows. Under the new operating regime, water will be shared across the entire river system.

The operating regime has been designed to address these issues to some extent. However, a natural bedrock restriction near the outflow from Golden Lake makes control within this range challenging.

Information Need #12:

Bedrock Restriction at Golden Lake Bridge: RPG has arranged to have the bedrock restriction downstream of the Golden Lake bridge studied. This information will enhance the existing hydrologic model and our understanding of Golden Lake's ability to pass spring water volumes.

Action:

Within the first term of the implementation of this plan, RPG will undertake a detailed engineering survey and water flow calculations to characterize the restriction and flow control point near the Golden Lake Dam. The hydrologic model will be updated accordingly.

While the Golden Lake water control structure is limited in its ability to control seasonal variations, the new operating regime has been designed to minimize this issue. Spring water levels will be kept lower than in the past to provide extra storage capacity to safely evacuate the spring freshet.

Issue 7.2:

Irrigation and Industrial Water Withdrawal

Farming and industrial operations may seek to withdraw water in the Golden Lake reach in the future. These future water needs may impact operating regimes on this reach.

Response:

See Table 8 for a list of permits to take water (PTTW) currently in place in the Bonnechere River watershed. PTTWs are issued by the Ontario Ministry of the Environment. There are currently no PTTWs in the Golden Lake reach that could impact waterpower operations or cause major water level or flow impacts to fish and wildlife. Any future applications for permits will need to involve consultation with local stakeholders. Applications will be reviewed in the context of this water management plan.

Issue 7.3:

Maintaining High Water Levels During Pike and Muskellunge Spawning & Incubation Period

The spring water levels on Golden Lake have traditionally been kept relatively low, limiting the success of spawning activity for northern pike and muskellunge. Water levels on Golden Lake are lowered to release water from the lake in anticipation of spring flooding associated with the freshet. Pike and muskellunge are known to spawn early in the spring in riparian areas, bays, mouths of tributaries (i.e. Brennans Creek) and wetlands that are thick with vegetation. If water levels are not kept relatively consistent throughout the pike and muskellunge spawning and incubation period, eggs and juveniles are left exposed. The degree to which water levels in this reach are lowered in anticipation of the spring freshet needs to be refined based on monitoring precipitation trends and water levels in and above this reach. If there is evidence of dry spring conditions (i.e. the spring of 2001 and 2003), water levels need to be maintained at a critical minimum to allow pike and muskellunge spawning before they are lowered significantly.

Response:

The provisions of the WMP designed to address the walleye spawn at the Tramore Dam may also support the pike and muskellunge spawning needs within the Golden Lake reach (see Issue 8.5). When water is spilled over the Tramore Dam to cover the walleye spawning bed in the spring, spring water levels increase on Golden Lake, which supports muskellunge and, to some extent, pike spawning.

Issue 7.4:

Maintaining Water Flows and Levels for Walleye Spawning and Incubation Above and Below Golden Lake Dam

Walleye are known to spawn near the Golden Lake Dam. It is important to ensure a consistent water flow through the dam for the duration of the walleye spawn and incubation period in the spring in order to keep the eggs covered.

Response:

This is addressed through the new operating regime at Golden Lake Dam in response to freshet conditions. Walleye are known to spawn upstream and downstream of the Golden Lake Dam. RPG, in co-operation with MNR, will adjust flows within the operating regime to achieve optimal spawning conditions.

Issue 7.5:

Maintaining Minimum Water Levels for Safe Summer Recreational Water Uses on Golden Lake

There is a need to maintain minimum water levels on Golden Lake during the summer period in order to allow safe enjoyment of recreational uses such as boating and swimming. RPG should consider the fact that a relatively small water level change exposes wide areas along several stretches of the Golden Lake shoreline.

Response:

This issue is related to the shallow, bowl-shape of Golden Lake and a gradual shoreline around much of the lake. In an average year, the summer water levels on Golden Lake have traditionally been kept static (i.e. at a level between 169.22 and 169.35 m asl). RPG intends to keep summer operations within a similar range. The operating regime cannot be so finely adjusted for the summer months as to not inconvenience any of the public recreating on the lake. The new operating regime provides a level-range of 169.1 to 169.44 m asl in summer. Water will be shared or passed from Round Lake to Golden Lake and the rest of the system during the summer season. Prior to making recreational plans, lake users should familiarize themselves with the operating regime to help them avoid areas that may become unsafe for boating. Riparian landowners should be well aware of the operating regime prior to installing water intake pipes, docks and other structures.

Issue 7.6:

Maintaining Water Flows and Levels for Lake Whitefish Spawning and Incubation

Lake whitefish, a recreationally and historically important fish, are known to spawn along certain sections on this reach. Operations at the Golden Lake and Tramore dams need to consider the elevation of these spawning beds, located above and or below these structures, to ensure adequate and consistent coverage for the whitefish spawning and incubation period in the fall and winter.

Response:

The following factors, which influence whitefish populations on Golden Lake, may be impacted to some degree by the Round Lake operating regime:

- spawning shoal elevation
- location of spawning shoal
- timing of spawning and hatching

To ensure that RPG stays within the license of occupation on Golden Lake, the water level of Golden Lake in the spring must be lowered to provide adequate storage. This is further compounded by the constriction at the outlet of Golden Lake.

Information Need #13:

Golden Lake Spawning Areas: Known and potential spawning areas on Golden Lake need to be identified. Information on spawning shoal size, location and elevation, and condition must be obtained. Time of spawning and fry emergence should also be investigated.

Issue 7.7:

Erosion Along Shoreline at Red Pine Camp During High Water Levels

There is a concern about spring erosion along the shoreline near Red Pine Camp. A property owner has reported that high spring water levels in combination with prevailing winds lead to erosion of the sandy shoreline in this area.

Response:

The operating regime cannot eliminate the potential for erosion along the shoreline. It is the responsibility of individual landowners to take action to protect their property. Property owners need to be prepared for erosion resulting from storm events and from seasonal flow and level extremes.

In response to this issue, RPG has hosted a shoreline protection workshop. All riparian landowners in the watershed were encouraged to attend. The workshop included general information on shoreline work and free introductory consultations with engineers familiar with various shoreline stabilization techniques. MNR and Fisheries and Oceans Canada provided landowners information on the work permit application process.

Issue 7.8:

Recognition of Future Water Use by Algonquins at Golden Lake

There are no known negative impacts from level fluctuations to water withdrawals for residential use or sewage treatment on the Golden Lake reach. However, future demands for water should be considered. Preliminary plans for a future water and sewage treatment plant to service the Algonquin community at Golden Lake are being discussed.

Response:

This water management plan cannot address this issue until specific proposals are identified. Any significant impacts to or from the operating regime in relation to future water-use proposals will need to be addressed through the plan amendment process.

Other Information Needs for Reach 7 Include:

Information Need #14:

Monitoring Walleye Success: The success of the five-year walleye season closure (i.e. moratorium in place for 2002 to 2006) and other rehabilitative efforts should be monitored. The operating regime may have an impact on the degree of success in rehabilitating walleye.

Information Need #15:

Lake Whitefish Population Status: Little baseline information exists on the impacts of current waterpower operations on the long-term sustainability of the Golden Lake whitefish population. It is recommended that the present status of the population be assessed (i.e. SPIN) and continue to be re-assessed under the new operating regime.

Information Need #16:

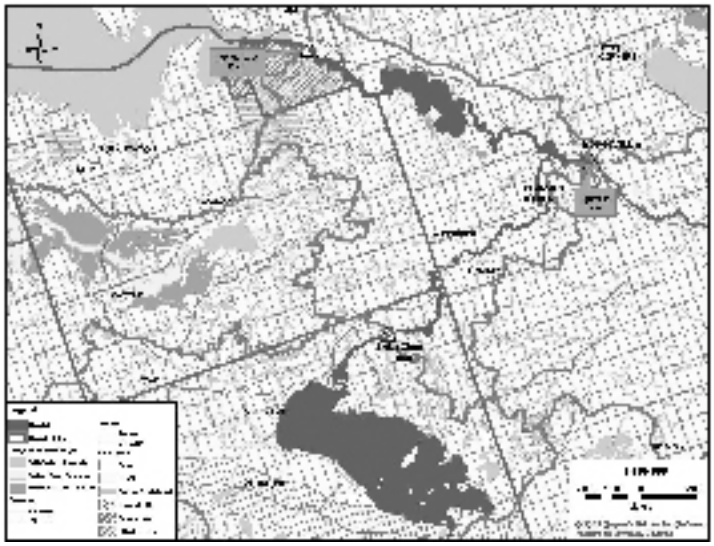
Brennans Creek Spawning Fish Community: Water flows on Brennans Creek are affected by the operation of the Old Killaloe Mill and Killaloe Station Dams. This may have implications for fish and wildlife along the creek. The spring and fall spawning fish community and potential spawning areas should be assessed in order to help refine the operational regime at the Old Killaloe Mill upstream on the creek. Impacts will be investigated.

Information Need #17:

Monitoring Water Levels and Flows on Golden Lake: RPG has committed to upgrading the water level monitoring gauge (temperature and flow information) near the Golden Lake bridge. Real-time water level information will be available to the MNR for WMP implementation and enforcement.

Information Need #18:

Water Level and Flow Impacts on Wild Rice: Members of the Algonquins of Pikwàkanagàn community traditionally harvest wild rice on parts of Reach 7 and Reach 6. It is recommended that studies be conducted to identify the extent and location of these areas traditionally harvested, and to determine if water level and flow manipulations regulated through the WMP impact those areas and/or harvesting activity.



5.6 ISSUES SPECIFIC TO REACH 6: WILBER LAKE (GOLDEN LAKE DAM TO EGANVILLE DAM)

Issue 6.1:

Potential Impacts from Water Level Fluctuations on Wildlife Habitat in Wilber Lake

The Wilber Lake Provincially Significant Wetland (PSW) provides important wildlife habitat. Wildlife of special public concern include bullfrogs, fish, fur-bearers, and shoreline and wetland-nesting birds. The degree of impact on wildlife from raising and lowering water levels and frequent level fluctuations on the Wilber Lake Wetland needs to be considered in the WMP.

Response:

The present vegetation community will be reviewed to determine the impact of fluctuating levels on the wetland. MNR has background information from the Wetland Evaluation. The bullfrog population on Wilber Lake is being monitored each year through the ongoing bullfrog monitoring project. It should be noted that the flow from Wilber Lake is limited by the rock weir and the rapids at the outlet of Wilber Lake.

Action:

The potential impacts of level fluctuations on Wilber Lake will be monitored. Specifically, bullfrogs, shoreline nesting birds and vegetation will be monitored.

Issue 6.2:

Low Summer Water Level Impact on Recreation and Tourism on Wilber Lake

Wilber Lake, a widening of the Bonnechere River, is a shallow lake surrounded by flat topography. During the spring freshet the surface area of the lake and wetland is substantially larger than it is during the summer. This translates into exposure of wide areas of shoreline in the summer. Land owners and a tourist operator on the shores of Wilber Lake have raised the issue of low summer water levels and their negative impact on tourism (e.g. limits ability to launch and operate boats).

Response:

The operating regimes for Round Lake and Golden Lake include a gradual lowering of water levels from mid to late summer. Under normal summer conditions, sufficient volumes of water should be passed from upstream into this reach to mitigate this issue on Wilber Lake to some extent. The WMP does not address issues related to abnormally low water conditions or flooding events, which would both be dealt with through other processes (see Section 2.5.2).

Action:

RPG proposes to undertake seasonal monitoring of water levels and flows at the inflow and outflow of Wilber Lake to collect baseline information (based on gauges at Golden Lake bridge and at the rapids downstream of Wilber Lake).

Issue 6.3:

Low Water Level on Hurds Creek and Impacts to Fish and Wildlife in Summer

RPG attempts to maintain water flow and level on Hurds Creek. During very dry conditions, fish and wildlife populations in the creek may be impacted. Beaver activity has reduced the effectiveness of the Lake Clear Dam in controlling levels and flows. This is the single most important factor that limits RPG's ability to control water flow through Hurds Creek, especially in the summer months.

Response:

Beaver activity is part of any natural aquatic ecosystem. One outcome of the impoundment of water by beaver dams and the decreased flow during summer months is

change in habitat types. Low flows are impacting coldwater species. Discussions are ongoing between RPG, MNR, the Township of Bonnechere Valley and the County of Renfrew Public Works Department to strategically manage beaver numbers and damming activity. The county and the township have an interest in reducing blockage of culverts along municipal roads. Extensive beaver damming on Hurds Creek limits RPG's ability to effectively manage flows from Lake Clear. Landowners have positive and negatives views on the impact of the beaver activity on Hurds Creek. Some would like to see the beavers and their dams removed. Others would not.

Action:

Trapping of beaver has begun, in co-operation with the Renfrew County Nuisance Fur-Bearing Animal Committee, and needs to continue on a seasonal basis. The agencies involved need to continue to co-operate to manage the impact of beaver activity on Hurds Creek.

Issue 6.4:

Maintaining Minimum Water Level for Eganville Water Treatment Plant and Fire Fighting

The Eganville water treatment plant is permitted to withdraw up to a maximum of 2,000,000 litres of water from the Bonnechere River per day. Approximately 890,000 litres are actually withdrawn for municipal purposes during an average day. Water withdrawal and consumption increases in the summer months. Recognition and consideration should be given to this important water need. Although this has not been an issue in the past, a minimum water level needs to be maintained through the Eganville Dam to ensure that water is available for the Eganville water treatment plant and community use.

Response:

The water intake for the Eganville water treatment plant is located midstream and pumps from deep in the river channel. The operating regime for the Eganville Dam will not impact the water intake for the water treatment plant or the availability of water for fire fighting purposes. Note that water intakes for fire fighting purposes in areas around Eganville are portable (i.e. mobile and adjustable). Bonnechere Valley uses the municipal water supply for fire fighting. Under normal conditions, water availability for fire fighting will not be an issue.

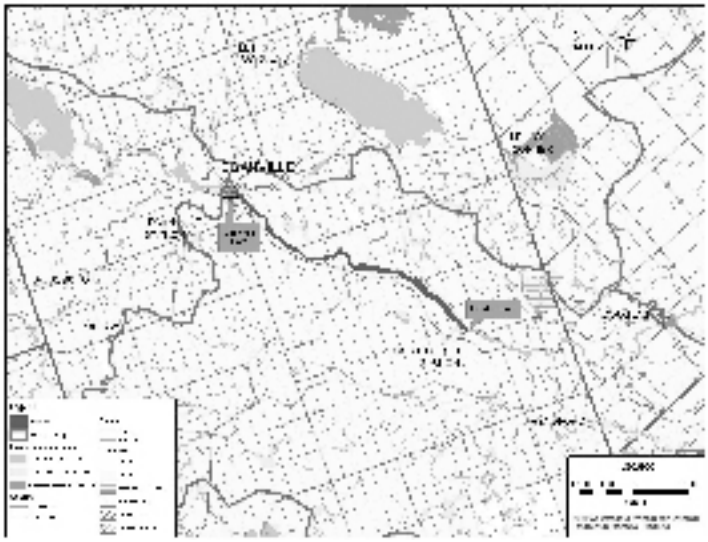
Other Information Needs on this Reach include:

Information Need #19:

Walleye Spawning Below Golden Lake Dam: The area downstream of the Golden Lake Dam is known to attract spawning walleye in the spring. It is recommended that the spawning activity be assessed. This information should be used to refine the operating regime at the Golden Lake Dam during the spring to maximize the amount of available spawning and rearing habitat.

Information Need #20:

Brook Trout in Hurds Creek: It is recommended that the status of the brook trout population in Hurds Creek be assessed. This information should be used to refine the operating regime at the Lake Clear Dam upstream.



5.7 ISSUES SPECIFIC TO REACH 5: EGANVILLE DAM TO FOURTH CHUTE

Issue 5.1:

Maintaining Flows for Sewage Effluent Dilution and Impacts to Fish Habitat Throughout the Year

The Eganville sewage treatment plant (STP) operations rely on water flows through the Eganville Dam. Enough water needs to pass through the Eganville Dam to allow proper mixing with effluent. The fish community is assumed to be mixed (e.g. baitfish, bass, brown trout, walleye) and vulnerable to seasonal low water conditions downstream of the dam in late summer. Low flows in dry seasons may cause algae blooms below the STP discharge area. In the summer and during low water conditions, fish habitat is impacted by a decrease in available oxygen. Suspended solids from sewage effluent sometimes cover spawning areas. There is a need for co-ordination between dam and STP operators, to ensure a minimum flow to protect fish habitat.

Response:

The operating regime for the Eganville generating facility includes a continuous flow requirement of 0.68 cms for sewage effluent dilution. This should minimize any potential impacts to fish habitat throughout the year.

Action:

Volumes and conditions will be investigated during low flow months to verify that the minimum flow requirement meets fish habitat needs. The operating regime for the Eganville Dam will be monitored for any impacts on potential spawning areas on this reach.

Issue 5.2:

Maintaining Water Levels and Flows from the Eganville Dam for Wildlife Habitat

Frogs, muskrat, turtles and possibly other wildlife habitat in water and riparian areas may be impacted by low flows. These impacts are a concern in dry seasons when the water is shallow and the river channel is relatively narrow.

Response:

There is a requirement in this water management plan for historic minimum flows to be maintained through all control structures (see Section 2.5.3). An information need has been documented to establish specific minimum flows for each control structure.

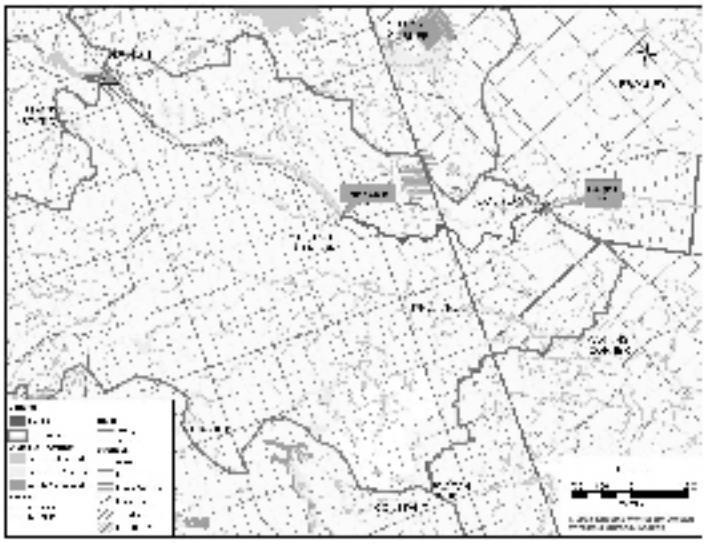
Action:

Volumes and conditions will be investigated during low flow months to verify that the minimum flow requirement for the Eganville generating facility meets wildlife habitat needs.

Other Information Needs on this reach include:

Information Need #21:

Brown Trout Survival: It is recommended that year-round survival success of brown trout present in this reach be assessed.



5.8 ISSUES SPECIFIC TO REACH 4: FOURTH CHUTE TO DOUGLAS DAM

Issue 4.1:

Maintaining Water Levels and Flows for Fish and Wildlife Habitat in River and Riparian Areas Below Fourth Chute

The flow below Fourth Chute, near the Bonnechere Caves, often drops considerably. The flow may be further reduced through operations at the Douglas Dam (downstream) and Eganville Dam (upstream). This impacts fish and wildlife on the reach. The river is meandering and shallow making fisheries assessment work challenging. Little information exists but the fish community is assumed to be mixed (e.g. baitfish, brown trout, bass, pike, walleye). The operating regimes at the Eganville Dam and Douglas Dam need to incorporate minimum flows to protect fish habitat year round.

Response:

Fish and wildlife in this reach have adapted to some degree to the low water conditions in the summer time. The operating regime for the Eganville generating facility and gradual summer water drawdown in the upstream reaches (i.e. Round Lake and Golden Lake) will supplement the low water conditions which may be characteristic of this reach at certain times of the year.

The operation of the Douglas facility impacts water levels in the Bonnechere River for approximately 1 km upstream from the dam.

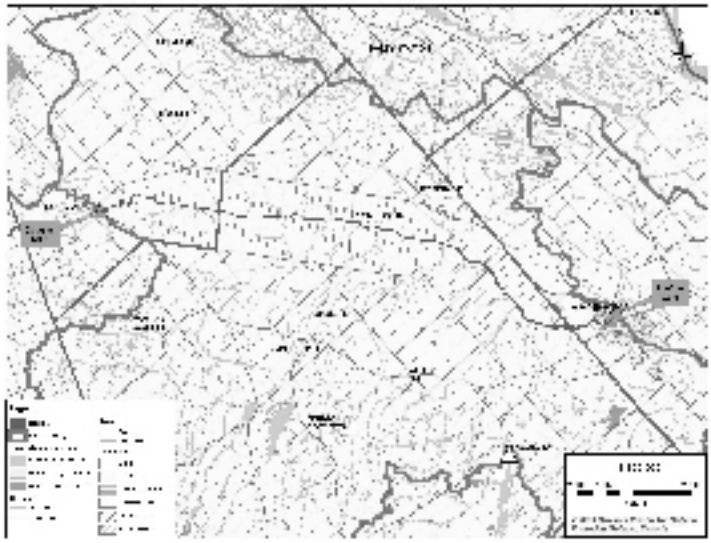
Information Need #22:

Impacts to Spawning Sites: The operating regime established for the Eganville Dam and Douglas Dam should be monitored for any negative impacts on potential spawning areas in this reach. Studies should be conducted to establish fish species and spawning success in this reach. Spawning activity should be monitored to identify any impacts caused by the operating regime and seasonal conditions.

Other Information Needs on Reach 4 include:

Information Need #23:

Brown Trout Survival: It is recommended that year-round survival success of brown trout present in this reach be assessed.



5.9 ISSUES SPECIFIC TO REACH 3: DOUGLAS TO RENFREW DAM #2

Issue 3.1:

Wildlife Habitat Impacted Due to Lack of Control of River and Fluctuations in Levels and Flows Throughout the Year

There is often a lack of water downstream of the Douglas Dam. There is evidence that fish and wildlife habitat has been de-watered because of the operating procedures in place at the Douglas Dam. There are impacts on aquatic habitat for wildlife such as beaver mink, and shoreline nesting birds. Control over operations at the Douglas Dam is needed.

Response:

The operating regime for the Douglas generating facility will address this. The gradual summer water drawdown in the upstream reaches (i.e. Round Lake and Golden Lake) will supplement the low water conditions. Some assessment of wildlife impacts may be determined through actions on Information Need #2.

Issue 3.2:

Appropriate Management of Water Levels and Flows to Cover Fish Spawning Sites Below Douglas Dam

Adequate flows will need to be passed during fish spawning periods to cover eggs and allow for safe incubation and rearing. The operating regime for the Douglas Dam needs to consider fish spawning needs downstream.

Response:

The operating regime for the Douglas generating facility will provide for appropriate water flows.

Information Need #24:

Spawning and Spawning Habitat Assessment: The spawning patterns and specific locations of the spawning sites in this reach should be assessed. The operating regime for the Douglas Dam should be monitored in terms of impacts to spawning sites and fish survival downstream of the dam.

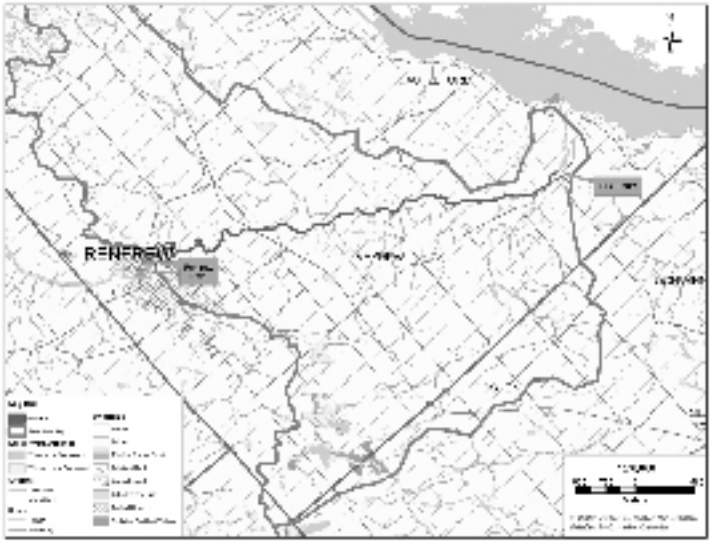
Issue 3.3:

Issue: Maintaining Minimum Water Levels for the Renfrew Water Treatment Plant

The Town of Renfrew is permitted to withdraw up to 13,000,000 liters per day from the Bonnechere River for municipal uses. Approximately 80 percent of this is returned to the river just downstream of Renfrew Dam 2. Recognition and consideration should be given to this large need for water. Although this has never been identified as an issue, a minimum water level needs to be maintained through Renfrew Dam 1 such that a stable water level is available for intake pipe for the Town of Renfrew's treatment system.

Response:

The operating regime for the Renfrew generating stations will not cause de-watering upstream of the structures (i.e. will be maintained at an elevation above 110 m asl). The water intake for the Town of Renfrew water treatment system is located deep in the river and will remain submerged at all times.



5.10 ISSUES SPECIFIC TO REACH 2: RENFREW DAM #2 TO FIRST CHUTE

Issue 2.1:

Impacts to Fish and Fish Habitat Due to Flow Fluctuations and Dry Conditions

In times of low water flows, habitat conditions may have an impact on certain naturally reproducing fish species.

Response:

Some fish species may have been able to adapt to low flow, warmer and less oxygenated conditions. A minimum flow level agreement between RPG and the Town of Renfrew (see Issue 2.2) should address this issue.

Issue 2.2:

Impacts of Low Flow Conditions on Sewage Effluent Dilution

There is a need for RPG to exhibit more control over water flows on this reach to ensure adequate dilution of sewage effluent.

Response:

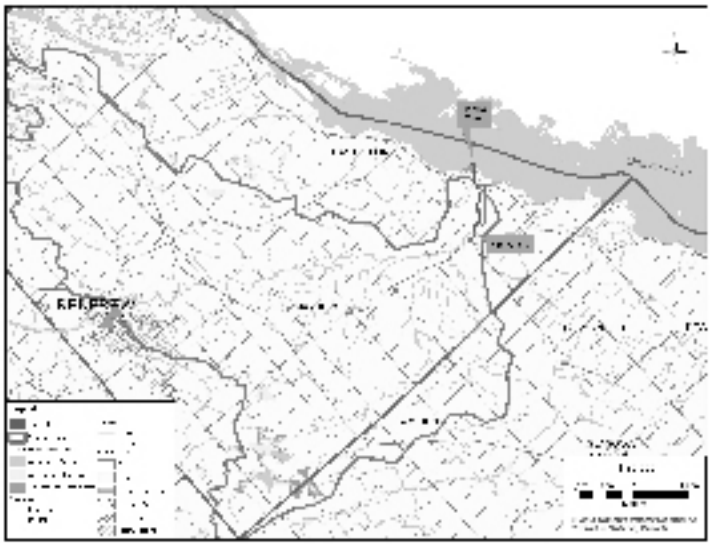
The effect of poor sewage effluent dilution, especially in the summer months, needs to be investigated. Some fish species may be affected by the associated pollutant concentrations.

The Town of Renfrew is planning considerable upgrades to the STP. The new Certificate of Approval that will be issued by the MOE in the future as part of the upgrade process may include an agreement between RPG and the Renfrew STP. This agreement should specify an appropriate minimum flow. This information may need to be incorporated into the WMP as a plan amendment.

Other Information Needs on Reach 2 Include:

Information Need #25:

Spawning and Spawning Habitat Assessment: It is recommended that the spawning patterns and specific locations of spawning sites in this reach be assessed. This information will be useful for updating operating regimes for the dams in Renfrew and upstream in order to maximize fish survival and optimize flows for power generation.



5.11 ISSUES SPECIFIC TO REACH 1 FIRST CHUTE TO OTTAWA RIVER

No issues were raised which apply exclusively to this reach of the Bonnechere River.

Information Needs on Reach 1 Include:

Information Need #26:

Spawning and Spawning Habitat Assessment: The status and health of fish spawning and rearing habitat should be assessed. Spawning patterns and specific locations of the spawning sites in this reach should be assessed. Spawning sites should also be assessed for possible impacts from siltation.

BONNECHERE RIVER WATER MANAGEMENT PLAN

6.1 Effectiveness Monitoring Plan

Through the identification of issues (see Section 5) associated with this water management plan, several specific objectives have been identified that need to be achieved during the term of the plan. Each of these objectives, listed below have associated actions that will be implemented during the term of the plan.

Actions will be developed in co-operation with the Standing Advisory Committee. Some of the actions, to some extent, are already being done. Other actions involve the need to develop partnerships with other organizations, such as local fish and game clubs. And other actions, requiring financial resources and staff time from MNR, will be addressed as resources become available to achieve them.

Effectiveness Monitoring Plan

#	Objective	Actions	Who	Issue	Reach
1	Improve public understanding of water flow and level management on the Bonnechere River.	Develop an Internet Web site and respond to all phone requests, providing current flow and level information to the public	Waterpower producers	0.2	8 - 1
		Promote public use of the Web site and phone response system	Waterpower producers and MNR		
	Monitoring: The Web site has been developed and is available on-line. The Standing Advisory Committee will review the function of and the efforts to promote the Internet Web site and the phone response system and make recommendations for improvements.				
2	Ensure the health and sustainability of lake trout populations in Round Lake through the protection of spawning shoals.	Annually monitor and assess ice thickness and water depth (with drill holes and probes) over the lake trout spawning shoal on Round Lake during the spring. Adjust lake levels during this critical period (weeks 8 to 13) to meet this objective.	Renfrew Power Generation and MNR	8.8	8
	Monitoring: MNR will monitor the effectiveness of this effort and, in co-operation with Renfrew Power Generation, will report annually to the Standing Advisory Committee.				
3	Ensure water coverage over the walleye spawning area below Tramore Dam.	Work with local partners to maintain a Walleye Watch program below the Tramore Dam. Using new stream gauges that provide water temperature values, adjust flows through the Tramore Dam to meet this objective.	RPG and MNR	8.5	8
4	Ensure water coverage over the walleye spawning area above and below Golden Lake Dam.	Work with local partners to maintain a Walleye Watch program above and below the Golden Lake Dam. Using new stream gauges that provide water temperature values, adjust flows and levels to meet this objective.	RPG and MNR	7.4	7
	Monitoring: MNR will monitor the effectiveness of this effort and, in co-operation with Renfrew Power Generation, will report annually to the Standing Advisory Committee.				

#	Objective	Actions	Who	Issue	Reach
5	Increase our understanding of the natural constriction in the river near the Golden Lake Dam and assess the impact of this constriction on the ability to manage flows and levels effectively on the Bonnechere system.	Within the term of the implementation of this plan, undertake a detailed engineering survey and water flow calculations to characterize the restriction and flow control point near the Golden Lake Dam.	Renfrew Power Generation	7.1	8 - 7
	Monitoring: MNR will review the outcome of the Renfrew Power Generation engineering survey and in co-operation with RPG, will report the results to the Standing Advisory Committee.				
6	Investigate the possible impact of water level and management on recreation and tourism on Wilber Lake.	Collect baseline information (based on proposed new stream gauges at the Golden Lake bridge and at the rapids downstream of Wilber Lake) to document seasonal levels and flows on this reach.	Renfrew Power Generation	6.2	6
		Once baseline flow and level data has been established, work with local tourism operations and residents to identify any possible impacts on recreation and tourism.	Renfrew Power Generation and MNR		
	Monitoring: RPG and MNR will report the results of the above efforts to the Standing Advisory Committee.				
7	Establish minimum flow requirements (for ecological values) for each of the control structures on the main channel of the Bonnechere River.	Install stream gauges at each of the control structures to collect accurate flow data.	Waterpower Producers and MNR		8 - 1
		Where possible, determine historic, very-low flow information for each control structure by measuring leakage flows.	Waterpower Producers and MNR		
		Use data collected above, in combination with the best available information on river ecology, natural flow regime models, etc. to establish minimum flow requirements for each control structure.	Waterpower Producers and MNR		
	Monitoring: MNR and waterpower producers will install stream gauges as resources become available and will establish minimum flow requirements for ecological values, in consultation with Fisheries and Oceans Canada (within the first two years of the term of this water management plan). Once established, minimum flow requirements will be added to the water management plan as an amendment				

6.2 Information Needs Table / Data Collection Program

Through the identification of issues (see Section 5) associated with this water management plan, a suite of information needs for the watershed have been identified. These information needs should be addressed on a priority basis through the implementation of the plan. A data collection program to address these information needs and set priorities will be developed (within the first year of plan implementation) in collaboration with the Standing Advisory Committee.

IN#	Information Need Description	Related to		Data Collection	
		Reach	Issue #	Agency	When
1	**Status of Amphibian and Reptile Populations:** Only anecdotal information exists on the location and abundance of amphibian and reptile species (turtles are of special concern). Research needs to be expanded in this area. This is a system-wide information need that could be addressed in conjunction with fur-bearer research.	1 – 8	0.7 0.8		
2	**Status of Fur-Bearer Populations:** Only anecdotal information exists on the location and abundance of fur-bearer species. Research could be expanded in this area. This is a system-wide information need that could be addressed in conjunction with amphibian and reptile research.	3 – 8	0.9		
3	**Water Level Impacts on Near Shore Nesting Birds:** Effects of high and low water levels on nesting locations (e.g. Killaloe Swamp, oxbows) should be investigated at different times of the year to see if the wetlands are dry enough in the summer and wet enough in the spring. There is a need to assess the operating regime impacts on the reproductive success of aquatic birds and vegetation in areas where this type of habitat occurs.	3 – 8	0.11		
4	**Minimum Flows:** Specific minimum flows through each of the control structures on the Bonnechere River are required to maintain fish habitat and the overall health of the aquatic ecosystem. Those specific minimum flows need to be established and added to the operating regimes for the control structures on the river.	2 – 8			
5	**Bathymetry Data:** Bathymetry data, particularly for Round Lake, Golden Lake and Wilber Lake, need updating. This will assist with other information needs on the Bonnechere watershed, and fish and wildlife research on the river system.	6, 7, 8			
6	**Monitor the Whole Fish Community:** MNR has done some assessment of the fish community on the Bonnechere and will continue to monitor fish populations under the district fish and wildlife program. The whole fish community should be assessed (i.e. NSCIN) on Reaches 5, 4 and 2.	2, 4, 5			

IN#	Information Need Description	Related to		Data Collection	
		Reach	Issue #	Agency	When
7	**Status of Lake Trout Population on Round Lake:** Little baseline information exists on the impacts of current waterpower operations on the long-term sustainability of the naturally reproducing lake trout population in Round Lake. Evidence suggests that there may be weak recruitment (i.e. very few young fish survive). The status of the population will be assessed (i.e. SLIN or SPIN) on an on-going basis to measure the population response to the new operating regime.	8	8.8		
8	**Lake Trout and Walleye Spawning Areas:** Lake bathymetry data should be refined by identifying and assessing known and potential spawning areas for lake trout and walleye. Water temperature and depth of spawning would also be useful in refining the operating regime in this reach. A more in-depth shoal survey needs to be conducted at known lake trout spawning shoals to characterize their shape relative to water levels. This should be done in combination with a fall lake trout spawning assessment. Spawning fish and eggs should be located and compared to the characteristics of the shoal to confirm the depth of the critical spawning habitat.	8			
9	**Lake Trout Spawning at Lower Levels:** The feasibility of forcing or conditioning lake trout to spawn at lower water levels should be investigated. The outcome or result of this information may have an impact on the future operations.	8			
10	**Northern Pike Spawning Areas:** It is recommended that this information be refined by identifying and assessing known and potential spawning areas for northern pike.	8	8.4		
11	**Ice Effect on Shoreline:** Need to assess how movement of Round Lake ice impacts the shoreline environment.	8	8.3		
12	**Bedrock Restriction at Golden Lake Bridge:** RPG has arranged to have the bedrock restriction downstream of the Golden Lake bridge studied. This information will enhance the existing hydrologic model and our understanding of Golden Lake's ability to pass spring water volumes.	7	7.1		
13	**Golden Lake Spawning Areas:** Known and potential whitefish spawning areas on Golden Lake need to be identified. Information on spawning shoal size, location and elevation, and condition must be obtained. Time of spawning and fry emergence should also be investigated.	7	7.6		
14	**Monitoring Walleye Success:** The success of the five-year walleye season closure (i.e. moratorium in place for 2002 to 2006) and other rehabilitative efforts should be monitored. The operating regime may have an impact on the degree of success in rehabilitating walleye.	7			

IN#	Information Need Description	Related to		Data Collection	
		Reach	Issue #	Agency	When
15	**Lake Whitefish Population Status:** Little baseline information exists on the impacts of current waterpower operations on the long-term sustainability of the Golden Lake whitefish population. It is recommended that the present status of the population be assessed (i.e. SPIN) and continue to be re-assessed under the new operating regime.	7			
16	**Brennans Creek Spawning Fish Community:** Water flows on Brennans Creek are affected by the operation of the Old Killaloe Mill Dam. This may have implications for fish and wildlife along the creek. The spring and fall spawning fish community and potential spawning areas should be assessed in order to help refine the operational regime at the Old Killaloe Mill upstream on the creek. Impacts will be investigated.	7			
17	**Monitoring Water Levels and Flows on Golden Lake**: RPG has committed to upgrading the water level monitoring gauge (temperature and flow information) near the Golden Lake bridge. Real-time water level information will be available to the MNR for WMP implementation and enforcement.	7			
18	**Water Level and Flow Impacts on Wild Rice**: Members of the Algonquins of Pikwàkanagàn community traditionally harvest wild rice on parts of Reach 7 and Reach 6. It is recommended that studies be conducted to identify the extent and location of these areas traditionally harvested, and to determine if water level and flow manipulations regulated through the WMP impact those areas and/or harvesting activity.	7 – 6			
19	**Walleye Spawning Below Golden Lake Dam:** The area downstream of the Golden Lake Dam is known to attract spawning walleye in the spring. It is recommended that the spawning activity be assessed. This information should be used to refine the operating regime at the Golden Lake Dam during the spring to maximize the amount of available spawning and rearing habitat.	6			
20	**Brook Trout in Hurds Creek** It is recommended that the status of the brook trout population in Hurds Creek be assessed. This information should be used to refine the operating regime at the Lake Clear Dam upstream.	6			
21	**Brown Trout Survival:** It is recommended that year-round survival success of brown trout present in this reach be assessed.	5			

IN#	Information Need Description	Related to		Data Collection	
		Reach	Issue #	Agency	When
22	**Impacts to Spawning Sites:** The operating regime established for the Eganville and Douglas dams should be monitored for any negative impacts on potential spawning areas in this reach. Studies should be conducted to establish fish species and spawning success in this reach. Spawning activity should be monitored to identify any impacts caused by the operating regime and seasonal conditions.	4	4.1		
23	**Brown Trout Survival:** It is recommended that year-round survival success of brown trout present in this reach be assessed.	4			
24	**Spawning and Spawning Habitat Assessment:** The spawning patterns and specific locations of the spawning sites in this reach should be assessed. The operating regime for the Douglas Dam should be monitored in terms of impacts to spawning sites and fish survival downstream of the dam.	3	3.2		
25	**Spawning and Spawning Habitat Assessment:** It is recommended that the spawning patterns and specific locations of spawning sites in this reach be assessed. This information will be useful for updating operating regimes for the dams in Renfrew and upstream in order to maximize fish survival and optimize flows for power generation.	2			
26	**Spawning and Spawning Habitat Assessment:** The status and health of fish spawning and rearing habitat should be assessed. Spawning patterns and specific locations of the spawning sites in this reach should be assessed. Spawning sites should also be assessed for possible impacts from siltation.	1			

7.0 BIBLIOGRAPHY

ACRES International, 2003. Bonnechere Engineering Study – Final Report, April, 2003.

Bennett, C. 1992, Eganville: Jewel of the Bonnechere 1825-1991.

Chapman, L.J. and D.F. Putnam, 1984. The Physiography of Southern Ontario. OMNR, Toronto, Ontario. Ontario Geological Survey Special Vol. 2, 220 pp. Accompanied by map p. 2125.

Crins, W. J, 2002. Ecozones, Ecoregions and Ecodistricts of Ontario – prepared for the ELC Working Group (Renfrew County area).

Kennedy, C.C, 1970. The Upper Ottawa Valley – A Glimpse of History.

Krentzwiser, R. and R. de Loe, 1998. Agricultural and Rural Water Use in Ontario. (used by Low water task force - July 1999).

Mackay, R., 1996. Spirits of the Little Bonnechere River-A History of Exploration, Logging and Settlement - 1800 to 1920.

MNR, 2002. Ministry of Natural Resources, Water Management Planning Guidelines, May 2002.

MNR–OPG, 2000. Ontario Ministry of Natural Resources and Ontario Power Generation, Madawaska River Water Management Review - Final Report, January, 2000.

Ontario Parks (Mark Stabb), 2001. Bonnechere River and Foy Property Provincial Parks Newsletter - Fall 2001.

Statistics Canada. 1996 Agricultural Census, and Statistics Canada community profiles Web site.

8.0 GLOSSARY OF TERMS AND ABBREVIATIONS

7Q20 – the minimum 7-day average flow with a recurrence period of 20 years.

Accretion – slow addition to land by deposition of water-borne sediment.

Acre Feet – measure of the volume of water stored in an area, usually behind a dam or weir; calculated based on one foot of water height covering one acre of lake or land; used to quantify how much water storage a lake and control structure provide.

Area of Natural and Scientific Interest – area with special resource management provisions designed to protect significant earth and life science values; usually has a management plan that guides activities permitted and restricted in this area.

Bathymetry – detailed topography or contour profile of the bottom of a lake or river.

Bedrock Outcrops – areas where the underlying bedrock underground layers of rock foundation are exposed above the soil layer.

Bonnechere River Watershed Group – a group of volunteers who have formed the Bonnechere River Watershed Project to promote and enhance the quality and integrity of the environment through volunteer work by individuals, school and community groups in the watershed.

Booming – used in historical logging techniques; a barrier composed of a chain of floating logs enclosing other free-floating logs, typically used to catch floating debris.

Canadian Shield – a plateau region of eastern Canada extending from the Great Lakes and the St. Lawrence River northward to the Arctic Ocean; composed predominantly of granitic rock formations; some four billion years old; soils in this area are shallow, many smaller wetlands and bedrock outcrops are common.

Contingency Plans – a possible future event, circumstance or environmental condition that could influence potential action or future water distribution and use; management of the resource dependent on an uncertain event such as drought or flood.

Earthflow – flow of well-mixed mass of rock, earth, and water that behaves like a fluid and moves down slopes with a consistency similar to that of newly mixed concrete; downward and outward movement or unconsolidated material together or as a series of units; also called slope failure.

Ecosystem – an ecological community together with its environment, functioning as a unit.

Ecotourism – tourism involving travel to areas of natural or ecological interest, typically under the guidance of a naturalist, for the purpose of observing wildlife and learning about the environment.

Effluent – waste material (e.g. municipal sewage) which has undergone an acceptable level of treatment and is discharged to the natural environment.

Energy Competition Act – legislation that enacted four schedules, among them the *Electricity Act* and amendments to the *Ontario Energy Board Act*; started the transition to a competitive generation, sale and distribution of electricity market.

Extirpate – to wipe out or destroy totally a population of a particular species, such that the species is still known to exist elsewhere in the world (i.e. wood turtle populations can be extirpated in Ontario, while other populations of wood turtles are known to exist elsewhere).

Fluvial – relating to, or inhabiting a river or stream, or produced by the action of a river or stream.

Forebay – area behind a dam where water is stored or held back for later release through turbines

Glacial Spillway – area in the landscape where, after a glacier had receded, it drained, often leaving behind materials it carried as it scoured the landscape (i.e. areas of sand and gravel).

Headwater – streams flowing from the sources of a river; usually associated with upland areas.

Hydrologic Model – a model of the properties, distribution, and effects of water on the earth's surface, sometimes in the soil and the underlying rocks, and in the atmosphere.

Independent Market Operator (IMO) – or The Independent Electricity Market Operator (IMO) is the hub of the electricity wholesale marketplace, connecting all participants - from the generators and suppliers who sell electricity to the wholesale consumers and distributors who purchase electricity and sell it to consumers.

Lakes and Rivers Improvement Act (LRIA) – a piece of legislation in Ontario that provides for the use of waters of lakes and rivers in Ontario; regulates improvements, development or construction in these; preserve public rights over such waters, protects the interests of the riparian owners; aims to legislate the use and management of fish and other natural resources dependent of the waters, and to preserve the natural amenities of Ontario's waterways, and associated shores and banks.

Leda Clays – soils composed of fine particles, usually standing as near-vertical cliffs; surface tension or attractive forces of tiny soil particles holds soil together as a cohesive mass, when saturated with water, becomes unstable and soil turns into slurry, often flowing away as a land slide.

License of Occupation (LO) – type of land use occupational authority that conveys the right to occupy Crown Land under certain conditions; one type of tenure document used by the MNR to authorize the occupation and use of Crown land; issued under the authority of Section 20 of the *Public Lands Act*; describes the land parcel(s) that are affected and the type of land use that it allows (i.e. flooding, water lots, construction of water control structures).

Littoral Zone – the area of the shore of a lake where light is able to penetrate to the bottom; often more than 60 percent of the flora and fauna in the lake or other body of water exists in the littoral zone.

Marsh – low land flooded in wet weather and usually watery at all times of the year.

Near Shore Community Index Netting (NSCIN) – A standardized netting technique, conducted in late summer, which is used to assess warm or cool water fisheries as a whole. The technique is non-lethal, and involves the use of trapnets.

Ontario Energy Board (OEB) – a regulatory agency of the Ontario Government, is an independent, quasi-judicial tribunal created by the *Ontario Energy Board Act*. Although it reports to the Legislature through the Minister of Environment and Energy, the Board operates independently from the Ministry and all other government departments in the performance of its regulatory functions and responsibilities. The Board has regulatory oversight of both natural gas and electricity matters in the province and also provides advice on energy matters referred to it by the Minister of Environment and Energy and the Minister of Natural Resources.

Ontario Low Water Response (formerly Water Response 2000) – is intended to ensure provincial preparedness, to assist in co-ordination and to support local response in the event of a drought. This plan is based on existing legislation and regulations and builds on existing relationships between the province and local government bodies.

Oxbow – a loop formed by a horseshoe bend in a river; many oxbows have slower moving water and offer a secure habitat for diverse flora and fauna.

Peaking System (hydro) – whereby the waterpower generating facilities hold back water in order to release and generate electricity at the most profitable time as dictated by the electricity market; a peak in current.

Polishing – the dilution or distribution of treated effluent from sewage treatment plants.

Post Glacial Lake – lake created as a result of earth scouring, dropping of ice chunks during ice sheet movement or the process of glaciers melting as they retreat.

Provincially Significant Wetlands (PSW) – wetlands that have special characteristics of natural or cultural importance; PSWs are evaluated wetlands that are assessed and scored in terms of their characteristics (i.e. Have valued hydrological function such as flood attenuation capacity; Contain vulnerable, threatened or endangered flora or fauna); development in and around PSWs is restricted and limited.

Rain Shadow Effect – The result of the process by which moist air on the windward side of a mountain rises and cools, causing precipitation and leaving the leeward side of the mountain dry.

Reach – Any length of river under study, with definable features; reaches on the Bonnechere River are defined or separated by waterpower facilities, water control structures or obvious natural features that cause a change in the characteristics of the river.

Riparian Properties – properties or land parcels along a riverbank or on lakefront.

Run-of-the-River – a generating facility is called a run-of-the-river operation when it has minimal forebay storage, passes all or most of the inflow of water from upstream through one or more turbines on a continual basis, with the remainder of the water spilling over existing falls or the dam's spillway.

Spring Littoral Index Netting (SLIN) – A standardized netting technique that specifically targets lake trout, and which is conducted in spring, before the lake has thermally stratified. The technique is non-lethal and involves the use of gill nets.

Summer Profundal Index Netting (SPIN) – A standardized netting technique which specifically targets lake trout in the summer. Similar methodology to a SLIN, with modifications to account for summer lake temperatures. The technique is non-lethal and involves the use of gill nets.

Spring Freshet – wet conditions in a watershed associated with spring rains, melting snow cover, often high water table levels, and sometimes surface water flooding.

Stratified – constructed or accumulated in layers.

Sustainable – an action that conserves an ecological balance by avoiding the depletion of natural resources, at the same time considering economic and social concerns and demands; sustainability can be measured in time and across different user groups dependent on a natural resource.

Turbid – muddy and not clear or transparent.

Waterpower – Generating electricity by conversion of the energy of running water.

Watershed – a line of separation between waters flowing to different rivers, or basins; area of land drained by a single river and its tributaries or creeks.

Water Response 2000 – (see Ontario Low Water Response).

Water Taking Permits – permits to take water under Section 34 of the *Ontario Water Resources Act*, the MOE regulates the withdrawal and use of large quantities of surface and ground water (i.e. 50,000 litres per day or greater requires a water taking permit); the ecosystem approach and impacts to supply of water in the watershed is to be taken into consideration when the MOE reviews and approves permits; permit applications are posted on the *Environmental Bill of Rights* Registry. For more information see www.eco.on.ca.

Weathering – the action of weather on materials exposed to it (e.g. erosion*)* weathering could also be caused by chemical changes or physical changes.

APPENDICES

Appendix 1
Project Terms of Reference
Bonnechere River Water Management Review

Appendix 2
Acres International Cover Letter: Summary of Model Results for Alternative 1
Acres International Cover Letter: Summary of Model Results for Alternative 2
Model Results, Round Lake Water Levels, Alternative 1
Model Results, Round Lake Water Levels, Alternative 2
Fact Sheet: Wilber Lake - History of Rock Weir
13-Year Operating Levels on Round Lake and Golden Lake

Appendix 3
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Consensus Ground Rules

Appendix 4
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Appendix 5
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Appendix 6
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Appendix 7
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Appendix 1

to the Bonnechere River Water Management Plan

Project Terms of Reference

Bonnechere River Water Management Review

BONNECHERE RIVER WATER MANAGEMENT REVIEW (BRWMR)

Project Terms of Reference

(November 2001)

Background

The Bonnechere River carries much ecological, social and economic significance. The River is large and diverse. It is 145 km (90 miles) in length and encompasses an area of 2,400 sq. km (935 sq. miles). Over 80% of the land in the Bonnechere River watershed is privately owned.

With its headwaters on the Canadian Shield in Algonquin Park (McCaskill's Lake and North Branch), the Bonnechere River flows into the Ottawa River at Castleford. The character of the river changes from cold and clear to warm and turbid as it flows and meanders from a rocky and forested landscape at its origin, to the open farmland with more erodible clay soils, human settlement and scattered woodlands. Golden Lake and Round Lake, two of the largest lakes in Renfrew County, are situated on the Bonnechere and are an attraction for tourists, seasonal cottagers and local residents.

Historically and today, Renfrew County residents and communities in the Bonnechere River watershed continue to rely on the River for its natural resources including its hydro-electric production. Power generation activities are governed by *Licences of Occupation* and *Waterpower Lease Agreements* administered by the Ministry of Natural Resources (MNR) under the *Public Lands Act*. Also, recent amendments to the *Lakes and Rivers Improvement Act* have given the Minister the authority to demand that a water management review or plan be produced and adhered to by any of the hydro producers in the province.

The Ontario Ministry of Natural Resources, Renfrew Power Generation Inc., Eganville Generation Corporation, Multistream Power Corporation and operators of the Old Killaloe Grist Mill Dam are conducting a review of water levels and flows management on the Bonnechere River in a partnership encouraged by the newly amended legislation. The result of this Review will be a Water Management Plan (WMP) with operational limits and constraints that will take into account fish and wildlife concerns, the needs of various user groups on the River, as well as sustainability of hydro production on the Bonnechere River. This plan will be periodically reviewed and updated as new information becomes available through research on the Bonnechere and other river systems.

The BRWM Review is a significant step forward for several reasons:

1. It aims to apply several concepts to all users: sustainable development, water management planning and an ecosystem approach to management;
2. It involves water management planning for the entire Bonnechere River, not just sections of it;
3. It involves public information and participation as a key element of water management planning throughout the process;
4. It strives to develop management approaches that are cost-effective, building on experience elsewhere in the province;
5. Its scope considers not only the Bonnechere River, but also gives regard to the headwaters, wetlands and major tributaries along the River where man-made water control structures are operational;
6. It will improve communication and cooperation between the MNR, power generators, and communities and recreational users along the Bonnechere River.

Goal

To develop an inter-agency water level and flow management plan for the Bonnechere River that integrates socio-economic and environmental values, and to communicate it to the public.

Objectives

1. Review existing water management by hydro utilities and MNR, from an ecosystem, watershed and resource use perspective.
2. Provide long-term and meaningful opportunities for broad public involvement in the River's management.
3. Build towards a comprehensive water level management plan (WMP) for the river and contribute findings of studies and this process to watershed management initiatives on the Bonnechere River and elsewhere in the future.

Guiding Principles for the Review

1. Current and future operations must adhere to present licensing and regulatory requirements and build on existing operational practices (under extreme natural conditions it may not be possible to operate within 'normal' limits). Changes to legislation will be considered and complied with.
2. Identification of options must be a comprehensive and cost-effective exercise.
3. Internal and external communications are important to the Review and will be coordinated between the organizations.
4. Cost sharing options to implement the outcome of the planning process will be explored by the Working Group.

Roles and Responsibilities

The roles and responsibilities associated with the Review will be divided between three groups, the Working Group, Public Advisory Committee and the Steering Committee. Members of the *Working Group* will work through concerns and issues raised during the review, will deal with action items that will contribute to solutions, and will advise the PAC and support its activities during pubic consultation. The *PAC* will advise the Working Group of any issues and possible solutions as they solicit these from the public, and will continually help in planning and implementation of communications and public consultation. The *Steering Committee*'s primary responsibility rests in reviewing phases of the work to be completed, ensuring the work is meeting the goals of the review, and ensuring the implementation of the review's recommendations. The Steering Committee will offer guidance and recommendations throughout the process. Task groups may be formed to deal with specific components or action items of the review.

Planning Process

1. Prepare a planning schedule, Terms of Reference, Joint Communication Strategy
2. Collect background information, review past studies, assess information needs
3. Identify and verify problems, issues, perspectives, possible solutions with PAC and the public
4. Analyze and develop solutions
5. Review problems, issues and solutions with public, clients/stakeholders, and PAC
6. Complete draft plan
7. Review draft plan with PAC and public, make appropriate changes
8. Approve plan, print, and distribute, implementation, review and amend on regular basis

Internal and External Integration

1. Build on the information experience of other similar processes (i.e. Madawaska Water Management Review).
2. Develop a link with the Renfrew County Stewardship Council, through (a) Bonnechere River Committee member(s), deliver joint public presentations.
3. Develop a link and collaborate with the planning team concurrently developing a Management Plan for the proposed Little Bonnechere Provincial Park.

4. Consult with the public (i.e. Representation from interest groups such as anglers, farmers, hunters, canoeists, cottagers, permanent residents in the watershed) throughout the process.
5. Communicate with and integrate process within other related MNR projects and concerned government agencies or branches (i.e. Fish and Wildlife Branch, Waters Section, Department of Fisheries and Oceans, Ministry of the Environment, Ministry of Agriculture, Food & Rural Affairs).

Appendix 2
to the Bonnechere River Water Management Plan

Acres International Cover Letter: Summary of Model Results for Alternative 1

Acres International Cover Letter: Summary of Model Results for Alternative 2

Model Results, Round Lake Water Levels, Alternative 1

Model Results, Round Lake Water Levels, Alternative 2

Fact Sheet: Wilber Lake - History of Rock Weir

13-Year Operating Levels on Round Lake and Golden Lake

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April 4, 2002
P14417.05.01-002
.06.03

Ministry of Natural Resources
Pembroke District Office
31 Riverside Drive
Pembroke, Ontario K8A 8R6

Attention: Ms. Joanna Gaweda
Bonnechere River Planner

Dear Ms. Gaweda:

Bonnechere River Engineering Study
Summary of Model Results for Alternative 1

Introduction

We are pleased to present the results of our simulation to assess the impacts of changing the operating regime at Round Lake (referred to herein as Alternative 1). The Working Group of the Bonnechere Water Management Review has proposed to alter the operating zones of Round Lake (see Figure 1) and wish to determine the affect on downstream water availability when compared to the existing operating strategy. Specific areas of concern include:

A. The change in flow release from Round Lake to downstream Walleye spawning areas between March 19 and May 27 (Weeks 12 to 21).

B. The change in expected winter (November 1 to March 31) levels at Round Lake.

C. The change in expected year round water levels at Golden Lake.

D. The change in expected flows at the power stations in Eganville, Douglas and Renfrew.

E. The practicality of the proposed new operating band.

Below, each of these key issues has been separately addressed and discussed with tables and charts utilized to aid in the presentation.

Results and Discussion

A. Flow Downstream of Round Lake During Walleye Spawning

Walleye spawning is expected to occur between March 19 and May 27 (Weeks 12 to 21). During this period the results of Alternative 1 show that the average flow downstream of Round Lake is expected to increase – particularly during the month of April (Weeks 14 to 17). The increase in flow is the result of higher water levels in Round Lake. The proposed new operating band ensures higher levels in Round Lake in the winter period thereby leaving less storage available for capturing the runoff of the spring freshet. The high spring time floods must pass through Tramore Dam in order to avoid exceeding the upper limit of the operating zone (see green band in Figure 2). The reduced available storage requires higher flows to be passed in Alternative 1 than in the Base Case. A statistical breakdown of the results (and a comparison with the Base Case) is presented in Table 1 and Figures 2b, 2c, 3 and 4.

Acres would also like to express a concern with reducing the available storage for the capture of the spring freshet. The Base Case winter drawdown is typical of most dams in Canada. The low levels prior to the spring freshet provides the benefit of reducing spring flood levels on the lake as well as reducing peak discharges in the river downstream. As well, in some cases the winter drawdown is an important operational feature that ensures the safety of the dam during large floods. There has not been a dam safety assessment done on Round Lake so we cannot assess at this time whether the changes proposed in Alternative 1 will affect the safety of the dam, but we would recommend that this should be assessed before Alternative 1 is adopted as the new Water Management Plan.

B. Winter Levels at Round Lake

The Ministry Natural Resources (MNR) has determined that the risk due to ice damage is increased when the water elevation at Round Lake lies between 104.5 and 106.5 ft during the winter months (November 1 to March 31). For presentation of the model results, the operating range at Round Lake was divided into five zones. The zonal definitions are as follows:

- Zone 1 lies between elevations 102 and 104.5 ft
- Zone 2 lies between elevations 104.5 and 105.5 ft
- Zone 3 lies between elevations 105.5 and 106.5 ft
- Zone 4 lies between 106.5 and 107 ft
- Zone 5 lies between 107 and 108 ft.

A statistical summary of the expected water level at Round Lake for both the Base Case and Alternative 1 is shown in Figure 5. A comparison between the two scenarios reveals that there is an increase in the expected winter level at Round Lake. In the Base Case, winter levels are most often expected to lie in Zone 2 (104.5 to 105.5 ft) with an occurrence frequency of 50%. Conversely, the proposed new operating strategy for Round Lake will generally result in higher winter levels lying mostly (82% of the time) between 105.5 and 106.5 ft (Zone 3). The increase in winter levels is due to the reduction in the winter operating range. The proposed new operating strategy specifies a minimum winter level of 104.8 ft until the last week of March. Past operation has shown the level to go to 104 ft as early as February in anticipation of the spring runoff. The higher minimum level will, consequently, keep more water in Round Lake. Details of the simulated winter levels for the Base Case and Alternative 1 are presented in Tables 2 and 3, respectively.

C. Year Round Levels at Golden Lake

No change was specified in the operating range at Golden Lake for Alternative 1. Therefore, target levels in the simulation of Alterative 1 were identical to those in the simulation of the Base Case. A comparison between the simulation results shows that there is almost no change in the expected levels at Golden Lake (see Figure 6). Upon closer inspection the results show that the expected minimum level in April has increased when compared to the Base Case. The cause for the increase is due increased flow release from Round Lake during the Walleye season. Figures 7 and 8 show the statistical range of levels expected at Golden Lake for both scenarios.

It must be noted that the current state of the model contains a crude representation of the water level drop between Golden Lake Bridge and Golden Lake Dam. A more accurate description of the relationship between the two levels is required to represent the water levels and outflows at Golden Lake with a greater degree of confidence. Presently this relationship is not available. Acres has provided a summary of the expected water

level at Golden Lake using the crude relationship but it must be made clear that this estimate is associated with a higher degree of uncertainty.

D. Flow to Eganville, Douglas and Renfrew

Graphs comparing the average expected flow to Eganville, Douglas and Renfrew for both scenarios are shown in Figures 9, 10 and 11, respectively. Inspection of the figures yields the same conclusion as above – average expected flow is generally unchanged with the proposed new operating band at Round Lake except for the month of April. As mentioned, more flow is expected to be released from Round Lake in April by adopting this operating zone because of the limited storage available to capture the spring freshet. The maximum increase in average flow in April for Eganville, Douglas and Renfrew are 13%, 10% and 8%, respectively. Figures 12 to 14 present the statistical breakdown of the flow to each plant graphically for the Base Case, and Figures 15 to 17 present the statistical breakdown for Alternative 1.

E. The Practicality of the Proposed New Operating Band

Addressing this issue requires knowledge of the resources available to Renfrew Power Generation (RPG), who operates the control structure (Tramore Dam) at Round Lake. An important question that needs answering in order to address the practicality issue is: Is it feasible for RPG to operate Tramore Dam under the proposed new strategy with their current resource base?

Acres cannot answer this question directly. However, considering that the simulations implicitly assume that modeled flow releases can be achieved, a rough estimate of the number of times log placement must be changed at the dam (for both simulations) revealed that, in an average year, no additional effort is required to maintain the levels within the proposed new operating zones. Instead, this estimate revealed that only the timing of new log placements must be changed. Again, it must be emphasized that this is a rough estimate and should be confirmed with RPG.

Summary

An assessment of the ramifications associated with adopting new operating zones at Round Lake has been completed. The results of the analysis revealed that Round Lake could experience higher levels in the winter months, leaving less storage available for the spring runoff. If spring levels can be maintained within the safe zone (green band in Figure 1), then higher flows can be expected downstream. If not, then flooding of Round Lake becomes a risk.

Thank you for providing the opportunity to assist you with the development of your water management plan. If you have any questions about this report, please do not hesitate to call Alfred Breland or Jason Shaw at 905-374-5200.

Yours very truly,

(signed original sent by courier)

JS:wf A. B. Breland

Project Manager
N. Paroschy, MNR
P. Moreau, MNR
J. Shaw, Acres

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April 9, 2002
P14417.05.01-004
.06.04

Ministry of Natural Resources
Pembroke District Office
31 Riverside Drive
Pembroke, Ontario K8A 8R6

Attention: Ms. Joanna Gaweda
Bonnechere River Planner

Dear Ms. Gaweda:

Bonnechere River Engineering Study
Summary of Model Results for Alternative 2

Introduction

We are pleased to present the results of our second simulation to assess the impacts of changing the operating regime at Round Lake (referred herein as Alternative 2). The Working Group of the Bonnechere Water Management Review has proposed to alter the operating zones of Round Lake (see Figure 1) and wish to determine the affect on downstream water availability when compared to the existing operating strategy. Specific areas of concern include:

A. The change in flow release from Round Lake to downstream Walleye spawning areas between March 19 and May 27 (Weeks 12 to 21).

B. The change in expected winter (November 1 to March 31) levels at Round Lake.

C. The change in expected spring (April 1 to May 31) levels at Round Lake.

D. The change in expected year round water levels at Golden Lake.

E. The change in expected flows at the power stations in Eganville, Douglas and Renfrew.

F. The practicality of the proposed new operating band.

Below, each of these key issues has been separately addressed and discussed with tables and charts utilized to aid in the presentation.

Results and Discussion

A. Flow Downstream of Round Lake During Walleye Spawning

Walleye spawning is expected to occur between March 19 and May 27 (Weeks 12 to 21). During this period the simulation of Alternative 2 shows that the average flow downstream of Round Lake is expected to decrease slightly (when compared to the existing conditions [Base Case]). Closer inspection of the results reveals that flow released from Round Lake between March and April will be higher than the Base Case while flow released in the latter half of the spawning season (May) will be less. The average decrease in flow is the result of lower target water levels prior to the Walleye spawning period. The proposed operating band ensures lower levels in Round Lake in the winter period thereby leaving more storage available for capturing the spring freshet. The high spring time floods are captured in Round Lake and raise the water level throughout the spawning season (see green band in Figure 2a). A statistical breakdown of the results (and a comparison with the Base Case and Alternative 1 [see letter report issued April 4, 2003]) is presented in Table 1 and Figures 2b, 2c, 3 and 4.

B. Winter Levels at Round Lake

The Ministry Natural Resources (MNR) has determined that the risk due to ice damage is increased when the water elevation at Round Lake lies between 104.5 and 106.5 ft during the winter months (November 1 to March 31). For presentation of the model results, the operating range at Round Lake was divided into five zones. The zonal definitions are as follows:

- Zone 1 lies between elevations 102 and 104.5 ft
- Zone 2 lies between elevations 104.5 and 105.5 ft
- Zone 3 lies between elevations 105.5 and 106.5 ft
- Zone 4 lies between elevations 106.5 and 107 ft
- Zone 5 lies between elevations 107 and 109 ft.

A statistical summary of the expected water level at Round Lake for the Base Case, Alterative 1 and Alternative 2 is shown in Figure 5a. In the Base Case and Alternative 2, winter levels are most often expected to lie in Zone 2 (104.5 to 105.5 ft) with an occurrence frequency of 50% and 56%, respectively. These results are in direct contrast to Alternative 1 where the water level is expected to lie between 105.5 and 106.5 ft (Zone 3) 82% of the time. The decrease in water level at Round Lake in Alternative 2 is, once again, due to the low target levels between November and March where the proposed operating strategy dictates that Round Lake goes as low as 102.5 by March 4. Details of the simulated winter levels for the Base Case, Alternative 1 and Alternative 2 are presented in Tables 2, 3 and 4, respectively.

C. Spring Levels at Round Lake

The expected spring (April to May) water level in Round Lake was also summarized and grouped according to the Zones described in Section B. The simulation results show that the spring levels are generally lower under Alternative 2 as compared to Alternative 1 and the Base Case simply because

1. the target levels during the spring are lower and,
2. there is sufficient flow capacity at Tramore dam to accommodate the change in operating strategy.

The frequency breakdown of the monthly Round Lake levels is presented in Figures 5g and 5h and Table 5.

D. Year Round Levels at Golden Lake

No change was specified in the operating range at Golden Lake for Alternative 2. Therefore, target levels in the simulation of Alterative 2 were identical to those in the simulation of the Base Case. A comparison between the simulation results shows that there is almost no change in the expected levels at Golden Lake (see Figure 6). Closer inspection (see Figures 7 and 8 for daily statistical breakdown) of the daily results leads to the same conclusion – there is no appreciable difference between the Base Case and Alternative 2.

It must be noted that the current state of the model contains a crude representation of the water level drop between Golden Lake Bridge and Golden Lake Dam. All scenarios tested thus far show that the Golden Lake outlet has sufficient capacity to pass all but very high flows downstream. Therefore, simulated Golden Lake levels have remained within the specified operating zone more often than expected.

A more accurate description of the relationship between the level at the bridge and the dam is required to represent the water levels and outflows at Golden Lake with a greater degree of confidence. As noted in the Bonnechere Engineering Study Report (April 2003), this relationship is not presently available. Acres has provided a summary of the expected water level at Golden Lake using the crude relationship but it must be made clear that this estimate is associated with a higher degree of uncertainty. Given the historical operation of the outlet at Golden Lake, it is conceivable that the estimated water levels could be higher.

E. Flow to Eganville, Douglas and Renfrew

Graphs comparing the average expected flow to Eganville, Douglas and Renfrew for the Base Case and Alternative 2 are shown in Figures 9, 10 and 11, respectively. Inspection of the figures reveals three time periods where there is a significant difference in flow. The first period occurs between January 1 and April 22 where Round Lake water level is reduced to accommodate, and then consequently be filled by, the spring freshet. To achieve Alternative 2 target levels at Round Lake during this period more flow must be released (relative to the Base Case). The excess flow is carried downstream and amounts to an average increase of 9.4%, 8.3% and 6.8% at Eganville, Douglas and Renfrew, respectively.

Following April 22, the target level at Round Lake continues to rise in Alternative 2 until the last week of May. However, the Base Case shows the level at Round Lake peaking and then receding. The difference in water level trajectories results in a lower flow release from Tramore dam in Alternative 2. The decrease in flow results in approximately -19%, -18% and -16% at Eganville, Douglas and Renfrew, respectively and is expected to continue until the second week of July.

The third period where there is a significant difference in flow downstream of Golden Lake occurs between September 24 and October 7. At this time, Alternative 2 requires a sudden drop in the target level of approximately 1.4 ft. Accomplishing this requires a sudden release from Round Lake, the result of which causes the flow at Eganville, Douglas and Renfrew to almost double when compared to the Base Case. The approximate increase in flow is presented in Table 6 along with the differences associated with the periods 1 and 2.

A statistical breakdown of the flow to Eganville, Douglas and Renfrew for both the Base Case and Alternative 2 are presented in Figures 12 to 17.

F. The Practicality of the Proposed New Operating Band

Addressing this issue requires knowledge of the resources available to Renfrew Power Generation (RPG), who operates the control structure (Tramore Dam) at Round Lake. An important question that needs answering in order to address the practicality issue is: Is it feasible for RPG to operate Tramore Dam under the proposed new strategy with their current resource base?

Acres cannot answer this question directly. However, caution must be exercised if the operating strategy of Alternative 2 were to be adopted. The main reason is due to the extremely narrow operating band (1 ft) during the spring (March to May). The simulation shows that, on average, the water level can not be kept within this band (see the first two weeks in April in Figures 2a and 2c). Such a narrow band is not flexible enough to accommodate the inherent extreme variability associated with spring runoff. Adhering to such a strategy may increase the risk of flood downstream – a risk which is exacerbated when an accurate representation of the outlet characteristics at Golden Lake is not yet known.

A secondary reason for noting caution with the adoption of the operating strategy proposed in Alternative 2 is the narrow operating band in September when the target level drops 1.4 ft. Again, there is no flexibility to account for the variability in the runoff associated with autumn storms and the risk due to flood is increased if Golden Lake does not have the capacity to hold the excess flow.

Summary

An assessment of the ramifications associated with adopting new operating zones at Round Lake (as proposed in Alternative 2) has been completed. The results of the analysis revealed that Round Lake may release more water between January 1 and April 22 in order to meet the proposed target levels. The excess flow release could prove problematic (if adopted) because of the uncertainty associated with the outlet characteristics of Golden Lake. At present, the outflow characteristics of Golden Lake are unclear making estimation of Golden Lake levels and, hence, the flood risk relatively uncertain.

Thank you for providing the opportunity to assist you with the development of your water management plan. If you have any questions about this report, please do not hesitate to call Alfred Breland or Jason Shaw at 905-374-5200.

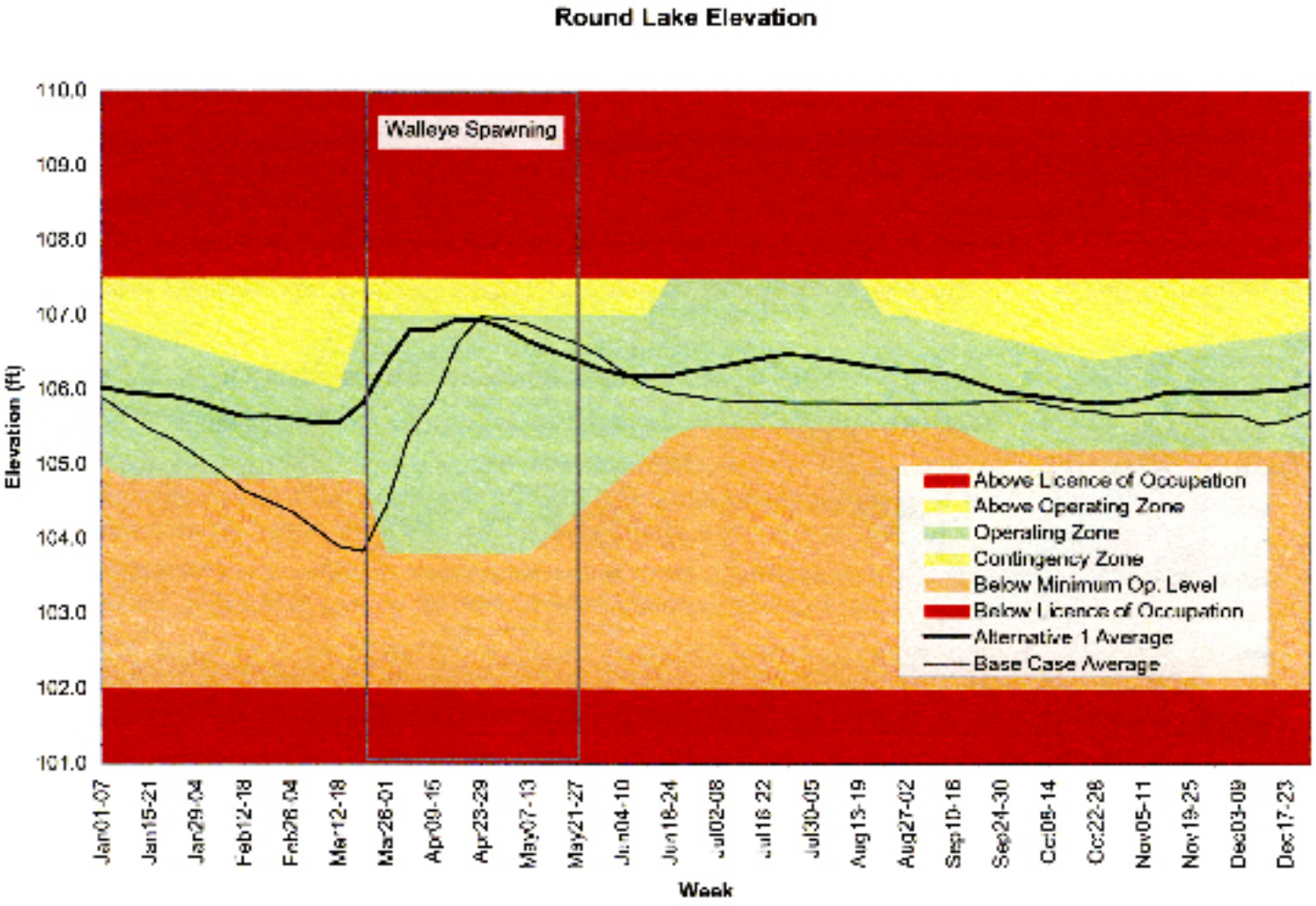
Yours very truly,

(original signed by ABB)

JS:wf A. B. Breland
Project Manager
cc N. Paroschy, MNR
J. Shaw, Acres

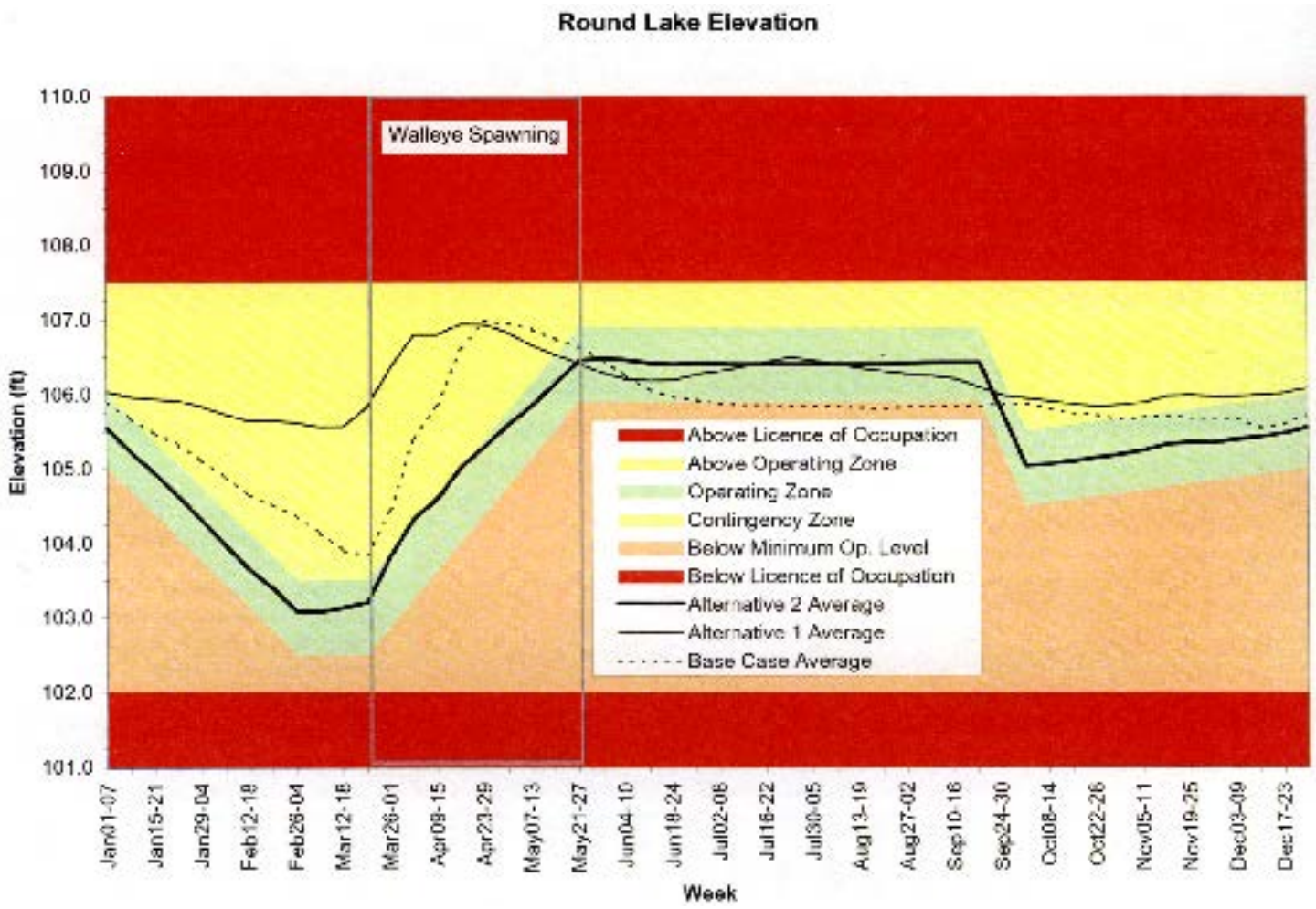
Model Results
Round Lake Water Levels
Alternative 1

The following chart showing Round Lake water levels under Alternative 1, is included as Figure 2a in the report titled *Bonnechere River Engineering Study Model Results for Alternative 1*. The full report is available for viewing at the office on the Ontario Ministry of Natural Resources at 31 Riverside Drive in Pembroke.



Model Results
Round Lake Water Levels
Alternative 2

The following chart showing Round Lake water levels under Alternative 2, is included as Figure 2a in the report titled *Bonnechere River Engineering Study Model Results for Alternative 2*. The full report is available for viewing at the office on the Ontario Ministry of Natural Resources at 31 Riverside Drive in Pembroke.



Bonnechere River Water Management Review

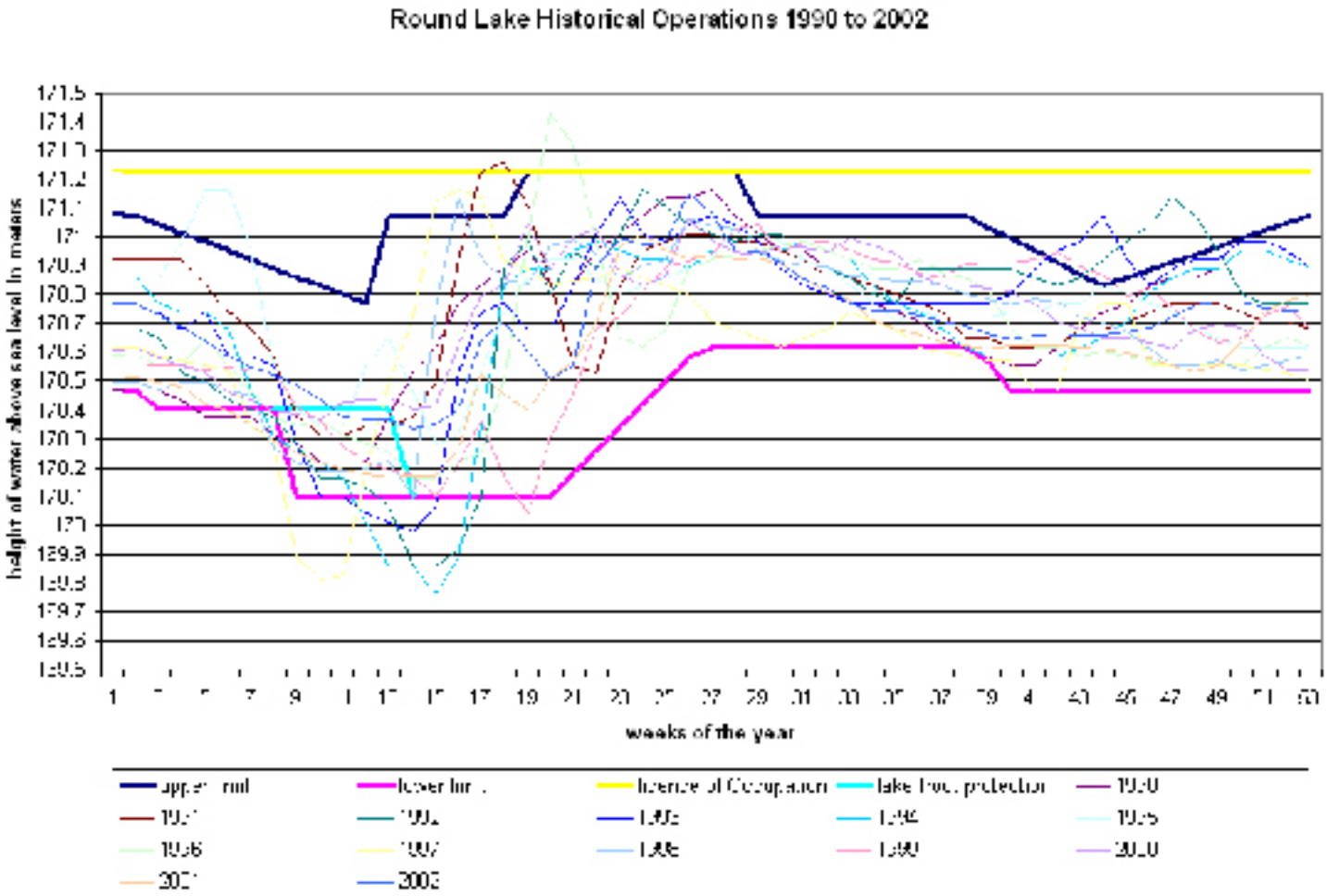
Fact Sheet: Wilber Lake – History of Rock Weir

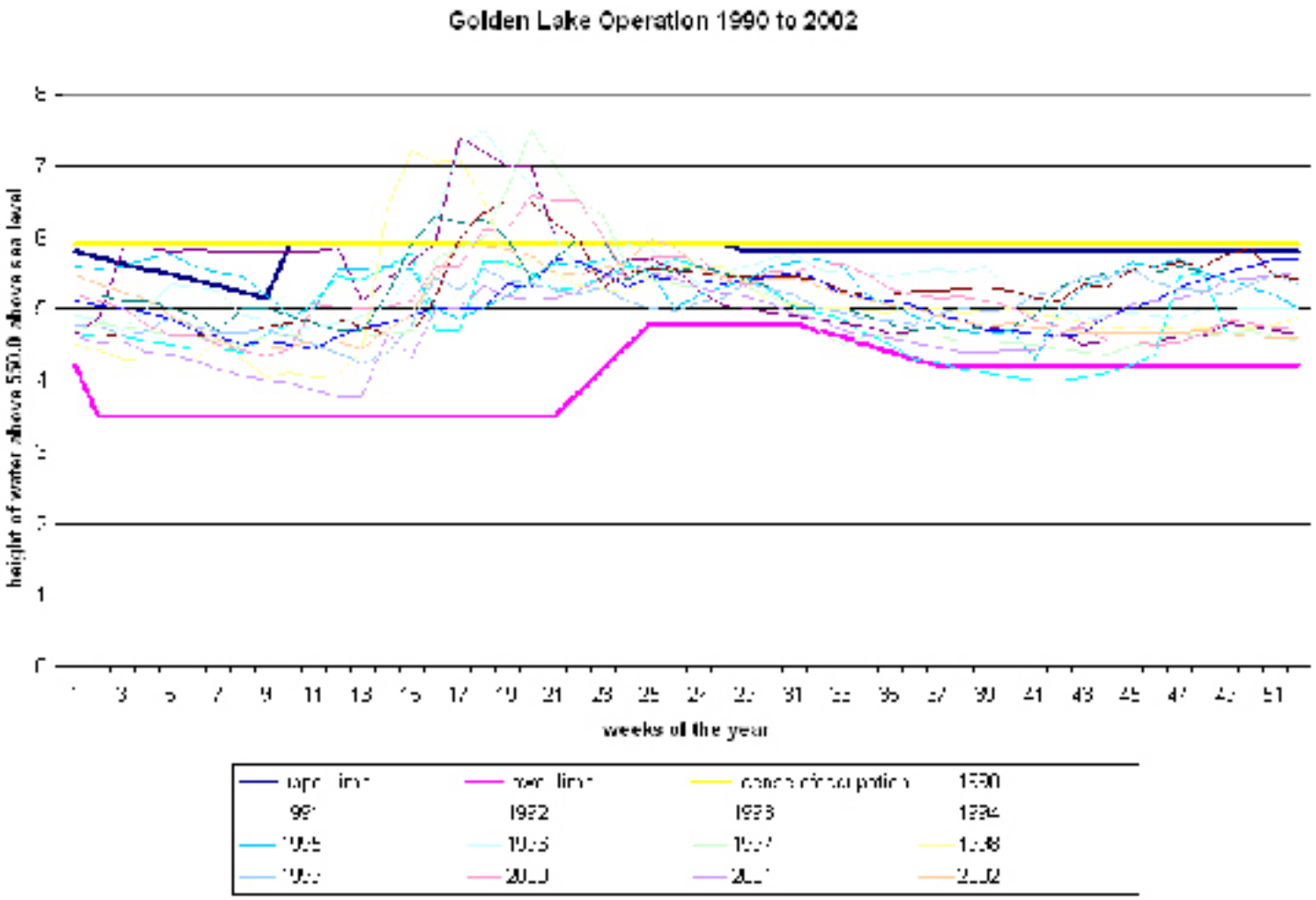
(Submitted to PAC Oct.23,02)

1. Landowners made a submission to PAC on Sept. 25, 2002 asking for more gradual water level changes on Wilber Lake and higher water levels in the summer / recreational season (i.e. 10 inch higher levels relative to 2002 summer levels)
2. Air photos for 1958 and 1976 suggest no significant water level changes in those two years
3. Lake is shallow throughout with a relatively undefined channel; flat to gently rolling topography; clear water feeding the lake from Golden Lake upstream, several rapids downstream of Wilber Lake, monitored bullfrog population
4. Some 400 ha in size, 34% privately, 66% publicly owned
5. The sections of the wetland which are less than 6 feet in depth and all sections deeper than 6 feet which support wild rice, as well as the whole shoreline of the lake is classified as a Provincially Significant Wetland, the wetland evaluation took place in 1985
6. Scores high in social and biological components of evaluation, fish spawning and rearing area
7. Regionally significant species found included: Labrador tea, leather leap, sheep laurel
8. Based on MNR files, past correspondence and conversation with past MNR lands staff:
   - MNR never authorized the construction of a rock weir at the foot of the wetland
   - Ranger crew went out to speak with one or two landowners in 1980, took photos
   - MNR crew removed rocks after request from Municipality to do so because some agricultural land at top of lake was being flooded; this was also done to check how levels were impacted by the 'weir'; not much change in September 1982 water levels after what remained of the weir was removed
   - MNR, MPP and municipality were approached by group of landowners, to install a 'conservation weir' to maintain higher level water in the summer months between 1980 and 1982
   - MNR response was that all landowners on lake would have to reach consensus, apply under *Lakes and Rivers Improvement Act* for construction of an engineered weir, and that this would require endorsement from municipality and Renfrew Hydro Commission (at that time) and would need to evaluate environmental impacts
   - This never happened and not clear who has been installing or removing rocks at the foot of the lake
9. Legislation and studies that landowners on Wilber Lake would need to head to and undergo in order to build a real weir include:
   a) provisions of the *Lakes and Rivers Improvement Act*
   b) section of the *Fisheries Act*
   c) construction-engineering-safety plans
   d) provisions of the *Navigable Waters Protection Act*
   e) full agreement and endorsement from all landowners and municipality that this is the best option for the people and properties up and downstream of the lake
   f) full agreement and endorsement by Renfrew Power Generation and Eganville Generation Corporation
   g) consideration and provisions for long term maintenance of the weir

13-Year Operating Levels on Round Lake and Golden Lake 1990 to 2002

The following charts show the 13-year operating levels on Round Lake and Golden Lake for the period 1990 to 2002. This is some of the historic operations data used in the Acres Hydrologic/Hydraulic model and with the Public Advisory Committee, to develop and assess alternatives for the Bonnechere River.




Golden Lake Operation 1990 to 2002
weeks of the year
1990
1992
1993
1994

Appendix 3
to the Bonnechere River Water Management Plan

Public Advisory Committee

Profile of Members

Terms of Reference

Consensus Ground Rules

BONNECHERE RIVER WATER MANAGEMENT REVIEW
PROFILE OF PUBLIC ADVISORY COMMITTEE MEMBERS

Robert Afelskie:

Robert is a full time resident who lives on the Bonnechere River with his family. He holds a self-supervisory position as a metallurgical research and development technician for a mining company near Haley Station. A licensed angler and hunter, Robert is a member of the Planetary Association for Clean Energy. He has 30 years of farming and 25 years of varied commercial and industrial work experience. Other skills that will be an asset to the Committee include Robert's experience in mediation, training, reporting and communication.

Don Bohart:

Don has been a seasonal resident on Round Lake where he currently lives all year. He has considerable past experience in land development and construction and communications. Don is also active locally as a municipal councillor for the Township of Killaloe, Hagarty and Richards, where he is responsible for the Environmental Waste Management Portfolio.

Aurel Boucher:

Aurel is a resident in the City of Pembroke who offers various experiences and skills he has learned in the Ottawa Valley. A journalism graduate from Algonquin College, Aurel has contributed to organizations and groups such as the Renfrew County Industrial Training Board, Apprenticeship Reform Council of Ontario, Ottawa Valley Computer Club, National Apprenticeship Mobility Advisory Board, and the City of Pembroke Planning Board.

Glen Briscoe:

Glen grew up on a dairy farm in Admaston Township in close proximity to the Bonnechere River. An avid outdoorsman, Glen enjoys fishing, canoeing, camping and hunting. Young but resourceful, he is an environmental engineering graduate and currently works as a hydro-geologist in Ottawa.

Murray Borer:

Murray's interest is to try to represent agricultural interests between Douglas and Renfrew. He operates a bee-keeping business in the Bonnechere Watershed, is a Forest Technician graduate, and an ecologist at heart. His dedication to volunteering includes work with local groups including the McNamara Field Naturalists, Grace United Church and the Bonnechere River Watershed Project.

Ron Deshane:

Ron is a retired resident and farmer in Admaston Township in the Bonnechere River Watershed, who spends his spare time trapping, hunting, and fishing along the river. An important principle for Ron is to 'make it a day-to-day practice to put more back into the land and its inhabitants than can be taken out'. Ron is active on the Renfrew Fur Council, and the Ontario Fur Managers Federation, the Admaston-Bromley Disaster Committee, and is a Fish and Wildlife Representative on the Bonnechere River Watershed Project.

Karen Handford:

A third generation cottage owner on Round Lake, Karen lives permanently in the Town of Renfrew. Having graduated with a Bachelor of Science in Physical Geography, Karen brings much skill and knowledge to the Committee. Her professional experiences include work with the County of Renfrew, and her involvement with the 9-1-1 Civic Addressing Project. She looks forward to dealing with the public during the Bonnechere River review.

Neil Mantifel:

Neil has first hand knowledge and experience with levels and flows on Round Lake as he has been born and raised on its shores. His involvement with the Round Lake Property Owners Association, specifically as the Water Level Chairman, makes him a valuable asset to the PAC as a communication link with groups and individuals in the Round Lake area. Neil also relates to recreational users of the Bonnechere system including fishermen, sailors, boaters, snowmobilers and hunters. Volunteering his spare time with the Bonn-Trae Snowmobile Club, Neil is a Mechanical Engineer by profession and currently works for AECL in Chalk River.

Wendy Milne:

Wendy lives permanently in Brudenell Township and is a property owner and cottager on Golden Lake. She has an interest in rural studies and energy considerations in sustainability of rural communities. Wendy is presently a Ph.D. Candidate, and holds a Masters Degree in Adult Education. She brings experience as a consultant, and from past work at the Renfrew County Health Unit, Council for Aging, and the Ministry of Agriculture, Food and Rural Affairs. Wendy is a committed volunteer, active in the Killaloe area.

PUBLIC ADVISORY COMMITTEE
Terms of Reference

September, 2001

Introduction:

The Bonnechere River Water Management Review (BRWMR) is a process that aims to optimize and balance water levels and flows of the Bonnechere River system for the benefit of fish and wildlife resources, power production, recreation, flood control and other uses. As part of the review, the lead agencies will be communicating and consulting with the public in a variety of ways, and have agreed to establish a Public Advisory Committee (PAC) to help in the process. The PAC will be composed of 10 volunteers or dedicated citizens representing a diversity of interests along the course of the river.

Mandate:

The Public Advisory Committee will provide a mechanism for the public to contribute to the review process and the final document which will describe a wide range of issues and solutions for future implementation in managing levels and flows of the Bonnechere River. The formation of such a committee will not only enhance the hydro-power representatives' and MNR's ability to provide a communications link with the public, but will also provide advice to the planning team. The PAC will support the agencies' efforts in obtaining a broad base of information and advice from the general public and existing organizations that have an interest in management of the Bonnechere. The PAC will report to the Bonnechere River Review Steering Committee (i.e. management staff from MNR and hydro-power producers). The recommendations and advice received from the PAC shall rest with the Steering Committee members, as their organizations are legally responsible for the management of the natural resources on the river system and dams present on the system.

Roles:

In reference to this mandate, the Public Advisory Committee will perform the following activities:

1. Review and advise on matters relating to the development of a water management plan for the river (i.e. issues and concerns; goals, objectives of for the plan; aquatic resources; information needs, water flows, levels and fluctuations; implementation strategies)

2. Assist in implementing the communications and consultation plan by:

    a) seeking to ensure the participation of all interested parties (general public, watershed residents, and special interest groups) in any consultation process;

    b) jointly hosting, along with MNR and waterpower partners, formal public consultation sessions;

    c) receiving and recording input from these parties; and,

    d) reviewing and advising on the comments received from the public and interest groups as a result of the public consultation (i.e. MNR, hydro partners and PAC logs).

Composition:

The PAC shall be composed of no more than 10 and no fewer than 6. Members of the advisory committee shall be selected jointly by the MNR and hydro partners. Selection of the members will be based on:

a) the knowledge and perspectives they can provide, rather than representing a specific constituency;

b) ensuring a diversity of perspectives or interests are represented, including fishing, recreation, cottagers, property owners, residents, boating, tourism, conservation/protection, business, development, municipal government, among others;

c) ensuring citizen representation from the public-at-large, and a range of special interest groups along the river and within the watershed;

d) knowledge of the region, or of the Bonnechere River Watershed, or residence within the watershed and or geographical representation by reach of the river;

e) demonstrated ability to work with various groups or organizations to form effective partnerships;

f) demonstrated ability to work with others in resolving issues and conflicts of interest.

Members shall be appointed to the PAC for the length of the review process. After this period expires, the PAC members will have the option of continuing. Those interested will go through an application and selection process to act on a Standing Advisory Committee that will oversee the implementation of the review.

Administration:

The following administrative rules shall apply to the functions of the committee:

- The members shall select a Chair, and a Vice-Chair, who will serve for a 6 month term and then be re-assessed by the PAC members. The Chair and Vice-Chair can share responsibilities at times.
- The members may establish an alternate person to represent them in their absence, but no member nor their alternate can miss more than three meetings in a row without adequate notification to the PAC, or the member will be removed at the discretion of the Steering Committee.
- The alternate or representative of a PAC member will not be able to contribute to decision making on behalf of the PAC member.
- The members will be reimbursed for reasonable expenses, such as travel and meals, but must log these expenses and document them by filling out a Non-OPS Expense Invoice Form.
- Meetings will be held at the direction of the Chair, to a minimum of 8 meetings and a maximum of 14 per year. Additional meetings may be scheduled with the agreement of all members or as requested by the Steering Committee.
- The Chair shall be responsible for ensuring adequate notice to members of upcoming meetings and items on the agenda, distribution of meeting agendas, minutes, and the overall conduct of meetings. Secretarial support will be provided from the MNR to prepare these communication items.
- In the absence of the Chair, the Vice-Chair shall assume the responsibilities of the Chair.
- Co-chairs representing the waterpower producers and MNR will be assigned to the committee and will act in an advisory, facilitating and liaison capacity to the committee.
- The minutes shall be reviewed and approved by the PAC and available for public review via a venue that will be decided upon as a group.
- Recommendations of the PAC shall be arrived at by consensus decision-making. Please see the Consensus Building Model in appendix. Where consensus cannot be achieved, majority and minority viewpoints will be noted.
- Recommendations of the PAC will be submitted to the Working Group for consideration and then given to the Steering Committee for decision–making. A decision summary will be provided by the Steering Committee, including written descriptions of where and why they agree or disagree with the recommendations of the PAC. These decisions

will be discussed by the PAC if deemed necessary by the group.

- Meetings shall generally be open to the public, although the committee shall have the right to meet in-camera where matters to be considered need to protect the privacy rights of individual(s).
- Meetings are working sessions; members of the public may observe the sessions and may make scheduled presentations if submitted to the Chair at least 2 weeks prior to the agenda being set for the next meeting, and PAC members notified.
- Other MNR and hydro representatives or staff may attend portions of committee meetings in the capacity of advisory or resource persons, and may provide the committee with data and information on matters related to the review through presentations and upon members' requests (i.e. PAC must be of the position that the subject matter is within the terms of reference for the project and that the request is reasonable in scope).
- Hydro electricity representatives and the MNR will jointly provide orientation training for the members of the PAC.
- The group's Code of Ethics with guide the PAC. Any PAC member who is found by the PAC to be disruptive to the working atmosphere, administration or intent of the PAC, will be removed from the PAC at the discretion of the Steering Committee.

Selection Process:

PAC members will be selected by MNR and hydro-power partners. Through advertisements and letters of invitation, the public will be invited to submit an expression of interest to participate on the PAC. Applicants shall be chosen based on the completion of a successful interview. It is the intent that selected PAC members will objectively represent the many geographic reaches and interests of the Bonnechere River.

Location of Meetings:

PAC meetings will be held in different locations in and around the Bonnechere River Watershed, likely in Renfrew and Eganville, to allow greatest public access to them.

Public Advisory Committee
Consensus Ground Rules

August 2001

All decisions will be made on the basis of consensus…what is consensus?

Consensus is a group-centered way of making decisions, wherein we build a collective sense, then a conclusion, on the matter at hand. An issue is identified, the meeting builds an understanding of the different concerns and the options available, and a mutually acceptable solution or plan of action is developed by synthesizing the alternatives into something that belongs to the entire group.

"Consensus does not mean total concurrence on all aspects on an issue, but acceptance of the proposed solution and all of its consequences."

The Bonnechere River Water Management Review Public Advisory Committee is committed to consensus building tools to assist in their decision-making. The PAC accepts and will work within this guideline:

1. A Chair and Vice-Chair will be carefully chosen by the group. This facilitator will be objective, will have strong communication skills and will be capable of leading group discussions.

2. Early into any discussions and debates, there will be an opportunity for all individuals at the table to voice their views in a 'go-around' style. Each member will add any (new) information as they come to know or remember it.

3. When reaching consensus, the Chair will periodically determine the 'sense of the session' and present it to the PAC for the group to see if it is acceptable. If agreed to, the stance will be accepted, recorded as such, and the discussion will proceed to the next topic. Where the group is divided, this will be noted. All members are welcome to suggest alternatives that appear to address the concerns expressed.

4. If a member withholds agreement on an issue, that member is responsible for explaining how the proposed decision or solution affects or impacts the interests of his/her constituency. If that member can demonstrate the above, then it is the responsibility of the PAC to make a genuine effort to address those concerns. The member withholding agreement must propose alternatives to be considered.

5. When initial agreement is reached, some PAC members may need to take the agreement back to their constituencies or groups with whom they have regular communication.

6. Once consensus is reached on an item of discussion, the item will be revisited only with the consent of the majority (>50%) of the PAC if compelling and relevant information is brought forth. With support of the PAC the group could revisit a finalized issue only if there is important new information.

7. Understandings reached during discussions are interim suggestions, pending discussions of the Working Group and Steering Committee.

8. In scenarios where a consensus cannot be reached, the PAC will proceed in the following sequence:

attempt to reach consensus

A. **Deferral and Seeking Input / Advice** – discussion is paused to consult data or information, or may be delayed to gather new information or consult other agencies, partners.

attempt to reach consensus

B. **Delegation** – discussion is delegated to a smaller group for more deliberation (i.e. Usually this subgroup has differing views). This allows the PAC to think the issue through and those with dissenting views can explore them more fully and come to an acceptable conclusion. This delegation can meet or communicate outside scheduled meetings of the PAC.

attempt to reach consensus

C. **Decision and Opinions** – if after each of A and B have been followed, and there is no agreement. There will be no voting, but rather the minority opinions shall be noted, as well as the reasoning behind the decision.

Consensus is a group-centered way of making decisions, wherein we build a collective sense, then a conclusion, on the matter at hand. An issue is identified, the meeting builds an understanding of the different concerns and the options available, and a mutually acceptable solution or plan of action is developed by synthesizing the alternatives into something that belongs to the entire group.

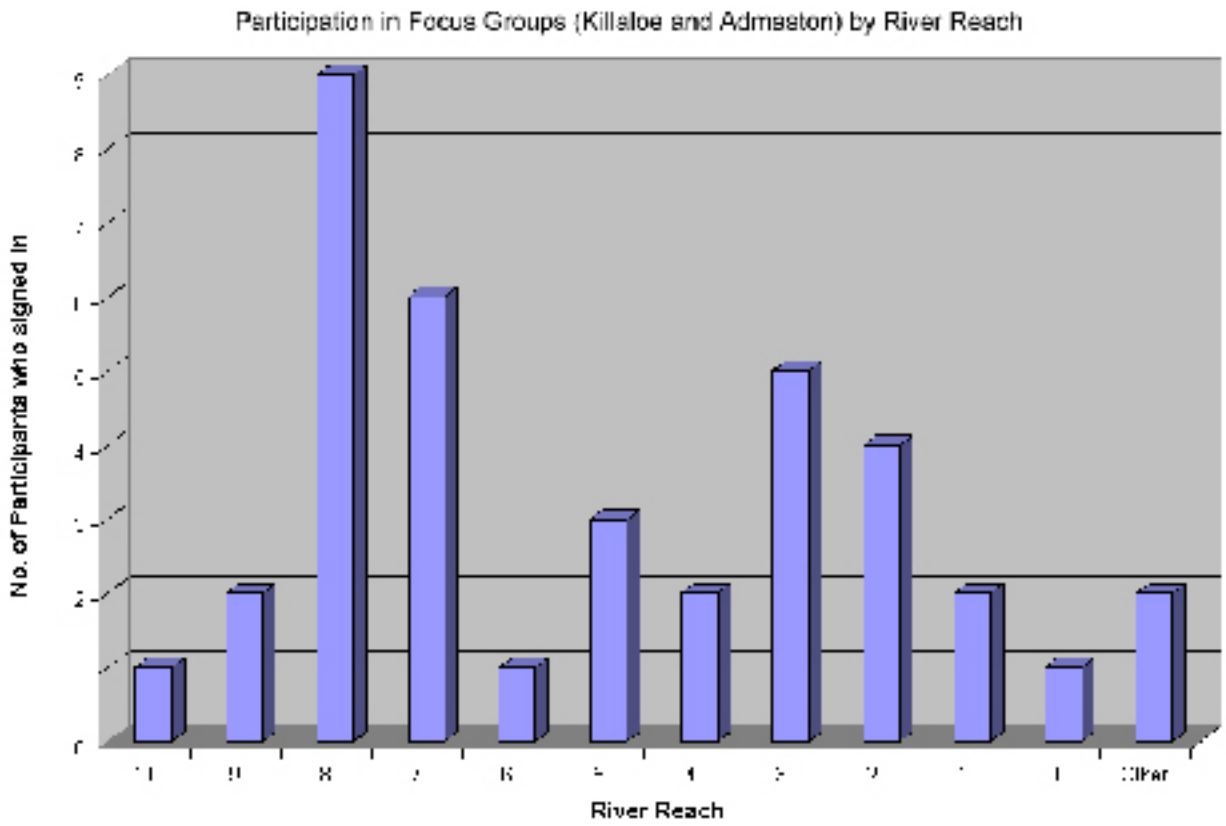
"Consensus does not mean total concurrence on all aspects on an issue, but acceptance of the proposed solution and all of its consequences."

Appendix 4

to the Bonnechere River Water Management Plan

Record of Public Consultation Table
Participation in Focus Group by River Reach
Issues Identified by the Public but not Within the Terms of Reference of the Review

Record of Public Consultation Table		
Date	**Type of Consultation**	**Topic**
Feb-Mar 2001	Briefing with municipal representatives in watershed	Scope & terms of reference
Jun 2001	Public Advisory Committee selected	Represent public issues
Aug 2001	Presentation to Round Lake Property Owners' Association Annual Meeting	Scope & terms of reference
Sept 2001	Focus Group Sessions in Killaloe and Admaston; Mailout	Scope issues & concerns related to levels & flows
Feb 2002	Staffed display and presentation at Bonnechere Watershed Project's annual meeting in Eganville	Display background information
Jun 2002	Public Open House in Eganville; Mailout	Confirm issues & concerns; display background information
Aug 2002	Staffed display at Bonnechere Watershed Project's public workshop	Discuss project with public; display background information
Sept 2002	Staffed display at Renfrew Fair	Discuss project with public
Oct 2002	Staffed display at Water Response 2000 Open House	Discuss project with public & agencies; display background information
Jul 2003	Public notice posted on *Environmental Bill of Rights* Registry	Intent of WMP, start of public comment period for Draft WMP
Jul 2003	Public Open Houses in Eganville and Killaloe; Mailout	Introduce Draft WMP
Fall 2004	EBR Posting, Notice to PAC, News Release	Release of Final WMP


Participation in Focus Groups (Killaloe and Ardnacrusha) by River Reach
No. of Participants who signed in
River Reach

Issues Identified by the Public but NOT within Terms of Reference of Review
-Referred to other Agencies in November, 2001-

NOTE: *To clarify the abbreviated terms below: DFO-Department of Fisheries and Oceans Canada; MOE-Ontario Ministry of the Environment; OMAFRA-Ontario Ministry of Agriculture, Food and Rural Affairs, OPP-Ontario Provincial Police; MMAH-Ontario Ministry of Municipal Affairs and Housing; County-County of Renfrew; BRWP-Bonnechere River Watershed Project*

1) The public is concerned that any potential new hydro development and any potential new structures may cause even more fluctuations in levels and flows. This could have impacts to flora and fauna and possible disruption of aesthetic and pristine values of the Bonnechere Provincial Parks.

   Response: The Bonnechere Review does not consider or evaluate any new water control structures or dams. No proposals for new structures have been filed to date. There is other legislation and approval processes that would consider and deal with any proposals in the future. For example, future developments will be considered through amendments to the Bonnechere River Water Management Plan.

2) The public is concerned about the availability of clean water for diverse uses such as human and animal consumption, agriculture, swimming, boating, and other recreational uses, as well as habitat for fish and wildlife. Although there have been efforts to upgrade sewage treatment facilities on the river system, as well as an increased awareness of the effects of pollutants in sections of the watershed, the public believes that water quality on this system is continually being degraded. There is a perception of increasing impacts from point and non-point sources. Some sources that were flagged include nutrient application and manure spreading on farms; phosphates and nitrates from the use of fertilizers in urban and rural areas, from outdated and leaky septic systems and sewage treatment by-pass out-falls; other organic wastes including livestock feces in the river due to non-restricted access to the river and creeks for watering. Also, the water intake process backwashes harmful substances into the Bonnechere River above the dam and bridge in the Town of Renfrew. Chemical sources brought up during the consultation include pesticide and herbicide applications resulting from agricultural and forest practices; salts and particulate matter released into the river and tributaries from snow removal and road clearing operations (specifically in the Town of Renfrew and from highways).

   Response: Referred to: DFO, MOE, Health Unit, OMAFRA, MMAH, Municipalities, County, Stewardship Council, BRW Project

3) The public has witnessed a pattern of public beach closures due to higher bacterial counts at some locations along the river (specifically upstream of Renfrew, and recent conditions at Douglas). There is growing concern that E.coli and other forms of bacteria may be spreading in surface and ground water.

   Response: Referred to: DFO, MOE, Health Unit, OMAFRA, Municipalities, Stewardship Council, BRW Project

4) Development pressure on the shorelines of lakes and the Bonnechere River, as well as destructive management practices along the banks of the river are being noticed across the Watershed. Many focus group participants are concerned about the unrestricted livestock (i.e. cattle, sheep and other) that access the river and tributaries for drinking and bathing. The lack of fencing and livestock control is common downstream of Golden Lake and very much prevalent from Eganville to the mouth of the river near Castleford. The impacts resulting from these activities are exasperated by the nature of the clay soil substrate. Issues raised include trampled and sliding banks; accelerated erosion from the shoreline and nearby fields; decreased water clarity and increased murkiness; change in light and temperature conditions in the water column; as well as increased siltation of wildlife habitat and spawning areas for fish. This issue will be treated in the Water Management Review only as it relates to extreme fluctuations in levels and flows due to dam operations.

   Response: Referred to: DFO, MOE, OMAFRA, Municipalities, County, Stewardship Council, BRW Project

5) Several individuals and groups challenge the scope of the Water Management Review. They strongly feel that there should be a Watershed Plan initiated by an agency such as Ministry of the Environment, for the Bonnechere River Watershed.

   Response: The momentum and funding for the Bonnechere River Water Management Review comes from the new Waterpower Program-The New Business Relationship. This initiative resulted from Bill 35, and the deregulation and opening of the electricity market scheduled for May of 2002. The Review is meant to be focused strictly on impacts of levels and flows management as this relates to hydro-electricity production. Consequently, this Review will stay focussed on the Bonnechere River and main tributaries to it with water control structures or dams, but will be a good starting point for any possible Watershed Planning in the future.

   Referred to: MOE, Stewardship Council, County

6) There are members of the public that are expressing a need for a water conservation strategy for the Bonnechere River Watershed. In future years of drought, competing consumptive uses on the river and tributaries are likely to cause conflicts over the resource. There is concern already among the farming community that watering of livestock and irrigation of crops will compete with urban uses (specifically in the Town of Renfrew). Metering of surface water use is rare on the system, little information is available to the public pertaining to the Permit to Take Water Program, and overall, there is an expressed need for a water conservation program for the Watershed.

   Response: Referred to: MOE, Municipalities, Stewardship Council, BRW Project

7) There is a growing number of user groups that rely on and enjoy the Bonnechere River and its lakes. Members of the public are concerned that there is a lack of restrictions, regulations and enforcement of boat size and speeds (specifically on Round L. Golden L. Lake Clear, and on the Bonnechere River between Renfrew and Douglas). The implications for public safety, the impacts to private property, shorelines and fish and wildlife resulting from speeding boats, large motor craft and coupled water and noise pollution were raised at both focus group sessions.

   Response: Referred to: DFO-Coast Guard, Municipalities, OPP

8) Many focus group participants have flagged the issues associated with increased and continually increasing tile draining of land in the Bonnechere River Watershed for agricultural purposes. The public is generally aware of the significant history and contributions of agriculture to the local economy. However, there is also concern that with more effective drainage methods huge tracks of land have and continue to be converted to pasture and crops in the Watershed. Participants listed implications for water quality, availability of diverse habitats such as wetlands and woodlands for wildlife, lack of knowledge and measures to protect groundwater recharge areas, and the maintenance of a naturally functioning hydrologic cycle in general, as just some impacts associated with tile draining.

   Response: Referred to: DFO, OMAFRA, County, Municipalities, MOE

9) Maintaining biodiversity and introductions of non-native species such as purple loosestrife and zebra mussel to the Bonnechere River Watershed are issues flagged by the public. Also, one of the values of the river system raised as important at both focus group sessions is the natural, vegetated or wooded nature of the shoreline that should be promoted and maintained along the river and its tributaries as a buffer area. Although the Renfrew County Stewardship Council has been making some headway in raising awareness about the value and importance of riparian vegetation, there is a lot of room for more projects and information dissemination to land owners and municipal offices. There was a recommendation that land use planning at the County level in cooperation with local municipalities should address these issues.

   Response: Referred to: Municipalities, County, MMAH, DFO, MOE, OMAFRA, Stewardship Council, BRW Project, Environment Canada

10) The effects of beaver activity on the Bonnechere River and its tributaries are flagged as issues by members of the public.

Response: Among the various changes that beaver damming and flooding has on the landscape and ecosystems, their dams change the faster flowing water into slower, in some cases stagnant conditions. In many cases this has potential to threaten public safety, particularly when creeks and culverts near public roads, often on private land, are obstructed or effected by beavers. Locations where beaver activity compromises the ability of a dam operator to control water levels and flows on a given body of water will be dealt with under the Bonnechere River Water Management Review. There is a need, however, to develop or improve any existing protocols and or programs used to resolve beaver activity issues that involve one or more private land owners. The Bonnechere River Water Management Review will not address decreased river flows as a result of beaver activity in times of drought. This could potentially be dealt with by local members and representatives on the Water Response 2000 or Low Water Response Teams.

Referred to: Low Water Response Team-MNR Pembroke-Water Response 2000 Lead, Municipalities, County

Appendix 5

to the Bonnechere River Water Management Plan

Dissenting Opinions

The collaborative consensus-based decision making process applied during the development of the Bonnechere River Water Management Plan allowed for the formal submission of dissenting opinions from PAC members. Three dissenting opinions submitted by individual PAC members are included here.

It should be noted that all three of the dissenting opinions submitted relate to the new operating regime for Reach 8 (Round Lake). Round Lake functions as the primary water storage facility on the Bonnechere River watershed. The operating regime for Round Lake has the potential to impact values on all downstream reaches. Water levels on Round Lake need to be managed and balanced with consideration for values on the entire watershed. For this reason, the operating regime cannot always provide levels on the lake that individual residents might consider optimal for their interests.

The dissenting opinions expressed here do not reflect the majority view of the Bonnechere River Water Management Plan Public Advisory Committee, and in some cases do not accurately represent the information assessed by the PAC during the planning process.

Dissenting Opinion 1:
Submitted by: Robert Afelskie

From: Robert Afelskie [mailto:robafelskie@myexcel.ca]
Sent: June 27,2003 9:40 PM
To: paul.moreau@mnr.gov.on.ca
Subject: Dissenting opinions on the WMP.

Dear Paul Moreau,

This is my dissenting opinion on the proposed operating water level for Reach 8:Round Lake.

I believe the maximum allowed operating water level of 107.5 ft.l.d. should be reduced to 106.8 ft. l.d. for the entire year of operations. This is because the water level of 107 ft. l.d. in Round Lake is at the point at which certain septic systems could be flooded by high water levels. If the septic systems are breached the untreated sewage may leach into Round Lake and into the water table below contaminating both the lake water and the more serious of the two, the drinking water. I see no reason for jeopardizing the health and safety of the public at any anytime.

Having the Round Lake maximum water level at 106.8 ft. l.d. will allow the dam operator to monitor incoming water volumes, particularly during periods of heavy rainfall and allow for enough time to respond by removing logs so as to prevent the impending disaster.

That is why I think the maximum operating water level of 106.8 ft. l.d. for Round Lake should be implemented.

Public health and safety should be the first issue to consider when developing a water management plan for the Bonnechere River Watershed!

Paul, thank you for your time and patience.

==========

Robert Afelskie
Managing Representative
613 649-2846 ph
robafelskie@myexcel.ca

Dissenting Opinion 2:
Submitted by: Neil Mantifel

Issue 8.2 - Dissenting Opinion, PAC Member - Neil Mantifel

The WMP does not address the request for water levels below 106.8 ft local datum, which cause excessive rates of erosion on Round Lake, nor does it address the request for levels to be kept above 106.0 during the summer period. The Round Lake Operating Regime allows levels to be a maximum of 107.0 to 107.5 for 25 weeks of the year, which will result in excessive rates of erosion for property owners on Round Lake. It also allows levels as low as 105.5 during 12 weeks of the year, which will result in increased boating hazards, and loss of boat use by property owners. No improvement on monitoring of incoming water volumes is planned or recommended by this WMP to provide proactive level control as compared to the reactive level management that now exists. MNR as the regulator has not enforced any improvements in dam operation while allowing levels as high as the License of Occupation legal limit. The Target Line has no written requirements for the dam operator to strive to stay near it and is recklessly close to the WMP maximum at week 28. The regulator has not considered the water level increase due to wave action in the setting of the operating regime since static levels measure at Tramore dam are quoted. The WMP must be designed for the normal yearly weather pattern and not the abnormally dry or wet years. The operator will be able to disposition abnormal years using long-term weather statistics.

The competing issue of fish habitat can be accommodated without levels of 107.0 in the spring. As many as 112 Round Lake Property owners have already protected their shoreline in some fashion to safeguard the littoral zone. This WMP will threaten the littoral zone by requiring as many as up to 67 more property owners to consider protecting their shoreline.

The competing issue of Electrical Power Production is insignificant. The opportunity cost to RPG by holding levels below 106.8 is approximately $5000.00 per year, about one percent of the annual value of power produced by RPG. Meanwhile to protect shoreline property owners will be required to spend 2000.00 to 3000.00 dollars per property, (totaling up to $210,000.00) and continue to pay to maintain that protection each year while altering the natural environment along the lakeshore. The WMP goal of compromise and fairness has not been achieved.

The competing issue of Golden Lake not being able to react to increased flows has been accounted for by having a lower levels in later winter in the Golden Lake Operating Regime to create a reservoir to accommodate normal flows from Round Lake. Once again the WMP needs to be design for the normal year and abnormal years can be dispositioned.

In summary the Acres computer modeling proved that a narrower summer regime will work. The levels requested are the same as has been operated to on average for the last 10 years. This issue brought forward by the public to the PAC has not been fairly addressed by this WMP, the property owners are suffering unreasonably.

Therefore I have requested to record this dissenting opinion.

Reach 8: Issue 8.3 - Dissenting Opinion, PAC Member - Neil Mantifel

The WMP does not adequately address the request for low water levels during freeze-up to protect shoreline property from ice damage. The Round Lake Operating Regime allows a level of up to 107.0 at time of freeze-up. Over the years it has been proven that even if the shoreline sand has been given the opportunity to dry before freeze-up by having a level dip in week 43 high levels at the time of freeze up will result in severe shoreline damage that property owners cannot protect themselves from. With no requirement for the operator to stay near the target line allowing a level of 107.0 at week 52 is unacceptable.

Therefore I have requested to record this dissenting opinion.

Dissenting Opinion 3:
Submitted by: Don Bohart

July 28, 2003
Mr. Paul Moreau, Information Management Supervisor
Working Group Co-Chair
Bonnechere River Water Management Plan
31 Riverside Drive
Pembroke, ON
K8A 8R6

Dear Mr. Moreau:

From: Don Bohart, PAC Member

Subject: Dissenting Opinion on Proposed "Bonnechere River Water Management Plan"

The proposal to develop a water management plan for the entire Bonnechere River system and other river systems in Ontario is indeed necessary. It was/is my understanding that a water management plan would produce a healthy, safe, more efficient operating guideline for the entire river system over the next five years. Healthy for fish and wildlife and people that are part of our system. Safe water levels for all the inhabitants, including people, who live along the entire waterway. More efficient for the power producers generating electricity.

Dissenting Opinion - Reach 8:

Reach 8 Round Lake is the primary reservoir for the Bonnechere Waterway. There is however, potential reserve capacity upriver from Round Lake. (Paugh Lake, Pine River Lakes, Robitaille Lake and McKaskill Lake, the true headwater of the Bonnechere).

A great deal of PAC time was spent discussing levels and an operating regime for Round Lake itself. The Public Advisory Committee was dedicated to developing a list of concerns within Reach 8. Some issues were discussed over and over again. Some issues were not complex and recommendations were easily developed.

It is my opinion that two primary issues, both discussed at great length, did not gain full consensus, nor was the response and proposed action for those concerns satisfactory. My dissenting opinion relates to Reach 8 issues A, B, and C.

Issue 8.1: "Developing an operating regime for Round Lake that will recognize needs of user groups downstream."

Downstream user group needs are acknowledged and are important, not only for sewer treatment plant dilution and hydro power production, but also to enhance fish and wildlife habitat and to provide enjoyable river conditions for people on and along the river.

On one hand, the response proposes providing adequate flows to downstream user needs, and on the other, the operating regime diagram recommends a 107.0' plan datum level from week 12, March, to week 37, September. In addition, an even higher elevation of 107.5' is recommended for Round Lake between weeks 18, April and 27, July.

There have not been any demonstrable reasons offered for maintaining such high water levels on Round Lake between weeks 12 and 37, not for fish habitat, not for boating or swimming, not even for power production. Maintaining such high levels in late spring and all summer when Round Lake (Tramore) dam is restricted will cause three things to happen:

1. Eganville Power generators shut down from time to time as they have in the past two years because of lack of necessary flows.

2. Flows dwindle for sewer treatment dilution downstream.

3. When levels are kept this high, shorelines all around Round Lake are pummelled by waves from inevitable windstorms that always occur during these critical weeks, April to September.

More environmental damage is done by wind and excessive water levels than all the motor boats, personal watercraft and other human frailties combined. All for no good reason.

As a PAC member, I have steadfastly argued that:

1. If we don't make recommendations to get "Round Lake Right", the whole system downstream will not be right either.

2. If it works, don't fix it.

In the past 10-15 years, there has been a relatively successful operating regime for Round Lake, one that by gentleman's' agreement between then Renfrew Hydro, MNR and Round Lake Property Owners' Association, worked most of the time for most of the parties concerned. This worked at a summer level of 106.4', not 107' or 107.5', a difference of less than 12 inches, but a terribly critical difference indeed. Renfrew Hydro proved during that time that they could maintain 106.4' for most of that critical period, and they did. Most people were happy most of the time.

One can refer to the dotted "target line" in the Round Lake Operating regime diagram and feel assured that no adverse results will occur. Proposing such higher allowable levels will undoubtedly encourage higher target lines that will still be in compliance, but will guarantee continued devastating shoreline damage, to the detriment of all species, plant, animal and human.

My response and action is: Don't change what works. Don't recommend higher operating levels for the next five years. (This is the proposed period for a first test of a new Water Management Plan). Keep operating levels from May through August at 106.4', with an upper operating limit of 106.8'. During the next five years, examine and test other levels using that much touted computer model for the entire Bonnechere Waterway, developed by Acres and Associates. Don't dwell on the level of the Licence of Occupation being 107.5' because three things are wrong:

1. This is an outdated elevation that is 92 years old. It should be reviewed.

2. This is ambulatory elevation. It should be a fixed point. As an ambulatory elevation, it moves constantly on the lake. In many cases, where 107.5' was in 1911, 1912, or even in 1916, it is not where it is today. By erosion it has moved greatly inland. The elevation of the water on or at the dam does not change. 107.5' was at the same spot on the dam structure in 1911 as it is today. An ambulatory elevation does not translate into anything reasonable or static at any point around the 18 miles of Round Lake Shoreline. Elevated water levels at critical times assure devastating shoreline damage that induces a new 107.5' contour line that marches inland unabated. Is this really so difficult to understand?

3. In addition, a proposed operating level of 107' at the end of December and the month of January flies in the face of what has worked in the past, and guarantees ice sheet damage from the end of January on. Aiding and abetting this condition is an overly high proposed level during the traditional drawdown period in September. This is the time when shorelines should be allowed to NATURALLY drain and dry out. To not do so assures root and plant damage by frost heaving after freeze up. Root systems are ruptured. The first line of trees die within a few years, they fall down, and their root systems disintegrate. Continued devastation marches inland.

Round Lake is a reservoir. It is no longer a natural lake with natural conditions. However, a reservoir should attempt to mimic the conditions of a natural lake as closely as possible. Nature and natural lake levels mean higher levels during springs freshet, declining levels through the summer, (run off and evaporation), plus further declines during the fall allowing drying out of the shoreline soil and oxygenation as recommended by knowledgeable biologists, plus further natural reductions through the winter in preparation for natural influxes in the next spring. Is this too difficult to mimic?

Reach 8 Issue 8.2: "Control of High Water Levels on Round Lake - Impact on Shoreline Erosion"

Part of my dissenting opinion on erosion has been expounded on in the previous Reach 8 Issue A. In addition, I made the position of the municipality of Killaloe, Hagarty and Richards abundantly clear as it relates to septic systems. The municipality is now responsible for overseeing the installation of new septic systems. Previously, systems were inspected by Renfrew County and District Health Unit.

Septic systems are installed correctly, according to the Ontario Building Code. I disagree that the municipality is responsible for demanding that ratepayers whose systems are no longer in compliance because of erosion move them inland at their expense, when the condition that caused "non compliance" was excessive high lake water levels creating unnatural erosion. This would be the result of proposing a water management plan that allows Renfrew Power Generation to be "in compliance", when everybody else falls into "non-compliance".

I disagree with the response that a target line of 107.0' is critical to human health. A target line of 106.4' will give an assurance that human health will not be a concern, and provide a little insurance for an unforeseen rainstorm that would push a 107.0' target line over the brink.

An "Act of God" is not an acceptable excuse. Acting too little too late at the dam by Renfrew Power Generation is not an excuse, it is the contributing factor that causes shoreline erosion and septic systems to no longer be "in compliance".

Under "Action" it is very generous of Renfrew Power Generation to offer free advice at a workshop in a distant community on shoreline stabilization. I suggest Renfrew Power Generation should also pay for that stabilization since Renfrew Power Generation is the main cause of that erosion.

I also disagree that the Township of Killaloe, Hagarty and Richards has begun investigating locations of septic systems which are a threat from receding shorelines. I am a member of the Council for the said Township of Killaloe, Hagarty and Richards and I know of no such investigation underway, nor planned by us. Nor do I believe that we have the authority to undertake such action.

It has been suggested to the PAC that, be they good years or bad years, the pain and/or the benefits on the entire system should be shared by all along the entire system. It would appear to me that the proposed operating regime for Round Lake will provide only benefits to all the reaches downriver from Round Lake, and only pain to the Round Lake reach itself.

Reach 8 Issue 8.3: "Water Levels on Round Lake, Ice Formation and Shoreline Damage"

I concur with evidence on the way ice forms on a water body (Round Lake) and the probable impact of such ice on the 18 miles of shoreline in question. This has been adequately explained by PAC member Neil Mantifel and Professor Johnston, of the University of Ottawa Department of Geography.

My dissenting opinion here goes back to the key contributing factor of how much damage is caused to a shoreline by ice formation, and where. The response and action professed for this item completely misses the initial ingredient that causes ice damage.

Wherever the water level is by week 40, October, will dictate where land upheaval will occur after freeze up. This upheaval generally takes place 10 to 14 feet horizontally inland from the mid October level (week 40). It reaches maximum upheaval by the following January 30th.

This point does not refer to the damage to shorelines from ice blown onto shore during spring thaw. Nor does it refer to mid-winter lake ice ridges. It does refer to a point on land between saturated land that has not been allowed to dry out naturally in the fall, and shoreline more inland that is much drier. This folding or "Frost Ring Effect" shows no mercy. It will erupt horizontally 10 to 14 feet inland from the water level in week 40, October. It could rise vertically 36 to 40 inches, depending on the severity of below freezing temperatures. It will lift and destroy storm walls, boathouses, walks and stairs, boat docks and most importantly, non-repairable tree roots and other vegetation wherever they occur anywhere along the shoreline. It does not have to be occupied land.

Careful consideration must be given to the upper limit and target limit at week 40, October. The adverse affects on lake trout spawning and hatching could be profound. I disagree that keeping water levels high in late fall and all

winter will guarantee good survival rates for lake trout. Much conflicting evidence has been offered to the PAC on lake trout natural regeneration. An MNR biologist has suggested little evidence or history is available to date.

My proposed "action" would be to study the effects of lower, upper and target limits during the next five years. Don't presume higher is better and discover in three years that it is wrong. Lake trout seem to know when to spawn and at what depth they prefer to spawn. Err on the side of caution. Study first, recommend later.

This dissenting opinion submitted by:

D.W. Bohart, Public Advisory Committee Member - 2001 - 2003

June 2003.

Appendix 6

to the Bonnechere River Water Management Plan

Site-Specific Data (Natural Flow Regimes)

Waterpower Project Science Transfer Report Site-Specific Data

BONNECHERE RIVER

Four waterpower facilities (WPF) were reported to exist on the Bonnechere River: Douglas (2KC4), Renfrew #1 and #2 (2KC21 and 2KC22), and Eganville (2KC12). Information provided to the WPSS indicated that Eganville was constructed in 1943 and Renfrew #1 was constructed in 1910, dates of construction were not provided for the other two facilities. The details of each WPF and corresponding source flow gauges, which are located in close vicinity of power facilities, are summarized in Table 1 and 2.

There are a number of natural gauges in close proximity to the Bonnechere River that were investigated for use as source gauges for the simulations (Table 1). There are no natural gauges with similar drainage areas as the WPFs on the Bonnechere in the HYDAT record. The regulated gauges on the Madawaska (02KD006 and 02KD001) are both located upstream of all major WPFs on that system and show minimal signs of regulation (elevated winter flows), compared to the natural gauges in the area. The natural gauge on the Indian River (02KC014) has a good flow record and shows similar flow patterns to the Bonnechere, but its drainage area is small (443 km^2) compared to the Bonnechere WPFs. The Skootamatta River gauge (02HL004) is slightly larger (712 km^2) and also has a good natural flow record, but is slightly Southeast of the Bonnechere River resulting in small differences in the timing of event flows (earlier spring flows). The York River gauge (02KD002) is in close proximity to the Bonnechere River and has a larger drainage area (837 km^2), compared to the other two gauges. This gauge is listed as regulated in HYDAT but appears only to be regulated for water levels, showing slightly increased winter flows. Otherwise the flow record is similar to the Indian and Skootamatta Rivers, as well as the Bonnechere. All other gauges investigated (Table 1) either showed strong signs of regulation or had dissimilar flow patterns to the Bonnechere River.

Table 1. WPF and Streamflow gauges in Bonnechere River catchment and its vicinity.

N	Code	River	Period of record or the year built	Area (km^2)	Comment
1	02KC003	Bonnechere at Renfrew	1916 – 1921	2380	Regulated by Renfrew
2	02KC009	Bonnechere near Castleford	1921 – 2001	2351	Regulated by all WPF
3	02KD006	Madawaska at Whitney	1942 – 1957	1010	Slight regulation in low flows
4	02KD001	Madawaska at Madawaska	1915 – 1942	1370	Little sign of regulation
5	02KC014	Indian River near Pembroke	1969 – 1985	443	Natural
6	02HL004	Skootamatta River near Actinolite	1955 – 2000	712	Natural
7	02KB001	Petawawa River near Petawawa	1915 – 2000	4120	Elevated winter flows due to regulation, earlier spring melt
8	02KD002	York River near Bancroft	1915 – 1993	837	Minimal regulation
9	02LA004	Rideau River at Ottawa	1933 – 2000	3830	Regulated for levels
10	02LB005	South Nation River near Platagenet Springs	1915 – 2000	3810	Minimal regulation, missing data 1933 – 1972, different timing of flows

Gauge 02KD001 and 02KC014 were selected as the source gauges for the natural FDC for all WPFs (Table 2). Due to the small drainage area of the 02KC014 gauge it could not be used on its own. The 02KD001 gauge has a larger drainage area but showed some signs of regulation. Therefore, the FDCs for the two were averaged to create one source FDC. To compensate for differences in discharge between the source site and the WPFs, a correction factor was calculated based on the ratio of drainage areas of the WPFs and gauge 02KD001. Due to their similar drainage areas and close proximity Renfrew #1 and #2 were treated as one facility for the simulation. The calculated correction factors were 1.47 for Douglas, 1.72 for Renfrew and 1.34 for Eganville (Table 2). Due to missing data in the record at 02KD001, the FDC was calculated from 1916 – 1942.

The simulation of daily natural flows was conducted using the natural records from 02KC014, 02KD002 and 02HL004 (Table 2). Gauge 02KD014 was given the greatest weight in the simulations due to its closer proximity to the WPFs and natural record. The other two gauges were given equal weights and were used to extend the simulation record to 20 years, from 1969 – 1988.

Table 2. Gauges used for simulation of natural flows for Bonnechere WPFs.

N	Code	River or WPF	Period of record or the year built	Area (km^2)	Comment
1	02KC014	Indian River	1969 – 1985	443	Used for FDC and simulation (weight 0.6)
2	02KD002	York River	1915 – 1993	837	Used for simulation (weight 0.2)
3	02HL004	Skootamatta	1955 – 2000	712	Used for simulation (weight 0.2)
4	02KD001	Madawaska	1915 – 1942	1370	Used for FDC
5	2KC4	Douglas	NA	2022	FDC correction factor 1.47
6	2KC21 2KC22	Renfrew	1910	2351	FDC correction factor 1.72
7	2KC12	Eganville	1943	1844	FDC correction factor 1.34

BONNECHERE RIVER AT EGANVILLE NATURAL FLOW METRICS DATA SHEET

Station Information	
Site ID	2KC12
River Name	Bonnechere
Site Name	Eganville
Region	Southcentral
District	Pembroke
Drainage Area	1844 km²
Owner	Eganville PUC

Flow metrics are provided for the waterpower facility based on simulated natural flows as described in the draft *Waterpower Science Transfer Report 1.0* (MNR, 2003). The target metrics provided are described in the *Aquatic Ecosystem Guidelines* (MNR, 2002) and the *Waterpower Science Strategy* (MNR, 2002). Metrics are based on simulated natural daily flow from 1968 to 1988 (21 yrs). Other descriptive metrics have been included in the data sheet to provide a more complete description of the ranges of streamflow on the river system and to facilitate comparisons between river systems.

Annual (1968 - 1988):

I. Streamflow time series

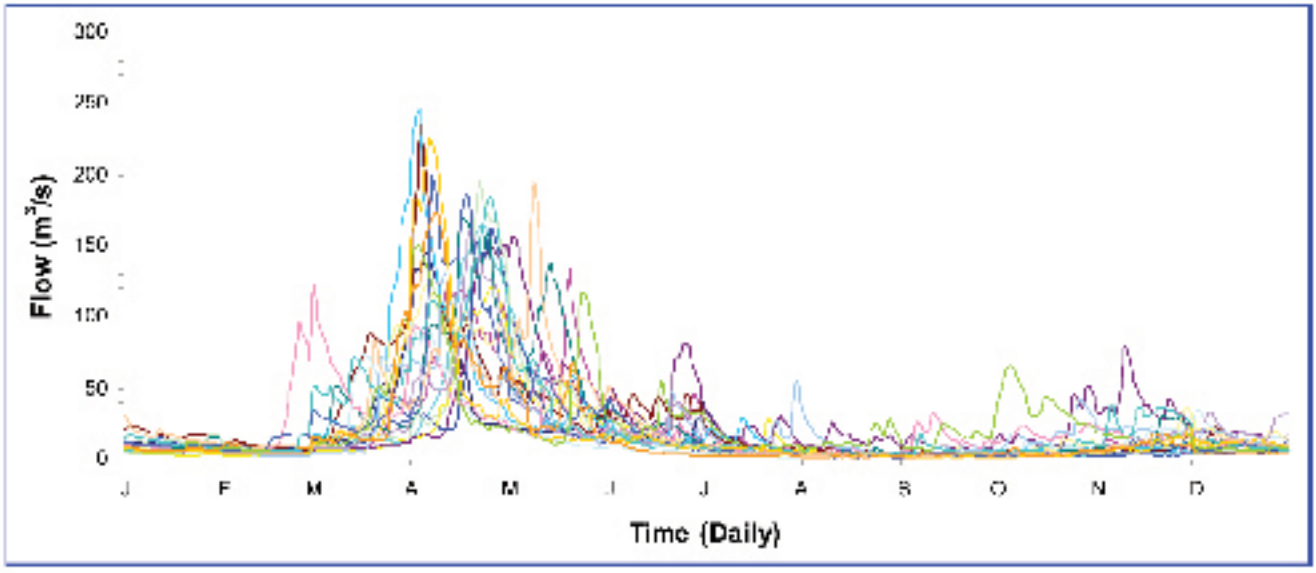


Figure 1: Annual daily flow hydrographs from 1968 to 1988.

Table 1: Annual flow metrics based on 21 years of data.

Descriptive Metrics	Value
Mean Annual Flow	20.6 m³/s
20% Time Exceeded Flow	25.4 m³/s
Median Flow	9.5 m³/s
80% Time Exceeded Flow	4.6 m³/s
Month of Max. Median Flow	April
Month of Min. Median Flow	August
Mean Rising Rate of Change of Flow	5.0 m³/s/day
Mean Falling Rate of Change of Flow	-2.8 m³/s/day
Extreme Low Flow Conditions:	
7-day-avg. low flow in 2-yr ret. Period, $7Q_2$	2.7 m³/s
7-day-avg. low flow in 10-yr ret. Period, $7Q_{10}$	1.6 m³/s
7-day-avg. low flow in 20-yr ret. Period, $7Q_{20}$	1.5 m³/s
Target Metrics	**Value**
Riparian Flows (Q_2 - Q_{20})	184-235 m³/s
Bankfull Flows ($Q_{2.5}$ - Q_{10})	147.5-155.1 m³/s

BONNECHERE RIVER AT EGANVILLE NATURAL FLOW METRICS DATA SHEET

II. Flow Duration

Time Exceeded %	Flow m^3/s
0.1	219.5
1.0	153.1
5.0	87.5
10.0	51.9
20.0	25.4
30.0	17.1
40.0	12.8
50.0	9.5
60.0	7.7
70.0	5.9
80.0	4.6
90.0	3.4
95.0	2.8
99.0	2.0
99.9	1.0

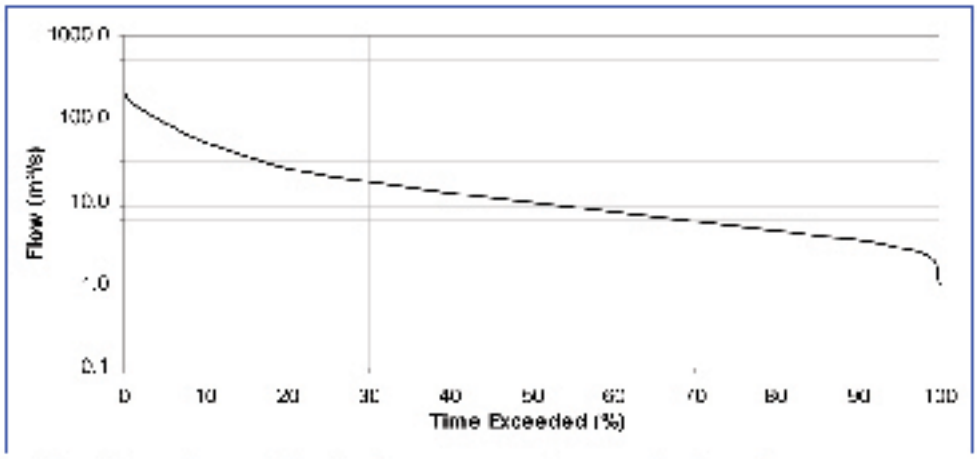


Table 2 and Figure 2: Flow duration table and curve displaying flow vs. percent time exceeded over 21 years.

III. Flood Frequency Analysis

Return Period yrs	Flow m^3/s
1.05	107.0
1.25	133.0
1.50	147.5
1.70	155.1
2	164.0
5	196.0
10	218.0
20	236.0
50	256.0
100	270.0

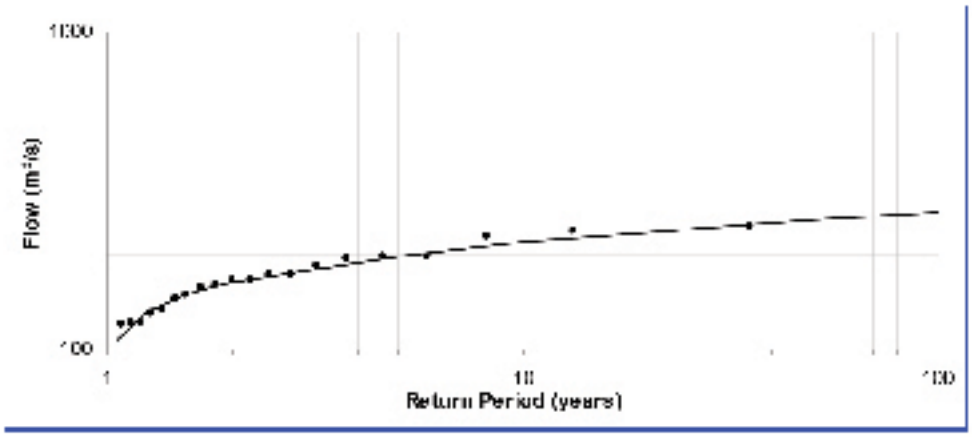


Table 3 and Figure 3 : Flood frequency analysis and curve fitted by the *Log Pearson Type III* probability distribution.

IV. Low Flow Frequency Analysis (Performed using 7-day-average low flow)

Return Period yrs	Flow m^3/s
1.005	5.8
1.01	5.3
1.11	4.1
1.25	3.8
2	2.7
5	1.9
10	1.3
20	1.3
50	1.1
100	1.0

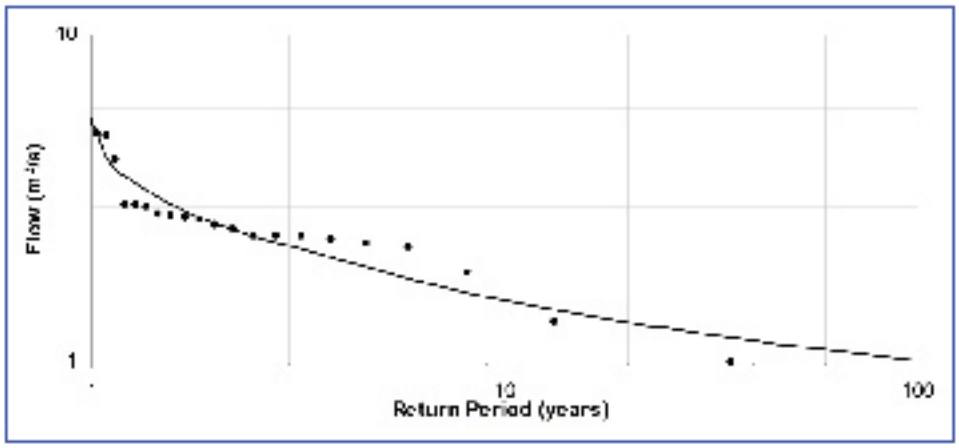


Table 4 and Figure 4: 7-day-average low flow frequency analysis and curve fitted by the *Gumble III* probability distribution.

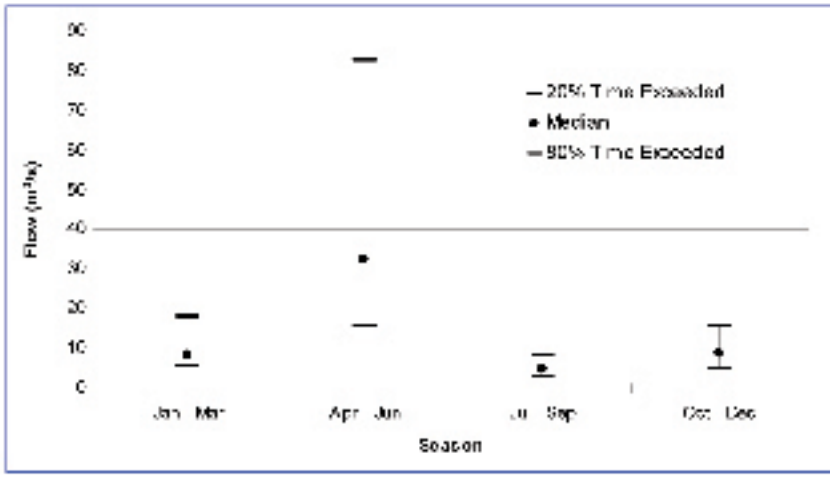
BONNECHERE RIVER AT EGANVILLE NATURAL FLOW METRICS DATA SHEET

Seasonal:

I. Flow Duration

Table 5 and Figure 5: Minimum flow targets based on seasonal median flows.

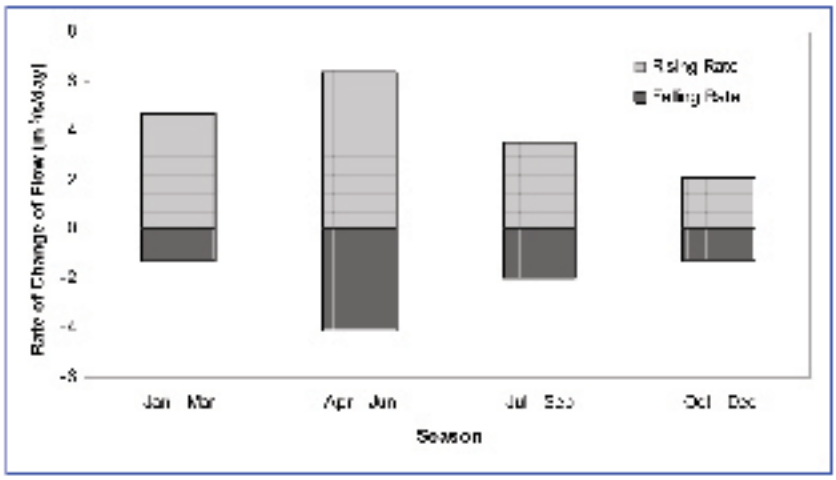
Season	20% Time Exceeded m^3/s	Median m^3/s	80% Time Exceeded m^3/s
Jan - Mar	17.9	6.5	5.5
Apr - Jun	62.8	32.7	15.8
Jul - Sep	8.5	4.6	2.9
Oct - Dec	15.6	6.7	4.8



II. Rate of Change of Flow

Table 6 and Figure 6: Ramping rate targets based on seasonal rising and falling rates of change of flow

Season	Rising Rate $m^3/s/day$	Falling Rate $m^3/s/day$
Jan - Mar	4.7	-1.2
Apr - Jun	6.4	-4.1
Jul - Sep	3.5	-2.0
Oct - Dec	2.1	-1.3



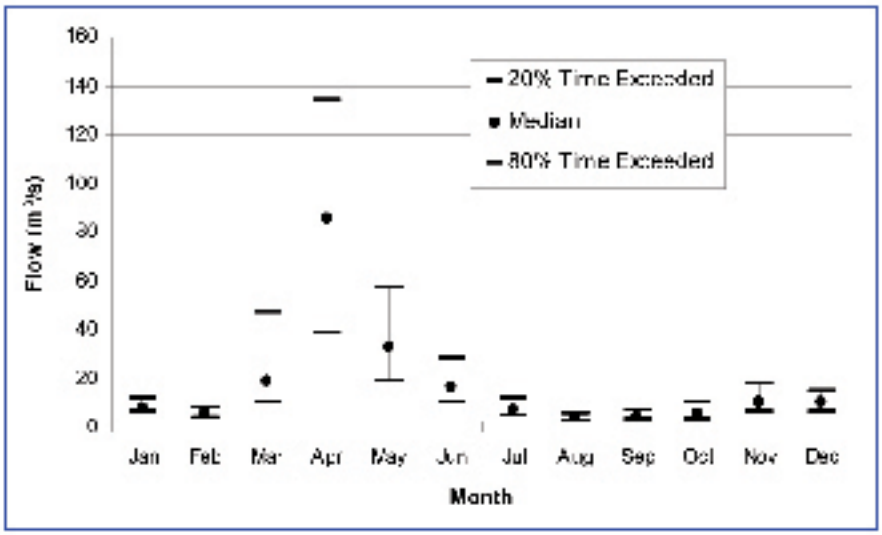
BONNECHERE RIVER AT EGANVILLE NATURAL FLOW METRICS DATA SHEET

Monthly:

I. Flow Duration

Table 7 and Figure 7: Minimum flow targets based on monthly median flows.

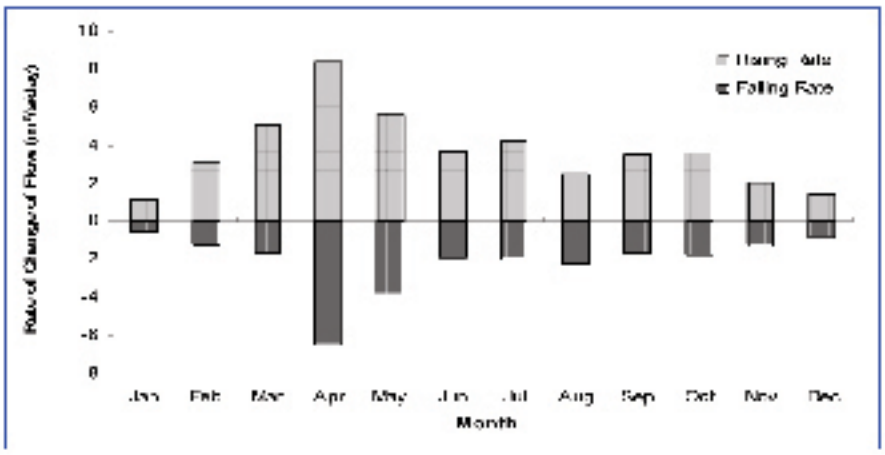
Month	20% Time Exceeded	Median	80% Time Exceeded
	m^3/s	m^3/s	m^3/s
Jan	11.9	7.7	6.7
Feb	7.9	5.4	3.5
Mar	47.4	19.1	10.4
Apr	134.1	85.6	38.7
May	57.6	33.3	18.5
Jun	28.0	16.3	10.5
Jul	11.9	6.9	4.4
Aug	5.8	3.7	2.7
Sep	6.7	4.1	2.8
Oct	13.5	5.7	3.5
Nov	18.2	10.4	6.3
Dec	15.3	9.9	6.4



II. Rate of Change of Flow

Table 8 and Figure 8: Ramping rate targets based on monthly rising and falling rates of change of flow.

Month	Rising Rate	Falling Rate
	$m^3/s/day$	$m^3/s/day$
Jan	1.7	-0.5
Feb	3.1	-1.2
Mar	5.1	-1.6
Apr	9.4	-6.5
May	5.9	-3.6
Jun	3.5	-1.9
Jul	4.2	-2.0
Aug	2.5	-2.2
Sep	3.5	-1.7
Oct	3.9	-1.7
Nov	2.0	-1.3
Dec	1.5	-0.8



BONNECHERE RIVER AT DOUGLAS NATURAL FLOW METRICS DATA SHEET

Station Information	
Site ID	2KC4
River Name	Bonnechere
Site Name	Douglas
Region	Southcentral
District	Pembroke
Drainage Area	2022 km²
Owner	NA

Flow metrics are provided for the waterpower facility based on simulated natural flows as described in the draft *Waterpower Science Transfer Report 1.0* (MNR, 2003). The target metrics provided are described in the *Aquatic Ecosystem Guidelines* (MNR, 2002) and the *Waterpower Science Strategy* (MNR, 2002). Metrics are based on simulated natural daily flow from 1968 to 1988 (21 yrs). Other descriptive metrics have been included in the data sheet to provide a more complete description of the ranges of streamflow on the river system and to facilitate comparisons between river systems.

Annual (1968 - 1988):

I. Streamflow time series

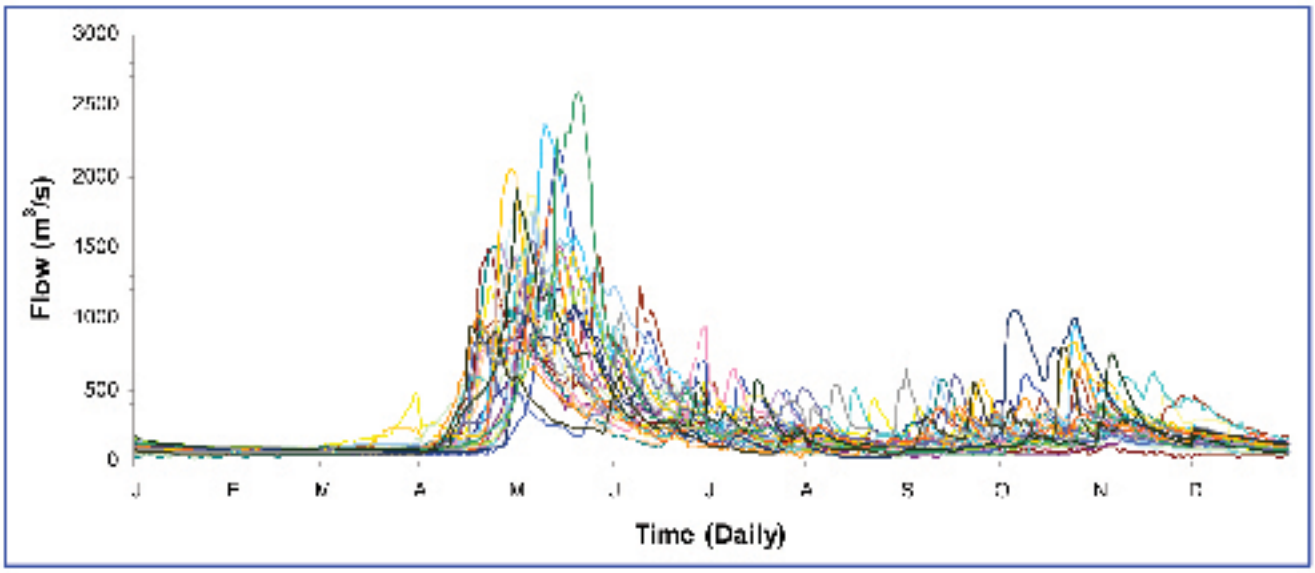


Figure 1: Annual daily flow hydrographs from 1968 to 1988.

Table 1: Annual flow metrics based on 21 years of data.

Descriptive Metrics	Value
Mean Annual Flow	243.6 m³/s
20% Time Exceeded Flow	28.5 m³/s
Median Flow	10.5 m³/s
80% Time Exceeded Flow	5.0 m³/s
Month of Max. Median Flow	April
Month of Min. Median Flow	August
Mean Rising Rate of Change of Flow	5.5 m³/s/day
Mean Falling Rate of Change of Flow	0.2 m³/s/day
Extreme Low Flow Conditions:	
7-day-avg. low flow in 2-yr ret. Period, $7Q_2$	2.9 m³/s
7-day-avg. low flow in 10-yr ret. Period, $7Q_{10}$	1.7 m³/s
7-day-avg. low flow in 20-yr ret. Period, $7Q_{20}$	1.5 m³/s
Target Metrics	**Value**
Riparian Flows (Q_2 - Q_{20})	160-259 m³/s
Bankfull Flows ($Q_{1.2}$ - $Q_{1.5}$)	161.8-170.2 m³/s

BONNECHERE RIVER AT DOUGLAS NATURAL FLOW METRICS DATA SHEET

II. Flow Duration

Time Exceeded %	Flow m^3/s
0.1	235.7
1.0	168.0
5.0	96.0
10.0	56.8
20.0	28.3
30.0	18.7
40.0	13.5
50.0	10.5
60.0	8.1
70.0	6.5
80.0	5.0
90.0	3.7
95.0	2.1
98.0	2.2
99.9	1.1

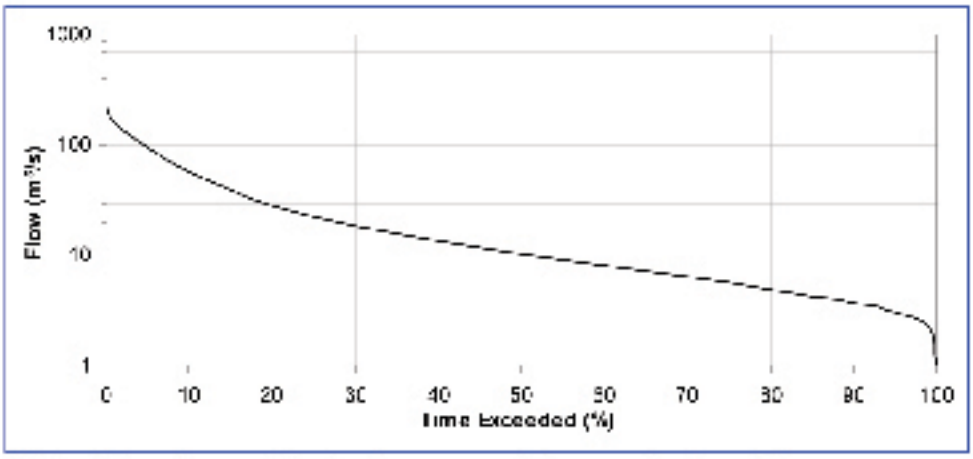


Table 2 and Figure 2: Flow duration table and curve displaying flow vs. percent time exceeded over 21 years.

III. Flood Frequency Analysis

Return Period *yrs*	Flow m^3/s
1.05	119.0
1.25	145.0
1.50	161.8
1.70	170.2
2	180.0
5	218.0
10	240.0
20	258.0
50	281.0
100	297.0

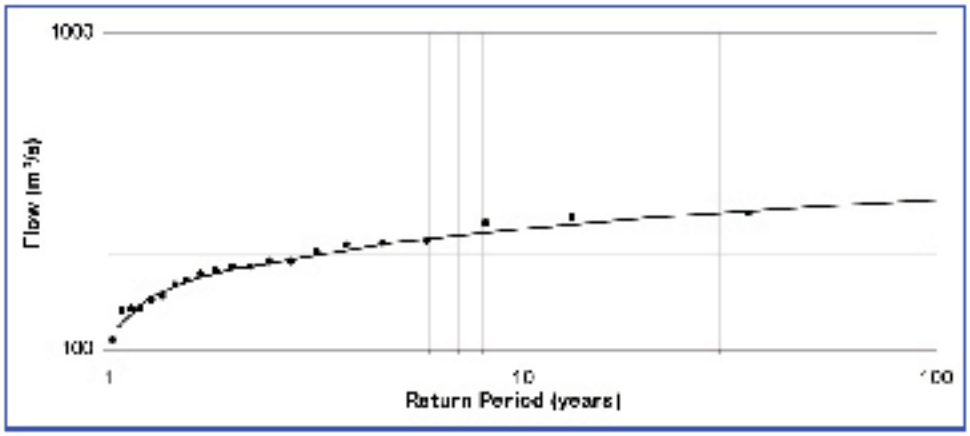


Table 3 and Figure 3 : Flood frequency analysis and curve fitted by the *Log Pearson Type III* probability distribution.

IV. Low Flow Frequency Analysis (Performed using 7-day-average low flow)

Return Period *yrs*	Flow m^3/s
1.005	6.1
1.01	5.6
1.11	4.5
1.25	3.9
2	2.9
5	2.1
10	1.7
20	1.5
50	1.2
100	1.1

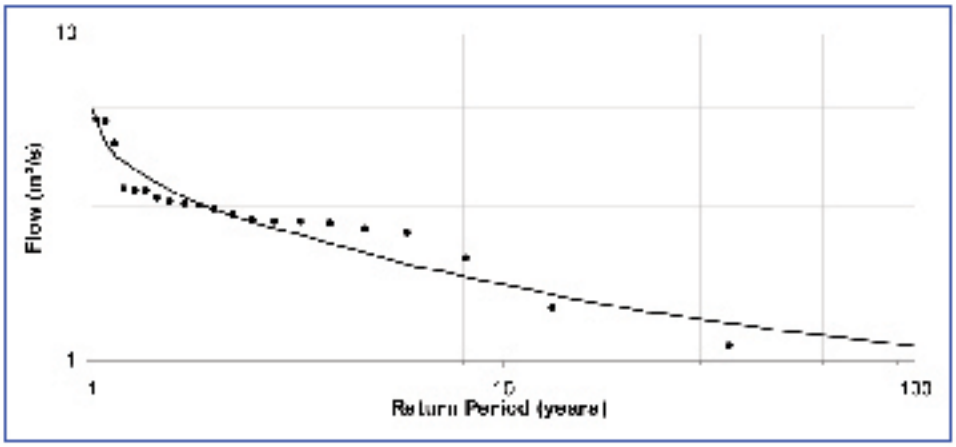


Table 4 and Figure 4: 7-day-average low flow frequency analysis and curve fitted by the *Gumble III* probability distribution.

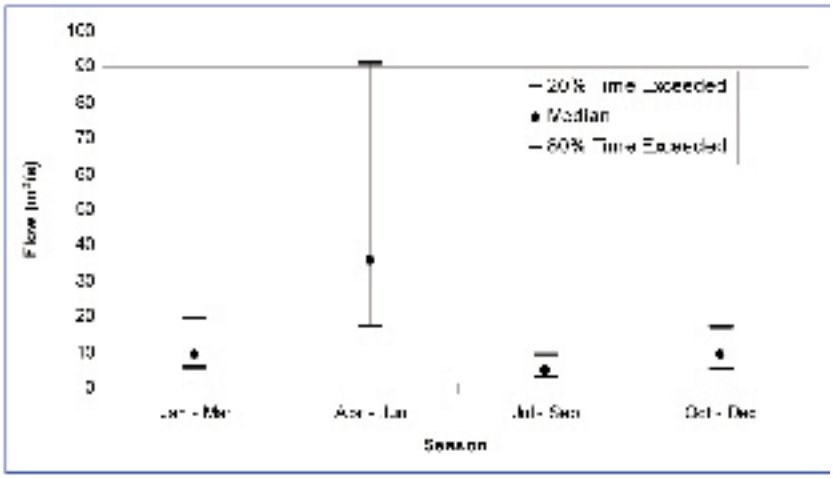
BONNECHERE RIVER AT DOUGLAS NATURAL FLOW METRICS DATA SHEET

Seasonal:

I. Flow Duration

Table 5 and Figure 5: Minimum flow targets based on seasonal median flows.

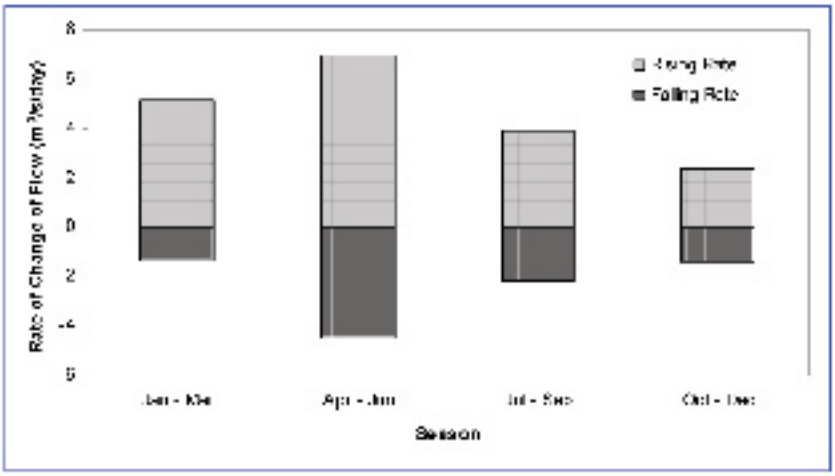
Season	20% Time Exceeded m^3/s	Median m^3/s	80% Time Exceeded m^3/s
Jan - Mar	19.7	9.1	6.0
Apr - Jun	90.9	35.8	17.3
Jul - Sep	9.3	5.1	3.2
Oct - Dec	17.1	9.8	5.3



II. Rate of Change of Flow

Table 6 and Figure 6: Ramping rate targets based on seasonal rising and falling rates of change of flow.

Season	Rising Rate $m^3/s/day$	Falling Rate $m^3/s/day$
Jan - Mar	5.2	1.4
Apr - Jun	6.9	-4.5
Jul - Sep	3.9	-2.2
Oct - Dec	2.3	-1.4



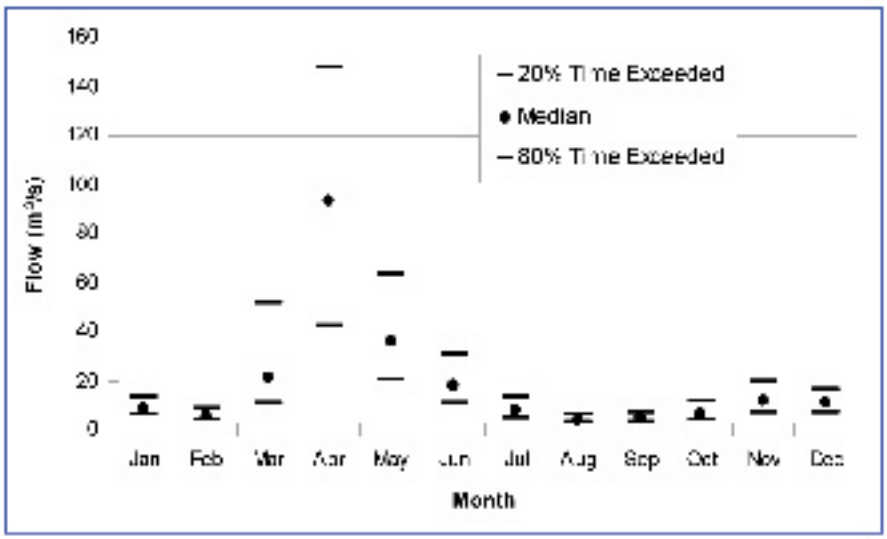
BONNECHERE RIVER AT DOUGLAS NATURAL FLOW METRICS DATA SHEET

Monthly:

I. Flow Duration

Table 7 and Figure 7: Minimum flow targets based on monthly median flows

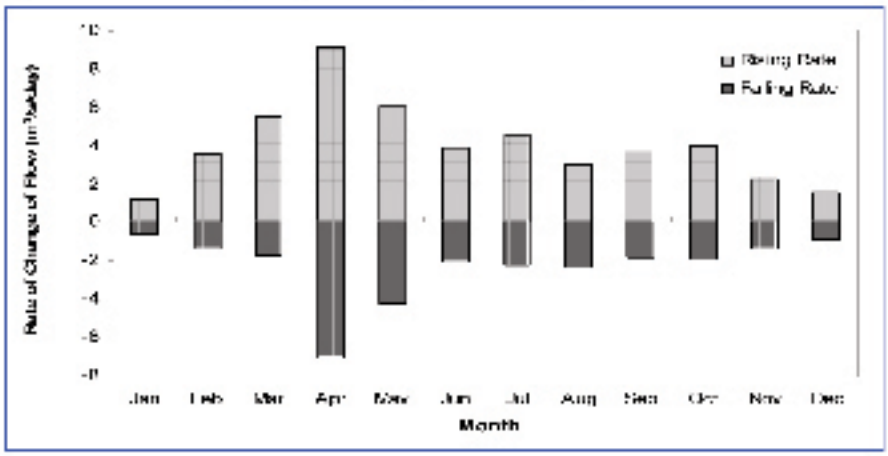
Month	20% Time Exceeded	Median	80% Time Exceeded
	m^3/s	m^3/s	m^3/s
Jan	[illegible]	8.4	5.5
Feb	8.7	5.8	4.2
Mar	52.0	21.[illegible]	11.0
Apr	[illegible]	53.3	42.4
May	63.2	33.3	20.5
Jun	30.7	17.8	11.2
Jul	[illegible]	7.5	4.8
Aug	6.4	4.[illegible]	2.8
Sep	7.3	4.5	3.0
Oct	[illegible]	6.3	3.8
Nov	20.0	11.4	3.8
Dec	[illegible]	11.0	7.0



II. Rate of Change of Flow

Table 8 and Figure 8: Ramping rate targets based on monthly rising and falling rates of change of flow.

Month	Rising Rate	Falling Rate
	$m^3/s/day$	$m^3/s/day$
Jan	1.2	-0.8
Feb	5.6	-1.3
Mar	5.5	1.8
Apr	9.1	-7.[illegible]
May	6.1	-4.2
Jun	3.9	-2.[illegible]
Jul	4.6	-2.2
Aug	3.0	-2.3
Sep	5.7	-1.8
Oct	4.0	-1.9
Nov	2.3	-1.4
Dec	1.6	-0.9



BONNECHERE RIVER AT RENFREW #1 AND #2 NATURAL FLOW METRICS DATA SHEET

Station Information	
Site ID	2KC21 & 2KC22
River Name	Bonnechere
Site Name	Renfrew #1 & #2
Region	Southcentral
District	Pembroke
Drainage Area	2351 km²
Owner	Renfrew H.E. Ctrl

Flow metrics are provided for the waterpower facility based on simulated natural flows as described in the draft *Waterpower Science Transfer Report 1.0* (MNR, 2003). The target metrics provided are described in the *Aquatic Ecosystem Guidelines* (MNR, 2002) and the *Waterpower Science Strategy* (MNR, 2002). Metrics are based on simulated natural daily flow from 1968 to 1988 (21 yrs). Other descriptive metrics have been included in the data sheet to provide a more complete description of the ranges of streamflow on the river system and to facilitate comparisons between river systems.

Annual (1968 - 1988):

I. Streamflow time series

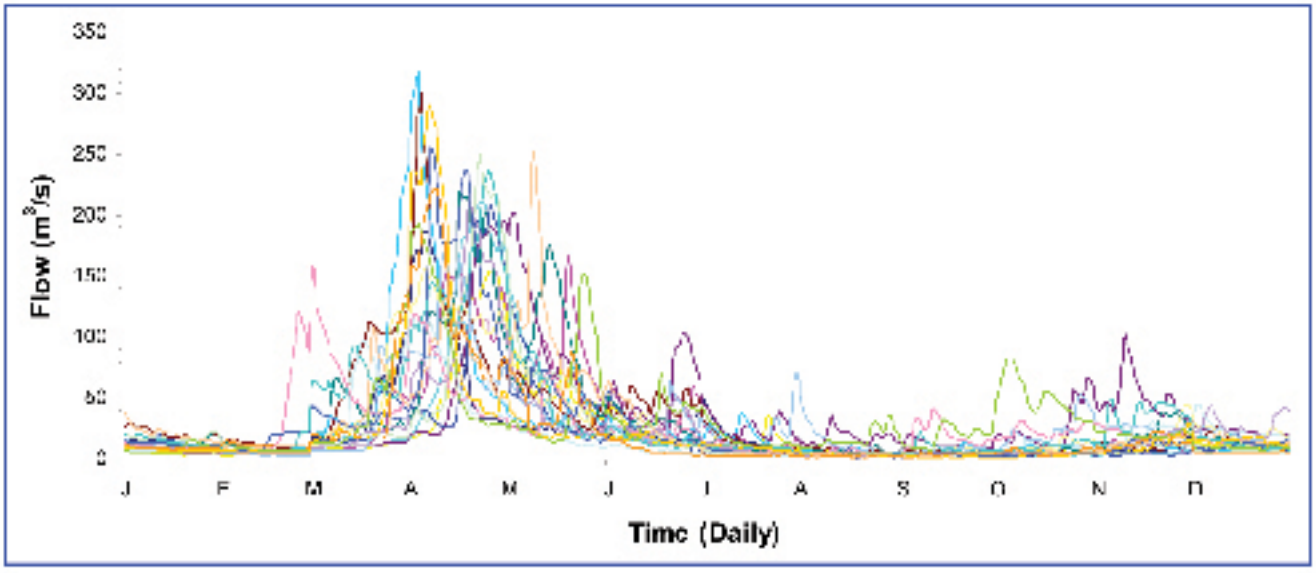


Figure 1: Annual daily flow hydrographs from 1968 to 1988.

Table 1: Annual flow metrics based on 21 years of data.

Descriptive Metrics	Value
Mean Annual Flow	26.4 m³/s
20% Time Exceeded Flow	33.0 m³/s
Median Flow	12.3 m³/s
80% Time Exceeded Flow	5.9 m³/s
Month of Max. Median Flow	April
Month of Min. Median Flow	August
Mean Rising Rate of Change of Flow	6.4 m³/s/day
Mean Falling Rate of Change of Flow	-3.6 m³/s/day
Extreme Low Flow Conditions:	
7-day-avg. low flow in 2-yr ret. Period, $7Q_2$	3.4 m³/s
7-day-avg. low flow in 10-yr ret. Period, $7Q_{10}$	2.0 m³/s
7-day-avg. low flow in 20-yr ret. Period, $7Q_{20}$	1.7 m³/s
Target Metrics	**Value**
Riparian Flows (Q_4 - Q_{20})	210-303 m³/s
Bankfull Flows ($Q_{1.5}$ - $Q_{2.5}$)	199.5-196.3 m³/s

BONNECHERE RIVER AT RENFREW #1 AND #2 NATURAL FLOW METRICS DATA SHEET

II. Flow Duration

Time Exceeded %	Flow m^3/s
0.1	280.5
1.0	198.5
5.0	110.8
10.0	66.5
20.0	33.0
30.0	22.0
40.0	18.1
50.0	12.3
60.0	8.5
70.0	7.5
80.0	5.9
90.0	4.7
95.0	3.8
99.0	2.5
99.9	1.3

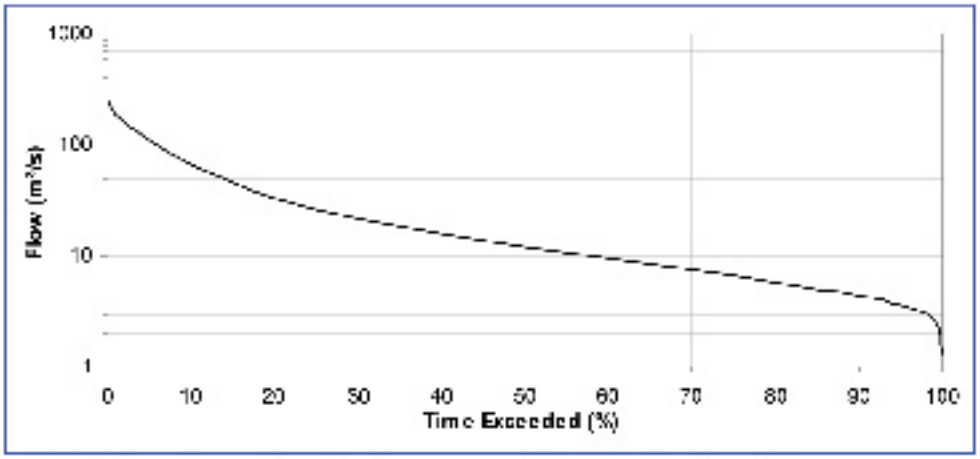


Table 2 and Figure 2: Flow duration table and curve displaying flow vs. percent time exceeded over 21 years.

III. Flood Frequency Analysis

Return Period *yrs*	Flow m^3/s
1.05	158.0
1.25	171.0
1.50	189.5
1.70	199.3
2	210.0
5	255.0
10	280.0
20	303.0
50	329.0
100	347.0

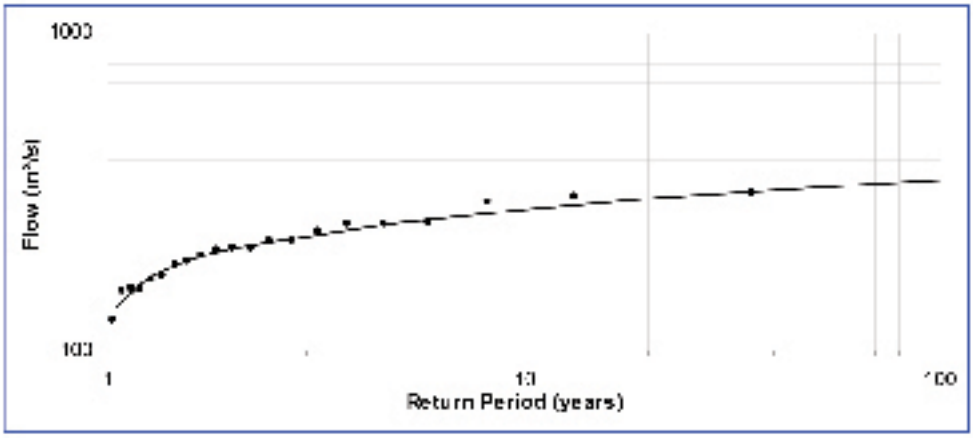


Table 3 and Figure 3 : Flood frequency analysis and curve fitted by the *Log Pearson Type III* probability distribution.

IV. Low Flow Frequency Analysis (Performed using 7-day-average low flow)

Return Period *yrs*	Flow m^3/s
1.005	7.1
1.01	6.6
1.11	5.2
1.25	4.5
2	3.4
5	2.1
10	2.0
20	1.7
50	1.4
100	1.3

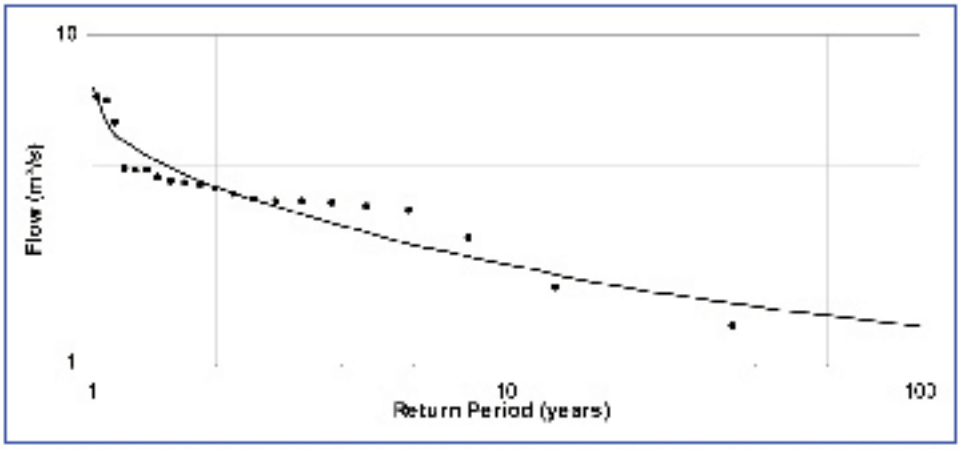


Table 4 and Figure 4: 7-day-average low flow frequency analysis and curve fitted by the *Gumbel III* probability distribution.

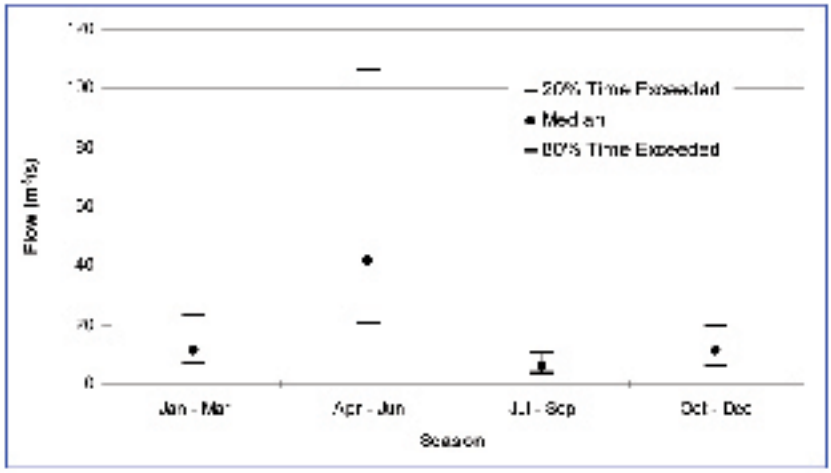
BONNECHERE RIVER AT RENFREW #1 AND #2 NATURAL FLOW METRICS DATA SHEET

Seasonal:

I. Flow Duration

Table 5 and Figure 5: Minimum flow targets based on seasonal median flows.

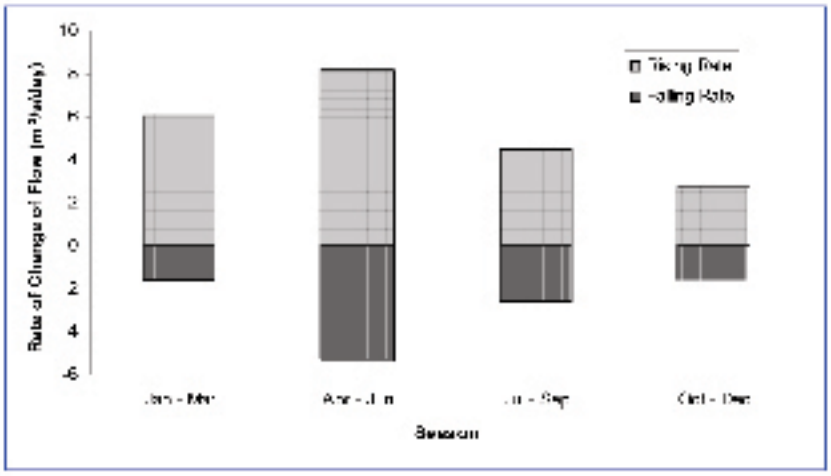
Season	20% Time Exceeded m^3/s	Median m^3/s	80% Time Exceeded m^3/s
Jan - Mar	23.0	11.0	7.0
Apr - Jun	108.0	42.0	20.3
Jul - Sep	10.9	6.0	3.7
Oct - Dec	20.0	11.7	6.2



II. Rate of Change of Flow

Table 6 and Figure 6: Ramping rate targets based on seasonal rising and falling rates of change of flow.

Season	Rising Rate $m^3/s/day$	Falling Rate $m^3/s/day$
Jan - Mar	6.1	1.6
Apr - Jun	8.2	-5.3
Jul - Sep	4.5	-2.5
Oct - Dec	2.7	-1.6



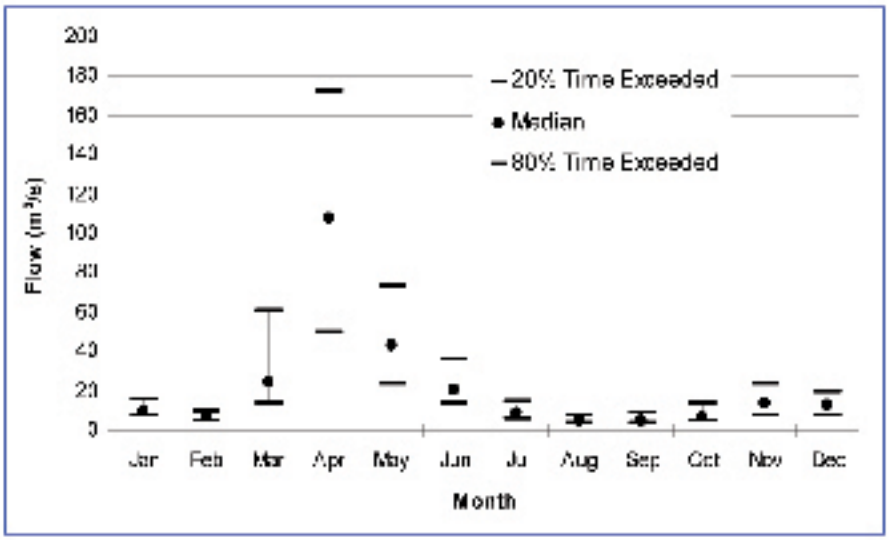
BONNECHERE RIVER AT RENFREW #1 AND #2 NATURAL FLOW METRICS DATA SHEET

Monthly:

I. Flow Duration

Table 7 and Figure 7: Minimum flow targets based on monthly median flows

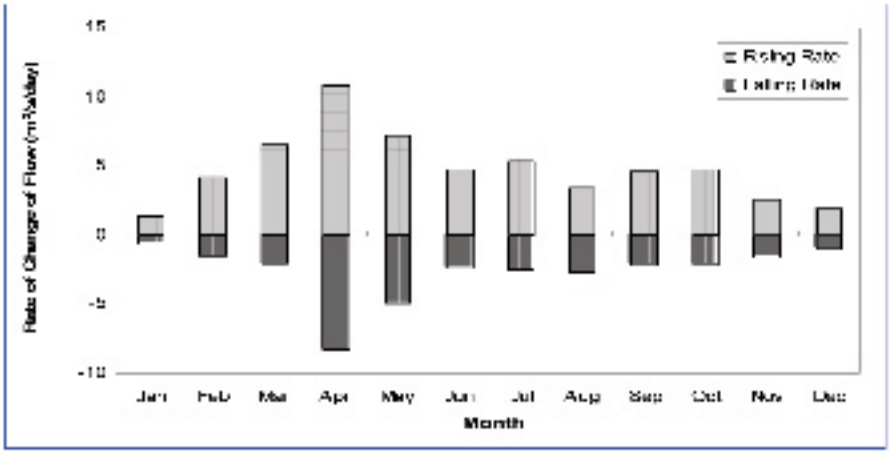
Month	20% Time Exceeded	Median	80% Time Exceeded
	m^3/s	m^3/s	m^3/s
Jan	15.3	9.9	7.0
Feb	10.2	5.9	5.0
Mar	30.0	27.5	13.5
Apr	172.1	108.0	50.2
May	74.0	43.2	23.9
Jun	35.0	21.0	13.5
Jul	14.5	8.9	5.5
Aug	7.5	4.8	3.4
Sep	8.6	5.3	3.6
Oct	13.5	7.3	4.5
Nov	23.4	13.3	8.1
Dec	19.5	12.5	8.2



II. Rate of Change of Flow

Table 8 and Figure 8: Ramping rate targets based on monthly rising and falling rates of change of flow.

Month	Rising Rate	Falling Rate
	$m^3/s/day$	$m^3/s/day$
Jan	1.4	-0.5
Feb	4.2	-1.5
Mar	5.5	-2.1
Apr	10.9	-8.3
May	7.2	-4.9
Jun	4.7	2.4
Jul	5.4	-2.5
Aug	3.4	-2.7
Sep	4.5	-2.2
Oct	4.7	-2.2
Nov	2.0	-1.3
Dec	1.9	-1.0



Appendix 7

to the Bonnechere River Water Management Plan

Table of Common Breeding Birds, Mammals and Herptiles

Table of Breeding Birds, Mammals and Herptiles of the Bonnechere River Watershed
The following table presents the birds, mammals and herptiles (reptiles and amphibians) that breed in the Bonnechere River Watershed. The information collected for this table came from various sources, and is not considered complete or conclusive. Occasionally species (i.e. certain "species at risk") have been deliberately excluded from this list, due to their vulnerability, in order to protect them.

Breeding Birds

Common Name	Scientific Name	Common Name	Scientific Name
alder flycatcher	*Empidonax ainorum*	brown creeper	*Certhia familiaris*
American bittern	*Botaurus lentiginosus*	brown thrasher	*Toxostoma rufum*
American black duck	*Anas rubripes*	brown-headed cowbird	*Molothrus ater*
American coot	*Fulica americana*	Canada goose	*Branta canadensis*
American crow	*Corvus brachyrhynchos*	Canada warbler	*Wilsonia canadensis*
American goldfinch	*Carduelis tristis*	cape-may warbler	*Dendroica tigrina*
American kestrel	*Falco sparverius*	cedar waxwing	*Bombycilla cedrorum*
American redstart	*Setophaga ruticilla*	chestnut-sided warbler	*Dendroica pensylvanica*
American robin	*Turdus migratorius*	chimney swift	*Chaetura pelagica*
American woodcock	*Scolopax minor*	chipping dparrow	*Spizella passerina*
bald eagle	*Haliaeetus leucocephalus*	clay-colored sparrow	*Spizella pallida*
Baltimore oriole	*Icterus galbula*	cliff swallow	*Hirundo pyrrhonota*
bank swallow	*Riparia riparia*	common goldeneye	*Bucephala clangula*
barn swallow	*Hirundo rustica*	common grackle	*Quiscalus quiscula*
barred owl	*Strix varia*	common loon	*Gavia immer*
bay-breasted warbler	*Dendroica castanea*	common merganser	*Mergus merganser*
belted kingfisher	*Ceryle alcyon*	common moorhen	*Gallinula chloropus*
black and white warbler	*Mniotilta varia*	common nighthawk	*Chordeiles minor*
black tern	*Chlidonias niger*	common raven	*Corvus corax*
black-backed woodpecker	*Picoides arcticus*	common tern	*Sterna hirundo*
black-billed cuckoo	*Coccyzus erthyropthalmus*	common yellowthroat	*Geothlypis trichas*
black-capped chickadee	*Parus atricapillus*	Cooper's hawk	*Accipiter cooperii*
black-throated blue warbler	*Dendroica caerulescens*	dark-eyed junco	*Junco hyemalis*
black-throated green warbler	*Dendroica virens*	double-crested cormorant	*Phalacrocorax auritus*
blackburnian warbler	*Dendroica fusca*	downy woodpecker	*Picoides pubescens*
blue jay	*Cyanocitta cristata*	eastern bluebird	*Sialia sialis*
blue-headed vireo	*Vireo solitarius*	eastern kingbird	*Tyrannus tyrannus*
blue-winged teal	*Anas discors*	eastern meadowlark	*Sturnella magna*
bobolink	*Dolichonyx oryzivorus*	eastern phoebe	*Sayornis phoebe*
broad-winged hawk	*Buteo platypterus*	eastern screech owl	*Otus asio*

Breeding Birds (cont.)			
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
eastern towhee	*Pipilo erythrophthalmus*	marsh wren	*Cistothorus palustris*
eastern wood pewee	*Contopus virens*	merlin	*Falco columbarius*
European starling	*Sturnus vulgaris*	mourning dove	*Zenaida macroura*
evening grosbeak	*Hesperiphona vespertina*	mourning warbler	*Oporornis philadelphia*
field sparrow	*Spizella pusilla*	Nashville warbler	*Vermivora ruficapilla*
golden-crowned kinglet	*Regulus satrapa*	northern cardinal	*Cardinalis cardinalis*
golden-winged warbler	*Vermivora chrsyoptera*	northern flicker	*Colaptes auratus*
grasshopper sparrow	*Ammodramus savannarum*	northern goshawk	*Accipiter gentilis*
gray catbird	*Dumetella carolinensis*	northern harrier	*Cicus cyaneus*
gray (Canada) jay	*Perisoreus canadensis*	northern mockingbird	*Mimus polyglottus*
gray (Hungarian) partridge	*Perdix perdix*	northern parula	*Parula americana*
great blue heron	*Ardea herodias*	nor. rough-winged swallow	*Stelgidopteryx ruficollis*
great-crested flycatcher	*Myiarchus crinitus*	northern saw-whet owl	*Aegolius acadicus*
great horned owl	*Bubo virginianus*	northern shoveler	*Anas ciypeata*
green heron	*Butorides striatus*	northern waterthrush	*Seiurus noveboracensis*
green-winged teal	*Anas crecca*	olive-sided flycatcher	*Contopus borealis*
hairy woodpecker	*Picoides villosus*	osprey	*Pandion haliaetus*
hermit thrush	*Catharus guttatus*	ovenbird	*Seiurus aurocapillus*
herring gull	*Larus argentatus*	peregrine falcon	*Falco peregrinus anatum*
hooded merganser	*Lophodytes cucullatus*	Philadelphia vireo	*Vireo philadelphicus*
horned lark	*Eremophila alpestris*	pied-billed grebe	*Podilymbus podiceps*
house finch	*Carpodacus mexicanus*	pileated woodpecker	*Dryocpus pileatus*
house sparrow	*Passer domesticus*	pine siskin	*Carduelis pinus*
house wren	*Troglodytes aedon*	pine warbler	*Dendroica pinus*
indigo bunting	*Passerina cyanea*	purple finch	*Carpodacus purpureus*
killdeer	*Charadrius vociferus*	purple martin	*Progne subis*
least bittern	*Ixobrychus exilis*	red crossbill	*Loxia curvirostra*
least flycatcher	*Empidonax minimus*	red-breasted nuthatch	*Sitta canadensis*
Lincoln's sparrow	*Melospiza lincolnii*	red-eyed vireo	*Vireo olivaceus*
loggerhead shrike	*Lanius ludovicianus*	red-headed woodpecker	*Melanerpes erythrocephalus*
long-eared owl	*Asio otus*	red-shouldered hawk	*Buteo lineatus*
magnolia warbler	*Dendroica magnolia*	red-tailed hawk	*Buteo jamaicensis*
mallard	*Anas platyrhynchos*	red-winged blackbird	*Agelaius phoeniceus*

Breeding Birds (cont.)			
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
ring-billed gull	*Larus delawarensis*	upland sandpiper	*Bartramia longicauda*
ring-necked duck	*Aythya collaris*	veery	*Catharus fuscescens*
rock dove	*Columba livia*	vesper sparrow	*Pooecetes gramineus*
rose-breasted grosbeak	*Pheucticus ludovicianus*	Virginia rail	*Ralluis limicola*
ruby-crowned kinglet	*Regulus calendula*	warbling vireo	*Vireo gilvus*
ruby-throated hummingbird	*Archilochus colubris*	whip-poor-will	*Caprimulgus vociferus*
ruffed grouse	*Bonasa umbellus*	white-breasted nuthatch	*Sitta carolinensis*
sandhill crane	*Grus canadensis*	white-throated sparrow	*Zonotrichia albicollis*
savannah sparrow	*Passerculus sandwichensis*	white-winged crossbill	*Loxia leucoptera*
scarlet tanager	*Piranga olivacea*	wild turkey	*Meleagris gallopavo*
sedge wren	*Cistothorus platensis*	willow flycatcher	*Empidonax trallii*
sharp-shinned hawk	*Accipiter striatus*	Wilson's (common) snipe	*Gallinago gallinago*
song sparrow	*Melospiza melodia*	winter wren	*Troglodytes troglodytes*
sora	*Porzana carolina*	wood duck	*Aix sponsa*
spotted sandpiper	*Actitis macularia*	wood thrush	*Hylocichla mustelina*
spruce grouse	*Dendragapus canadensis*	yellow-bellied flycatcher	*Empidonax flaviventris*
Swainson's thrush	*Catharus ustulatus*	yellow-bellied sapsucker	*Sphyrapicus varius*
swamp sparrow	*Melospiza georgiana*	yellow warbler	*Dendroica petrechia*
Tenessee warbler	*Vermivora peregrina*	yellow-throated vireo	*Vireo flavifrons*
tree swallow	*Tachycineta bicolor*	yellow-rumped warbler	*Dendroica coronata*
turkey vulture	*Cathartes aura*		

Mammals			
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
American marten	*Martes americana*	moose	*Alces alces*
beaver	*Castor canadensis*	muskrat	*Ondatra zibethicus*
big brown bat	*Eptesicus fuscus*	northern flying squirrel	*Glaucomys sabrinus*
black bear	*Ursus americanus*	northern long-eared bat	*Myotis septentrionalis*
bobcat	*Lynx rufus*	northern short-tailed shrew	*Blarina brevicauda*
coyote	*Canis latrans*	northern water shrew	*Sorex palustris*
deer mouse	*Peromyscus maniculatus*	Norway rat	*Rattus norvegicus*
eastern chipmunk	*Tamias striatus*	porcupine	*Erethizon dorsatum*
eastern gray squirrel	*Sciurus carolinensis*	pygmy shrew	*Sorex hoyi*
eastern pipistrelle	*Pipistrellus subflavus*	raccoon	*Procyon lotor*
eastern red bat	*Lasiurus borealis*	red fox	*Vulpes vulpes*
eastern small-footed bat	*Myotis leibeii*	red squirrel	*Tamiasciurus hudsonicus*
eastern wolf	*Canis lupus lyacon*	river otter	*Lutra canadensis*
elk	*Cervus elaphus*	rock vole	*Microtus pinetorum*
fisher	*Martes pennanti*	short-tailed weasel	*Mustela erminea*
groundhog (woodchuck)	*Marmota monax*	silver-haired bat	*Lasionycteris noctivagans*
hairy-tailed mole	*Parascalops breweri*	smoky shrew	*Sorex fumeus*
hoary bat	*Lasiurus cinereus*	snowshoe hare	*Lepus americanus*
house mouse	*Mus musculus*	southern bog lemming	*Synaptomys cooperi*
least chipmunk	*Tamias minimus*	southern flying squirrel	*Glaucomys volans*
least weasel	*Mustela nivalis*	southern red-backed vole	*Clethrionomys gapperi*
little brown bat	*Myotis lucifugus*	star-nosed mole	*Condylura cristata*
long-tailed weasel	*Mustela frenata*	striped skunk	*Mephitis mephitis*
masked shrew	*Sorex cinereus*	white-footed mouse	*Peromyscus leucopus*
meadow jumping mouse	*Zapus hudsonius*	white-tailed deer	*Odocoileus virginianus*
meadow vole	*Mictrotus pennsylvanicus*	woodland jumping mouse	*Napaeozapus insignis*
mink	*Mustela vison*		

Herptiles			
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**
American toad	*Bufo americanus*	northern map turtle	*Graptemys geographica*
American bullfrog	*Rana catesbeiana*	northern red-bellied snake	*Stoeria occipitomaculata*
Blanding's turtle	*Emydoidea blandingii*	northern ribbon snake	*Thamnophis sauritus*
blue-spotted salamander	*Ambystoma laterale*	northern two-lined salamander	*Eurycea bislineata*
common garter snake	*Thamnophis sirtalis*	northern watersnake	*Nerodia sipedon*
eastern milk snake	*Lampropeltis triangulum*	pickerel frog	*Rana palustris*
eastern newt	*Notophthalmus viridescens*	ring-necked snake	*Diadophis punctatus*
eastern red-backed salamander	*Plethodon cinerus*	smooth green snake	*Opheodrys vernalis*
four-toed salamander	*Hemidactylum scutatum*	snapping turtle	*Chelydra serpentina*
gray treefrog	*Hyla versicolor*	spotted newt	*Diemictylus viridescens*
green frog	*Rana clamitans melanota*	spotted salamander	*Ambystoma maculatum*
Midland painted turtle	*Chrysemys picta marginata*	spring peeper	*Hyla crucifer*
mink frog	*Rana septentrionalis*	stinkpot (musk turtle)	*Sternotherus odoratus*
mudpuppy	*Necturus maculosus*	western chorus frog	*Pseudacris triseriata*
northern brown snake	*Storeria dekayi*	wood frog	*Rana sylvatica*
northern leopard frog	*Rana pipiens*		

Appendix 8

to the Bonnechere River Water Management Plan

Compliance and Enforcement Principles
Round Lake (Tramore Dam) Daily Data Table
Golden Lake Dam Daily Data Table
Renfrew Station #1 Daily Data Table

Bonnechere River Water Management Plan Compliance and Enforcement Principles

This appendix to the BRWMP was added as an amendment to the plan in 2009.

The Compliance and Enforcement Regime (Appendix J) of the Water Management Planning Guidelines for Waterpower provides direction and guidance for compliance and enforcement actions related to the Bonnechere River Water Management Plan (BRWMP).

The waterpower industry has a self-monitoring and reporting role. The Ministry of Natural Resources (MNR) has an inspection, audit and enforcement role.

It is recognized that water level and flow management is subject to the variances of natural conditions.

All water level excursions outside the approved operating regime of a facility or structure are considered incidents. Each incident will be reviewed or investigated. The review or investigation will focus on a number of factors including but not limited to the severity of impact, weather, the intent and action or inaction of the operator, performance of equipment and unforeseen events. MNR will seek the input of the operator during the review or investigation. The operator will be provided an opportunity to determine and explain the reasons for the incident.

Once the review or investigation is complete, based on the specific circumstances, MNR will determine whether the incident will be considered an act of non-compliance with the terms of the plan, or remain as an incident. A determination of non-compliance is a finding by MNR that the actions or inactions of the dam owners or operators resulted in water levels and flows outside the approved operating ranges, and that the action or inaction is determined to be deliberate, negligent or repetitive. Following a determination of non-compliance, MNR will determine if any actions will be taken under the *Lakes and Rivers Improvement Act*.

If during the review it is determined that a high or low water indicator was met, the excursion remains an incident and is not considered a non-compliance event. All incidents will remain on file and will be included in the annual compliance report.

Round Lake (Tramore Dam) Daily Data Table

DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER
1	171.08	170.10	47	170.90	170.10	93	171.08	170.10	139	171.23	170.16
2	171.08	170.10	48	170.90	170.10	94	171.08	170.10	140	171.23	170.17
3	171.08	170.10	49	170.89	170.10	95	171.08	170.10	141	171.23	170.18
4	171.08	170.10	50	170.89	170.10	96	171.08	170.10	142	171.23	170.19
5	171.08	170.10	51	170.89	170.10	97	171.08	170.10	143	171.23	170.20
6	171.08	170.10	52	170.88	170.10	98	171.08	170.10	144	171.23	170.21
7	171.08	170.10	53	170.88	170.10	99	171.08	170.10	145	171.23	170.22
8	171.08	170.10	54	170.87	170.10	100	171.08	170.10	146	171.23	170.24
9	171.07	170.10	55	170.87	170.10	101	171.08	170.10	147	171.23	170.25
10	171.07	170.10	56	170.86	170.10	102	171.08	170.10	148	171.23	170.26
11	171.06	170.10	57	170.86	170.10	103	171.08	170.10	149	171.23	170.27
12	171.06	170.10	58	170.85	170.10	104	171.08	170.10	150	171.23	170.28
13	171.05	170.10	59	170.85	170.10	105	171.08	170.10	151	171.23	170.29
14	171.05	170.10	60	170.85	170.10	106	171.08	170.10	152	171.23	170.30
15	171.04	170.10	61	170.84	170.10	107	171.08	170.10	153	171.23	170.31
16	171.04	170.10	62	170.84	170.10	108	171.08	170.10	154	171.23	170.32
17	171.04	170.10	63	170.83	170.10	109	171.08	170.10	155	171.23	170.33
18	171.03	170.10	64	170.83	170.10	110	171.08	170.10	156	171.23	170.34
19	171.03	170.10	65	170.82	170.10	111	171.08	170.10	157	171.23	170.35
20	171.02	170.10	66	170.82	170.10	112	171.08	170.10	158	171.23	170.36
21	171.02	170.10	67	170.81	170.10	113	171.08	170.10	159	171.23	170.37
22	171.01	170.10	68	170.81	170.10	114	171.08	170.10	160	171.23	170.38
23	171.01	170.10	69	170.81	170.10	115	171.08	170.10	161	171.23	170.39
24	171.00	170.10	70	170.80	170.10	116	171.08	170.10	162	171.23	170.40
25	171.00	170.10	71	170.80	170.10	117	171.08	170.10	163	171.23	170.41
26	171.00	170.10	72	170.79	170.10	118	171.08	170.10	164	171.23	170.42
27	170.99	170.10	73	170.79	170.10	119	171.09	170.10	165	171.23	170.43
28	170.99	170.10	74	170.78	170.10	120	171.11	170.10	166	171.23	170.44
29	170.98	170.10	75	170.78	170.10	121	171.14	170.10	167	171.23	170.45
30	170.98	170.10	76	170.77	170.10	122	171.16	170.10	168	171.23	170.46
31	170.97	170.10	77	170.78	170.10	123	171.19	170.10	169	171.23	170.47
32	170.97	170.10	78	170.82	170.10	124	171.21	170.10	170	171.23	170.49
33	170.96	170.10	79	170.86	170.10	125	171.23	170.10	171	171.23	170.50
34	170.96	170.10	80	170.90	170.10	126	171.23	170.10	172	171.23	170.51
35	170.96	170.10	81	170.94	170.10	127	171.23	170.10	173	171.23	170.52
36	170.95	170.10	82	170.98	170.10	128	171.23	170.10	174	171.23	170.53
37	170.95	170.10	83	171.02	170.10	129	171.23	170.10	175	171.23	170.54
38	170.94	170.10	84	171.08	170.10	130	171.23	170.10	176	171.23	170.55
39	170.94	170.10	85	171.08	170.10	131	171.23	170.10	177	171.23	170.56
40	170.93	170.10	86	171.08	170.10	132	171.23	170.10	178	171.23	170.57
41	170.93	170.10	87	171.08	170.10	133	171.23	170.10	179	171.23	170.58
42	170.93	170.10	88	171.08	170.10	134	171.23	170.11	180	171.23	170.59
43	170.92	170.10	89	171.08	170.10	135	171.23	170.12	181	171.23	170.60
44	170.92	170.10	90	171.08	170.10	136	171.23	170.13	182	171.23	170.61
45	170.91	170.10	91	171.08	170.10	137	171.23	170.14	183	171.23	170.62
46	170.91	170.10	92	171.08	170.10	138	171.23	170.15	184	171.23	170.62

DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER
185	171.23	170.62	231	171.08	170.62	277	170.97	170.47	323	170.92	170.25
186	171.23	170.62	232	171.08	170.62	278	170.97	170.47	324	170.92	170.24
187	171.23	170.62	233	171.08	170.62	279	170.96	170.47	325	170.93	170.22
188	171.23	170.62	234	171.08	170.62	280	170.96	170.47	326	170.93	170.21
189	171.23	170.62	235	171.08	170.62	281	170.95	170.47	327	170.93	170.20
190	171.21	170.62	236	171.08	170.62	282	170.94	170.47	328	170.94	170.19
191	171.19	170.62	237	171.08	170.62	283	170.94	170.47	329	170.94	170.17
192	171.17	170.62	238	171.08	170.62	284	170.93	170.47	330	170.95	170.16
193	171.14	170.62	239	171.08	170.62	285	170.93	170.47	331	170.95	170.15
194	171.12	170.62	240	171.08	170.62	286	170.92	170.47	332	170.95	170.14
195	171.10	170.62	241	171.08	170.62	287	170.91	170.47	333	170.96	170.12
196	171.08	170.62	242	171.08	170.62	288	170.91	170.47	334	170.96	170.11
197	171.08	170.62	243	171.08	170.62	289	170.90	170.47	335	170.96	170.10
198	171.08	170.62	244	171.08	170.62	290	170.90	170.47	336	170.97	170.10
199	171.08	170.62	245	171.08	170.62	291	170.89	170.47	337	170.97	170.10
200	171.08	170.62	246	171.08	170.62	292	170.88	170.47	338	170.98	170.10
201	171.08	170.62	247	171.08	170.62	293	170.88	170.47	339	170.98	170.10
202	171.08	170.62	248	171.08	170.62	294	170.87	170.47	340	170.98	170.10
203	171.08	170.62	249	171.08	170.62	295	170.87	170.47	341	170.99	170.10
204	171.08	170.62	250	171.08	170.62	296	170.86	170.47	342	170.99	170.10
205	171.08	170.62	251	171.08	170.62	297	170.85	170.47	343	171.00	170.10
206	171.08	170.62	252	171.08	170.62	298	170.85	170.47	344	171.00	170.10
207	171.08	170.62	253	171.08	170.62	299	170.84	170.47	345	171.00	170.10
208	171.08	170.62	254	171.08	170.62	300	170.84	170.47	346	171.01	170.10
209	171.08	170.62	255	171.08	170.62	301	170.83	170.47	347	171.01	170.10
210	171.08	170.62	256	171.08	170.62	302	170.83	170.47	348	171.02	170.10
211	171.08	170.62	257	171.08	170.62	303	170.84	170.47	349	171.02	170.10
212	171.08	170.62	258	171.08	170.62	304	170.84	170.47	350	171.02	170.10
213	171.08	170.62	259	171.08	170.62	305	170.85	170.47	351	171.03	170.10
214	171.08	170.62	260	171.08	170.60	306	170.85	170.46	352	171.03	170.10
215	171.08	170.62	261	171.08	170.58	307	170.86	170.45	353	171.04	170.10
216	171.08	170.62	262	171.06	170.56	308	170.86	170.43	354	171.04	170.10
217	171.08	170.62	263	171.06	170.53	309	170.86	170.42	355	171.04	170.10
218	171.08	170.62	264	171.05	170.51	310	170.87	170.41	356	171.05	170.10
219	171.08	170.62	265	171.04	170.49	311	170.87	170.40	357	171.05	170.10
220	171.08	170.62	266	171.04	170.47	312	170.87	170.38	358	171.06	170.10
221	171.08	170.62	267	171.03	170.47	313	170.88	170.37	359	171.06	170.10
222	171.08	170.62	268	171.03	170.47	314	170.88	170.36	360	171.06	170.10
223	171.08	170.62	269	171.02	170.47	315	170.89	170.35	361	171.07	170.10
224	171.08	170.62	270	171.01	170.47	316	170.89	170.33	362	171.07	170.10
225	171.08	170.62	271	171.01	170.47	317	170.89	170.32	363	171.08	170.10
226	171.08	170.62	272	171.00	170.47	318	170.90	170.31	364	171.08	170.10
227	171.08	170.62	273	171.00	170.47	319	170.90	170.30	365	171.08	170.10
228	171.08	170.62	274	170.99	170.47	320	170.91	170.29			
229	171.08	170.62	275	170.98	170.47	321	170.91	170.27			
230	171.08	170.62	276	170.98	170.47	322	170.91	170.26			

Golden Lake Dam Daily Data Table

DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER
DAY 1	169.41	168.71	DAY 47	169.27	168.71	DAY 93	169.44	168.71	DAY 139	169.44	168.71
DAY 2	169.41	168.71	DAY 48	169.26	168.71	DAY 94	169.44	168.71	DAY 140	169.44	168.71
DAY 3	169.41	168.71	DAY 49	169.26	168.71	DAY 95	169.44	168.71	DAY 141	169.44	168.71
DAY 4	169.41	168.71	DAY 50	169.26	168.71	DAY 96	169.44	168.71	DAY 142	169.44	168.71
DAY 5	169.41	168.71	DAY 51	169.25	168.71	DAY 97	169.44	168.71	DAY 143	169.44	168.71
DAY 6	169.41	168.71	DAY 52	169.25	168.71	DAY 98	169.44	168.71	DAY 144	169.44	168.71
DAY 7	169.41	168.71	DAY 53	169.25	168.71	DAY 99	169.44	168.71	DAY 145	169.44	168.71
DAY 8	169.41	168.71	DAY 54	169.24	168.71	DAY 100	169.44	168.71	DAY 146	169.44	168.71
DAY 9	169.4	168.71	DAY 55	169.24	168.71	DAY 101	169.44	168.71	DAY 147	169.44	168.71
DAY 10	169.4	168.71	DAY 56	169.24	168.71	DAY 102	169.44	168.71	DAY 148	169.44	168.72
DAY 11	169.4	168.71	DAY 57	169.23	168.71	DAY 103	169.44	168.71	DAY 149	169.44	168.74
DAY 12	169.39	168.71	DAY 58	169.23	168.71	DAY 104	169.44	168.71	DAY 150	169.44	168.75
DAY 13	169.39	168.71	DAY 59	169.22	168.71	DAY 105	169.44	168.71	DAY 151	169.44	168.77
DAY 14	169.39	168.71	DAY 60	169.22	168.71	DAY 106	169.44	168.71	DAY 152	169.44	168.78
DAY 15	169.38	168.71	DAY 61	169.22	168.71	DAY 107	169.44	168.71	DAY 153	169.44	168.79
DAY 16	169.38	168.71	DAY 62	169.21	168.71	DAY 108	169.44	168.71	DAY 154	169.44	168.81
DAY 17	169.37	168.71	DAY 63	169.21	168.71	DAY 109	169.44	168.71	DAY 155	169.44	168.82
DAY 18	169.37	168.71	DAY 64	169.24	168.71	DAY 110	169.44	168.71	DAY 156	169.44	168.84
DAY 19	169.37	168.71	DAY 65	169.28	168.71	DAY 111	169.44	168.71	DAY 157	169.44	168.85
DAY 20	169.36	168.71	DAY 66	169.31	168.71	DAY 112	169.44	168.71	DAY 158	169.44	168.86
DAY 21	169.36	168.71	DAY 67	169.34	168.71	DAY 113	169.44	168.71	DAY 159	169.44	168.88
DAY 22	169.36	168.71	DAY 68	169.37	168.71	DAY 114	169.44	168.71	DAY 160	169.44	168.89
DAY 23	169.35	168.71	DAY 69	169.41	168.71	DAY 115	169.44	168.71	DAY 161	169.44	168.91
DAY 24	169.35	168.71	DAY 70	169.44	168.71	DAY 116	169.44	168.71	DAY 162	169.44	168.92
DAY 25	169.35	168.71	DAY 71	169.44	168.71	DAY 117	169.44	168.71	DAY 163	169.44	168.93
DAY 26	169.34	168.71	DAY 72	169.44	168.71	DAY 118	169.44	168.71	DAY 164	169.44	168.95
DAY 27	169.34	168.71	DAY 73	169.44	168.71	DAY 119	169.44	168.71	DAY 165	169.44	168.96
DAY 28	169.34	168.71	DAY 74	169.44	168.71	DAY 120	169.44	168.71	DAY 166	169.44	168.97
DAY 29	169.33	168.71	DAY 75	169.44	168.71	DAY 121	169.44	168.71	DAY 167	169.44	168.99
DAY 30	169.33	168.71	DAY 76	169.44	168.71	DAY 122	169.44	168.71	DAY 168	169.44	169.00
DAY 31	169.32	168.71	DAY 77	169.44	168.71	DAY 123	169.44	168.71	DAY 169	169.44	169.02
DAY 32	169.32	168.71	DAY 78	169.44	168.71	DAY 124	169.44	168.71	DAY 170	169.44	169.03
DAY 33	169.32	168.71	DAY 79	169.44	168.71	DAY 125	169.44	168.71	DAY 171	169.44	169.04
DAY 34	169.31	168.71	DAY 80	169.44	168.71	DAY 126	169.44	168.71	DAY 172	169.44	169.06
DAY 35	169.31	168.71	DAY 81	169.44	168.71	DAY 127	169.44	168.71	DAY 173	169.44	169.07
DAY 36	169.31	168.71	DAY 82	169.44	168.71	DAY 128	169.44	168.71	DAY 174	169.44	169.09
DAY 37	169.30	168.71	DAY 83	169.44	168.71	DAY 129	169.44	168.71	DAY 175	169.44	169.10
DAY 38	169.30	168.71	DAY 84	169.44	168.71	DAY 130	169.44	168.71	DAY 176	169.44	169.10
DAY 39	169.30	168.71	DAY 85	169.44	168.71	DAY 131	169.44	168.71	DAY 177	169.44	169.10
DAY 40	169.29	168.71	DAY 86	169.44	168.71	DAY 132	169.44	168.71	DAY 178	169.44	169.10
DAY 41	169.29	168.71	DAY 87	169.44	168.71	DAY 133	169.44	168.71	DAY 179	169.44	169.10
DAY 42	169.29	168.71	DAY 88	169.44	168.71	DAY 134	169.44	168.71	DAY 180	169.44	169.10
DAY 43	169.28	168.71	DAY 89	169.44	168.71	DAY 135	169.44	168.71	DAY 181	169.44	169.10
DAY 44	169.28	168.71	DAY 90	169.44	168.71	DAY 136	169.44	168.71	DAY 182	169.44	169.10
DAY 45	169.27	168.71	DAY 91	169.44	168.71	DAY 137	169.44	168.71	DAY 183	169.44	169.10
DAY 46	169.27	168.71	DAY 92	169.44	168.71	DAY 138	169.44	168.71	DAY 184	169.44	169.10

DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER
DAY 185	169.44	169.10	DAY 231	169.41	169.04	DAY 277	169.41	168.84	DAY 323	169.41	168.71
DAY 186	169.44	169.10	DAY 232	169.41	169.03	DAY 278	169.41	168.83	DAY 324	169.41	168.71
DAY 187	169.44	169.10	DAY 233	169.41	169.03	DAY 279	169.41	168.83	DAY 325	169.41	168.71
DAY 188	169.44	169.10	DAY 234	169.41	169.03	DAY 280	169.41	168.83	DAY 326	169.41	168.71
DAY 189	169.44	169.10	DAY 235	169.41	169.02	DAY 281	169.41	168.82	DAY 327	169.41	168.71
DAY 190	169.44	169.10	DAY 236	169.41	169.02	DAY 282	169.41	168.82	DAY 328	169.41	168.71
DAY 191	169.44	169.10	DAY 237	169.41	169.01	DAY 283	169.41	168.81	DAY 329	169.41	168.71
DAY 192	169.44	169.10	DAY 238	169.41	169.01	DAY 284	169.41	168.81	DAY 330	169.41	168.71
DAY 193	169.44	169.10	DAY 239	169.41	169.00	DAY 285	169.41	168.80	DAY 331	169.41	168.71
DAY 194	169.44	169.10	DAY 240	169.41	169.00	DAY 286	169.41	168.80	DAY 332	169.41	168.71
DAY 195	169.44	169.10	DAY 241	169.41	169.00	DAY 287	169.41	168.79	DAY 333	169.41	168.71
DAY 196	169.44	169.10	DAY 242	169.41	168.99	DAY 288	169.41	168.79	DAY 334	169.41	168.71
DAY 197	169.44	169.10	DAY 243	169.41	168.99	DAY 289	169.41	168.79	DAY 335	169.41	168.71
DAY 198	169.43	169.10	DAY 244	169.41	168.98	DAY 290	169.41	168.78	DAY 336	169.41	168.71
DAY 199	169.43	169.10	DAY 245	169.41	168.98	DAY 291	169.41	168.78	DAY 337	169.41	168.71
DAY 200	169.42	169.10	DAY 246	169.41	168.97	DAY 292	169.41	168.77	DAY 338	169.41	168.71
DAY 201	169.42	169.10	DAY 247	169.41	168.97	DAY 293	169.41	168.77	DAY 339	169.41	168.71
DAY 202	169.41	169.10	DAY 248	169.41	168.96	DAY 294	169.41	168.76	DAY 340	169.41	168.71
DAY 203	169.41	169.10	DAY 249	169.41	168.96	DAY 295	169.41	168.76	DAY 341	169.41	168.71
DAY 204	169.41	169.10	DAY 250	169.41	168.96	DAY 296	169.41	168.76	DAY 342	169.41	168.71
DAY 205	169.41	169.10	DAY 251	169.41	168.95	DAY 297	169.41	168.75	DAY 343	169.41	168.71
DAY 206	169.41	169.10	DAY 252	169.41	168.95	DAY 298	169.41	168.75	DAY 344	169.41	168.71
DAY 207	169.41	169.10	DAY 253	169.41	168.94	DAY 299	169.41	168.74	DAY 345	169.41	168.71
DAY 208	169.41	169.10	DAY 254	169.41	168.94	DAY 300	169.41	168.74	DAY 346	169.41	168.71
DAY 209	169.41	169.10	DAY 255	169.41	168.93	DAY 301	169.41	168.73	DAY 347	169.41	168.71
DAY 210	169.41	169.10	DAY 256	169.41	168.93	DAY 302	169.41	168.73	DAY 348	169.41	168.71
DAY 211	169.41	169.10	DAY 257	169.41	168.93	DAY 303	169.41	168.73	DAY 349	169.41	168.71
DAY 212	169.41	169.10	DAY 258	169.41	168.92	DAY 304	169.41	168.72	DAY 350	169.41	168.71
DAY 213	169.41	169.10	DAY 259	169.41	168.92	DAY 305	169.41	168.72	DAY 351	169.41	168.71
DAY 214	169.41	169.10	DAY 260	169.41	168.91	DAY 306	169.41	168.71	DAY 352	169.41	168.71
DAY 215	169.41	169.10	DAY 261	169.41	168.91	DAY 307	169.41	168.71	DAY 353	169.41	168.71
DAY 216	169.41	169.10	DAY 262	169.41	168.90	DAY 308	169.41	168.71	DAY 354	169.41	168.71
DAY 217	169.41	169.10	DAY 263	169.41	168.90	DAY 309	169.41	168.71	DAY 355	169.41	168.71
DAY 218	169.41	169.10	DAY 264	169.41	168.90	DAY 310	169.41	168.71	DAY 356	169.41	168.71
DAY 219	169.41	169.09	DAY 265	169.41	168.89	DAY 311	169.41	168.71	DAY 357	169.41	168.71
DAY 220	169.41	169.09	DAY 266	169.41	168.89	DAY 312	169.41	168.71	DAY 358	169.41	168.71
DAY 221	169.41	169.08	DAY 267	169.41	168.88	DAY 313	169.41	168.71	DAY 359	169.41	168.71
DAY 222	169.41	169.08	DAY 268	169.41	168.88	DAY 314	169.41	168.71	DAY 360	169.41	168.71
DAY 223	169.41	169.07	DAY 269	169.41	168.87	DAY 315	169.41	168.71	DAY 361	169.41	168.71
DAY 224	169.41	169.07	DAY 270	169.41	168.87	DAY 316	169.41	168.71	DAY 362	169.41	168.71
DAY 225	169.41	169.07	DAY 271	169.41	168.86	DAY 317	169.41	168.71	DAY 363	169.41	168.71
DAY 226	169.41	169.06	DAY 272	169.41	168.86	DAY 318	169.41	168.71	DAY 364	169.41	168.71
DAY 227	169.41	169.06	DAY 273	169.41	168.86	DAY 319	169.41	168.71	DAY 365	169.41	168.71
DAY 228	169.41	169.05	DAY 274	169.41	168.85	DAY 320	169.41	168.71			
DAY 229	169.41	169.05	DAY 275	169.41	168.85	DAY 321	169.41	168.71			
DAY 230	169.41	169.04	DAY 276	169.41	168.84	DAY 322	169.41	168.71			

Renfrew Station #1 Daily Data Table

DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER
DAY 1	111.03	110.03	DAY 47	111.03	110.03	DAY 93	111.19	110.03	DAY 139	111.19	110.03
DAY 2	111.03	110.03	DAY 48	111.03	110.03	DAY 94	111.19	110.03	DAY 140	111.19	110.03
DAY 3	111.03	110.03	DAY 49	111.03	110.03	DAY 95	111.19	110.03	DAY 141	111.19	110.03
DAY 4	111.03	110.03	DAY 50	111.03	110.03	DAY 96	111.19	110.03	DAY 142	111.19	110.03
DAY 5	111.03	110.03	DAY 51	111.03	110.03	DAY 97	111.19	110.03	DAY 143	111.19	110.03
DAY 6	111.03	110.03	DAY 52	111.03	110.03	DAY 98	111.19	110.03	DAY 144	111.19	110.03
DAY 7	111.03	110.03	DAY 53	111.03	110.03	DAY 99	111.19	110.03	DAY 145	111.19	110.03
DAY 8	111.03	110.03	DAY 54	111.03	110.03	DAY 100	111.19	110.03	DAY 146	111.19	110.03
DAY 9	111.03	110.03	DAY 55	111.03	110.03	DAY 101	111.19	110.03	DAY 147	110.86	110.03
DAY 10	111.03	110.03	DAY 56	111.03	110.03	DAY 102	111.19	110.03	DAY 148	110.86	110.03
DAY 11	111.03	110.03	DAY 57	111.03	110.03	DAY 103	111.19	110.03	DAY 149	110.86	110.03
DAY 12	111.03	110.03	DAY 58	111.03	110.03	DAY 104	111.19	110.03	DAY 150	110.86	110.03
DAY 13	111.03	110.03	DAY 59	111.03	110.03	DAY 105	111.19	110.03	DAY 151	110.86	110.03
DAY 14	111.03	110.03	DAY 60	111.03	110.03	DAY 106	111.19	110.03	DAY 152	110.86	110.03
DAY 15	111.03	110.03	DAY 61	111.03	110.03	DAY 107	111.19	110.03	DAY 153	110.86	110.03
DAY 16	111.03	110.03	DAY 62	111.03	110.03	DAY 108	111.19	110.03	DAY 154	110.86	110.03
DAY 17	111.03	110.03	DAY 63	111.03	110.03	DAY 109	111.19	110.03	DAY 155	110.86	110.03
DAY 18	111.03	110.03	DAY 64	111.03	110.03	DAY 110	111.19	110.03	DAY 156	110.86	110.03
DAY 19	111.03	110.03	DAY 65	111.03	110.03	DAY 111	111.19	110.03	DAY 157	110.86	110.03
DAY 20	111.03	110.03	DAY 66	111.03	110.03	DAY 112	111.19	110.03	DAY 158	110.86	110.03
DAY 21	111.03	110.03	DAY 67	111.03	110.03	DAY 113	111.19	110.03	DAY 159	110.86	110.03
DAY 22	111.03	110.03	DAY 68	111.03	110.03	DAY 114	111.19	110.03	DAY 160	110.86	110.03
DAY 23	111.03	110.03	DAY 69	111.03	110.03	DAY 115	111.19	110.03	DAY 161	110.86	110.03
DAY 24	111.03	110.03	DAY 70	111.03	110.03	DAY 116	111.19	110.03	DAY 162	110.86	110.03
DAY 25	111.03	110.03	DAY 71	111.03	110.03	DAY 117	111.19	110.03	DAY 163	110.86	110.03
DAY 26	111.03	110.03	DAY 72	111.19	110.03	DAY 118	111.19	110.03	DAY 164	110.86	110.03
DAY 27	111.03	110.03	DAY 73	111.19	110.03	DAY 119	111.19	110.03	DAY 165	110.86	110.03
DAY 28	111.03	110.03	DAY 74	111.19	110.03	DAY 120	111.19	110.03	DAY 166	110.86	110.03
DAY 29	111.03	110.03	DAY 75	111.19	110.03	DAY 121	111.19	110.03	DAY 167	110.86	110.03
DAY 30	111.03	110.03	DAY 76	111.19	110.03	DAY 122	111.19	110.03	DAY 168	110.86	110.03
DAY 31	111.03	110.03	DAY 77	111.19	110.03	DAY 123	111.19	110.03	DAY 169	110.86	110.03
DAY 32	111.03	110.03	DAY 78	111.19	110.03	DAY 124	111.19	110.03	DAY 170	110.86	110.03
DAY 33	111.03	110.03	DAY 79	111.19	110.03	DAY 125	111.19	110.03	DAY 171	110.86	110.03
DAY 34	111.03	110.03	DAY 80	111.19	110.03	DAY 126	111.19	110.03	DAY 172	110.86	110.03
DAY 35	111.03	110.03	DAY 81	111.19	110.03	DAY 127	111.19	110.03	DAY 173	110.86	110.03
DAY 36	111.03	110.03	DAY 82	111.19	110.03	DAY 128	111.19	110.03	DAY 174	110.86	110.03
DAY 37	111.03	110.03	DAY 83	111.19	110.03	DAY 129	111.19	110.03	DAY 175	110.86	110.03
DAY 38	111.03	110.03	DAY 84	111.19	110.03	DAY 130	111.19	110.03	DAY 176	110.86	110.03
DAY 39	111.03	110.03	DAY 85	111.19	110.03	DAY 131	111.19	110.03	DAY 177	110.86	110.03
DAY 40	111.03	110.03	DAY 86	111.19	110.03	DAY 132	111.19	110.03	DAY 178	110.86	110.03
DAY 41	111.03	110.03	DAY 87	111.19	110.03	DAY 133	111.19	110.03	DAY 179	110.86	110.03
DAY 42	111.03	110.03	DAY 88	111.19	110.03	DAY 134	111.19	110.03	DAY 180	110.86	110.03
DAY 43	111.03	110.03	DAY 89	111.19	110.03	DAY 135	111.19	110.03	DAY 181	110.86	110.03
DAY 44	111.03	110.03	DAY 90	111.19	110.03	DAY 136	111.19	110.03	DAY 182	110.86	110.03
DAY 45	111.03	110.03	DAY 91	111.19	110.03	DAY 137	111.19	110.03	DAY 183	110.86	110.03
DAY 46	111.03	110.03	DAY 92	111.19	110.03	DAY 138	111.19	110.03	DAY 184	110.86	110.03

DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER	DAY	UPPER	LOWER
DAY 185	110.86	110.03	DAY 231	110.86	110.03	DAY 277	110.86	110.03	DAY 323	110.86	110.03
DAY 186	110.86	110.03	DAY 232	110.86	110.03	DAY 278	110.86	110.03	DAY 324	110.86	110.03
DAY 187	110.86	110.03	DAY 233	110.86	110.03	DAY 279	110.86	110.03	DAY 325	110.86	110.03
DAY 188	110.86	110.03	DAY 234	110.86	110.03	DAY 280	110.86	110.03	DAY 326	110.86	110.03
DAY 189	110.86	110.03	DAY 235	110.86	110.03	DAY 281	110.86	110.03	DAY 327	110.86	110.03
DAY 190	110.86	110.03	DAY 236	110.86	110.03	DAY 282	110.86	110.03	DAY 328	110.86	110.03
DAY 191	110.86	110.03	DAY 237	110.86	110.03	DAY 283	110.86	110.03	DAY 329	110.86	110.03
DAY 192	110.86	110.03	DAY 238	110.86	110.03	DAY 284	110.86	110.03	DAY 330	110.86	110.03
DAY 193	110.86	110.03	DAY 239	110.86	110.03	DAY 285	110.86	110.03	DAY 331	110.86	110.03
DAY 194	110.86	110.03	DAY 240	110.86	110.03	DAY 286	110.86	110.03	DAY 332	110.86	110.03
DAY 195	110.86	110.03	DAY 241	110.86	110.03	DAY 287	110.86	110.03	DAY 333	110.86	110.03
DAY 196	110.86	110.03	DAY 242	110.86	110.03	DAY 288	110.86	110.03	DAY 334	110.86	110.03
DAY 197	110.86	110.03	DAY 243	110.86	110.03	DAY 289	110.86	110.03	DAY 335	110.86	110.03
DAY 198	110.86	110.03	DAY 244	110.86	110.03	DAY 290	110.86	110.03	DAY 336	110.86	110.03
DAY 199	110.86	110.03	DAY 245	110.86	110.03	DAY 291	110.86	110.03	DAY 337	110.86	110.03
DAY 200	110.86	110.03	DAY 246	110.86	110.03	DAY 292	110.86	110.03	DAY 338	110.86	110.03
DAY 201	110.86	110.03	DAY 247	110.86	110.03	DAY 293	110.86	110.03	DAY 339	110.86	110.03
DAY 202	110.86	110.03	DAY 248	110.86	110.03	DAY 294	110.86	110.03	DAY 340	110.86	110.03
DAY 203	110.86	110.03	DAY 249	110.86	110.03	DAY 295	110.86	110.03	DAY 341	110.86	110.03
DAY 204	110.86	110.03	DAY 250	110.86	110.03	DAY 296	110.86	110.03	DAY 342	110.86	110.03
DAY 205	110.86	110.03	DAY 251	110.86	110.03	DAY 297	110.86	110.03	DAY 343	110.86	110.03
DAY 206	110.86	110.03	DAY 252	110.86	110.03	DAY 298	110.86	110.03	DAY 344	110.86	110.03
DAY 207	110.86	110.03	DAY 253	110.86	110.03	DAY 299	110.86	110.03	DAY 345	110.86	110.03
DAY 208	110.86	110.03	DAY 254	110.86	110.03	DAY 300	110.86	110.03	DAY 346	110.86	110.03
DAY 209	110.86	110.03	DAY 255	110.86	110.03	DAY 301	110.86	110.03	DAY 347	110.86	110.03
DAY 210	110.86	110.03	DAY 256	110.86	110.03	DAY 302	110.86	110.03	DAY 348	110.86	110.03
DAY 211	110.86	110.03	DAY 257	110.86	110.03	DAY 303	110.86	110.03	DAY 349	110.86	110.03
DAY 212	110.86	110.03	DAY 258	110.86	110.03	DAY 304	110.86	110.03	DAY 350	110.86	110.03
DAY 213	110.86	110.03	DAY 259	110.86	110.03	DAY 305	110.86	110.03	DAY 351	110.86	110.03
DAY 214	110.86	110.03	DAY 260	110.86	110.03	DAY 306	110.86	110.03	DAY 352	110.86	110.03
DAY 215	110.86	110.03	DAY 261	110.86	110.03	DAY 307	110.86	110.03	DAY 353	110.86	110.03
DAY 216	110.86	110.03	DAY 262	110.86	110.03	DAY 308	110.86	110.03	DAY 354	110.86	110.03
DAY 217	110.86	110.03	DAY 263	110.86	110.03	DAY 309	110.86	110.03	DAY 355	110.86	110.03
DAY 218	110.86	110.03	DAY 264	110.86	110.03	DAY 310	110.86	110.03	DAY 356	110.86	110.03
DAY 219	110.86	110.03	DAY 265	110.86	110.03	DAY 311	110.86	110.03	DAY 357	110.86	110.03
DAY 220	110.86	110.03	DAY 266	110.86	110.03	DAY 312	110.86	110.03	DAY 358	110.86	110.03
DAY 221	110.86	110.03	DAY 267	110.86	110.03	DAY 313	110.86	110.03	DAY 359	110.86	110.03
DAY 222	110.86	110.03	DAY 268	110.86	110.03	DAY 314	110.86	110.03	DAY 360	110.86	110.03
DAY 223	110.86	110.03	DAY 269	110.86	110.03	DAY 315	110.86	110.03	DAY 361	110.86	110.03
DAY 224	110.86	110.03	DAY 270	110.86	110.03	DAY 316	110.86	110.03	DAY 362	110.86	110.03
DAY 225	110.86	110.03	DAY 271	110.86	110.03	DAY 317	110.86	110.03	DAY 363	110.86	110.03
DAY 226	110.86	110.03	DAY 272	110.86	110.03	DAY 318	110.86	110.03	DAY 364	110.86	110.03
DAY 227	110.86	110.03	DAY 273	110.86	110.03	DAY 319	110.86	110.03	DAY 365	110.86	110.03
DAY 228	110.86	110.03	DAY 274	110.86	110.03	DAY 320	110.86	110.03			
DAY 229	110.86	110.03	DAY 275	110.86	110.03	DAY 321	110.86	110.03			
DAY 230	110.86	110.03	DAY 276	110.86	110.03	DAY 322	110.86	110.03			