# 14 Effectiveness Monitoring Program

The effectiveness monitoring program will determine whether the operational changes arising from implementation of the WMP result in the anticipated ecological and social improvements. Results from these monitoring activities will be utilized in an adaptive management approach to provide continued improvements throughout the river system over time. Sharing of data and maintenance of good communication procedures between plan partners is crucial to the effective and long-term implementation of the plan.

For the Muskoka River Water Management Plan, the operational changes within lakes and river reaches were intended to address/improve the following ecological conditions:

- spring riparian zone habitat for spring spawning fish and amphibians
- sustainable minimum flow at walleye spawning sites
- aquatic habitat in riverine sections during the summer low flow period
- lake trout spawning habitat and over-winter survival of eggs/fry.

The operational changes were also intended to maintain/improve the following social objectives:

- access to and continued enjoyment of lake-based shoreline recreational structures
- higher, sustainable summer low flows in river reaches
- waterpower production.

The following pages detail the programs proposed to verify the anticipated ecological and social improvements, and outline the data sharing and communication between WMP partners as well as other watershed stakeholders. In some cases, methodologies/techniques are presently not available to provide the level of monitoring and statistical confidence required for successful evaluation of water management related changes or improvements. These instances are noted in the appropriate subsection. Section 15 outlines the activities that will be undertaken to investigate/address identified data gaps and science and information needs, so as to provide improved decision-making capability for the subsequent iteration of the plan. Table 14.1, located at the end of the section, provides a summary of monitoring goals and activities, and assigns responsibility for specific programs.

## 14.1 Ecological Objectives Monitoring

### 14.1.1 Spring Riparian Zone Habitat

A goal of the WMP is to maintain high spring water levels for a longer duration that would inundate floodplains and a portion of the riparian zone. The anticipated positive result of this change would be improved access to spawning grounds (i.e., wetlands and flooded shoreline vegetation) for spring spawning fish and amphibian species, recharge of groundwater supplies, and improved riparian zone and lake communities in the long term. Specific programs to assess the effectiveness of the above-noted anticipated changes are as follows:

#### Water Level Monitoring

Water levels are monitored on a daily basis by MNR by means of automatic water level recorders at nine of the larger watershed lakes, and monitored on a less regular basis (whenever personnel are at dams) at other lakes. This water level data will continue to be recorded, and compiled at MNR's Bracebridge and Algonquin Park offices. Summaries of lake level data will be prepared at year 3 after plan implementation, and again after year 8. Post-plan implementation data will be compared to pre-implementation water level data to verify that the anticipated water level changes have occurred.

### 14.1.2 Walleye Spawning Site Flows and Spawning Success

Improved consistency of flow for walleye spawning at South Falls and Moon Falls were goals of the water management planning process. The monitoring program will consist of a flow and temperature monitoring component at South Falls. Uncertainty regarding the effectiveness of the past flow target of 14 $m^3/s$ for the Moon River during the spring spawning period for walleye, at allowing successful production of walleye, has highlighted the need for further collection of information. As a result, data collection and investigations at Moon Falls will occur as described in Section 15, Data Gaps, Science and Information Needs.

#### Flow and Temperature Monitoring

**South Falls -** Hourly flow data will be collected at South Falls GS during the

walleye spawning period as part of the Compliance Monitoring Program (see Section 13 for details). This data set will provide overall flow quantity within the river system and hourly/daily variability. At South Falls, the primary walleye spawning area is located at the base of the bypass channel, and is provided with a minimum flow by means of a block installed within the stop logs leading to this channel. A gauge will be installed within this channel by OPG by summer 2005 to record flows passing through this area. Existing temperature sensors will be utilized to obtain temperature data.

An operational change due to plan implementation is the provision of a minimum flow of 5 $m^3/s$ (on an hourly basis) from the Baysville dam throughout the walleye spawning period (as determined by MNR). A comparative assessment of flow data from South Falls bypass channel, Matthias GS and Baysville dam will be undertaken annually by MNR to decide whether the minimum flow release from Baysville dam during the spawning period is providing the desired result of a consistent flow of 3 $m^3/s$ within the South Falls bypass channel.

**Spawning Habitat and Spawning Activity**

No effectiveness monitoring programs directed at walleye spawning habitat or spawning success investigations will be undertaken at the South Falls location. Spawning habitat in the bypass channel at South Falls has been examined on a number of occasions in the past, with alterations to channel planform undertaken to encourage walleye to utilize areas that will remain watered throughout the spawning and incubation period. These channel alterations have been generally successful, and minimize spawning excursions into unsuitable areas and associated egg mortality. Additional modifications of the spawning channel plan form may be proposed to further reduce the occurrence of spawning in unsuitable areas. No additional investigations of spawning habitat or spawning activity are required provided flows are maintained above the 3 $m^3/s$ level.

As discussed above, further work is planned at Moon Falls to provide additional information concerning site conditions, the relationship between flow and quantity of spawning habitat, and spawning success. These studies are described in Section 15. It is anticipated that from this work, a clearer relationship will be identified between different flow rates and amounts of available wetted walleye spawning habitat. From this work, further

discussions with OPG will occur regarding flow rates for the Moon River. Pending the outcome of these discussions and a potential amendment to flow management for the Moon River, an effectiveness monitoring plan will be developed.

### 14.1.3 Summer Riverine Habitat

The revised operating strategy for many of the watershed lakes is anticipated to provide higher and more uniform flows in river reaches throughout the summer low flow period. This is expected to improve habitat conditions for aquatic and riparian communities during that period. Flows will be monitored at a series of locations throughout the river system as noted below. Based on the outcome of those measurements, and the development of appropriate methodologies to assess habitat improvements in deep water river reaches (see Section 15), habitat may be monitored during the next plan iteration.

#### Flow Monitoring

Presently, river flow in the main branches of the river system is monitored by a series of gauges operated by Water Survey of Canada. These gauges provide information on an hourly basis, and are located as follows:

**North Branch**
- Williamsport on the Big East River
- Below Mary Lake dam

**South Branch**
- Oxtongue River near Dwight
- Below Baysville dam

**Lower Subwatershed**
- Moon River at Hwy 69
- Musquash River at Hwy 69

Information derived from these gauges will be used to monitor flows in larger reaches of the river system.

In addition, flow monitoring will be undertaken within a number of smaller reaches within the river system to determine whether flows arising from these tributaries are as expected. Spot measurements will be taken three times

during July and August at standardized measurement sites established at each of the following locations:

- McCraney Lake dam
- Tasso Lake dam
- Fox Lake dam
- Burnt Island Lake dam
- Tea Lake dam
- Kawagama Lake dam
- Moon dam.

Information will be summarized and compiled in report format. Summaries of flow data will be prepared at year 3 after plan implementation, and again after year 8. Post-plan implementation data will be compared to predicted flow values (ARSP output) to verify that the anticipated flow changes have occurred.

### 14.1.4 Lake Trout Habitat and Spawning Success

Lake trout spawning activity and incubation success within the drawdown zone of Kawagama Lake was monitored during the fall and winter of 2003/2004 to assist with option development for the plan. Those studies confirmed that the current operational strategy was adversely affecting egg survival, and provided the rationale for reduced differential between fall and winter water levels. Subsequently, Kawagama Lake was selected as the "test lake" to evaluate the success of lake trout oriented water management changes (i.e., reduced differential between fall and winter water levels, and associated effects on developing eggs and fry). Lake trout oriented effectiveness monitoring is described in the following section and the initial part of Section 14.1.5.

The fall 2003/2004 lake trout spawning survey will be repeated the first year following plan implementation. The survey would consist of the following activities:

- lake-wide spawning shoal survey to determine the number and location of spawning groups and shoals that are actively utilized (as well as any expansion into new territory)

– an estimate of spawning activity (i.e., number of fish) at each shoal. Determination of egg density and mortality due to fall/winter water level differential at highly used shoals.

Subsequently, the spawning shoal survey and enumeration of fish on actively used shoals would be undertaken every 3 to 4 years to determine whether any changes in spawning shoal usage and distribution patterns are occurring within the lake. A specific goal would be to establish whether lake trout are increasing their usage of other shoals within the lake, and/or are expanding to new sites.

If increased usage of existing shoals or usage of new shoals is confirmed, a determination of egg density and water level differential induced mortality would be undertaken at those shoals once within the 10-yr term of the plan.

### 14.1.5 Fish Community Assessments

Fish community assessments will be undertaken at Kawagama Lake and in Matthias reservoir during the course of the WMP to determine whether the proposed operational changes provide the anticipated positive effect on their fish communities. Brook trout populations will also be assessed at two select locations as noted below to determine whether the proposed water management changes have a positive effect on their populations.

#### Kawagama Lake

The positive outcome arising from a reduced differential between fall and winter water levels is an increased number of viable lake trout eggs. These eggs have the potential to develop into adult fish. A greater number of viable eggs should ultimately result in an increase in the Kawagama Lake lake trout population.

Kawagama Lake will be monitored to determine whether the anticipated changes resulting from implementation of the WMP result in the predicted (i.e., positive) change to the lake's lake trout populations. Presently, the lake trout population of Kawagama Lake has been monitored on a semi-regular basis by MNR as part of their ongoing data collection activities. These programs will continue, and will be expanded as follows:

– Previous surveys of lake trout populations were undertaken using the Spring Littoral Index Netting (SLIN) approach. Recently, the Summer Profundal Index Netting (SPIN) approach has been found to provide a better estimate of population characteristics. SPIN surveys (using approximately 50 net sets per survey) will be undertaken annually during the term of the plan to provide a measure of lake trout population (and associated changes) within the lake. Yearly sampling is required to provide statistically defensible results.

– A creel survey of lake trout populations in Kawagama Lake was undertaken in 2001, and will be repeated again 5 years after plan implementation. In the interim, a reduced version of the creel survey will be undertaken annually during the 10-yr term of the plan to provide a consistent record of harvest/ exploitation within the lake. This reduced program (6 to 7 days of sampling effort) will be undertaken between mid-February and mid-March annually, and will serve to provide a long-term data set to determine the effects of harvest on the population.

### Matthias Reservoir

Investigations of aquatic habitat and fish community characteristics were undertaken during the preparation of the WMP, and a preliminary examination of spawning habitat in the upper reaches of the reservoir was undertaken by MNR during the spring of 2004. Operational changes proposed during implementation of the WMP should lead to improved habitat conditions for spring/early summer spawning species (higher spring levels, more stable early summer levels), and subsequently, enhanced populations of northern pike, yellow perch and centrarchids. The following programs are proposed:

– Undertake a more detailed assessment of spawning activity in spring/early summer 2006, targeting northern pike, yellow perch, smallmouth bass, rock bass and pumpkinseed. Repeat the survey in 2008 and 2013.

– Repeat the aquatic habitat/fish community assessment undertaken in summer 2003 (Acres, 2003b) in 2008 and 2013.

### Brook Trout Populations

Improvements to brook trout populations are expected in the upper portions of the North Branch as a result of proposed changes to McCraney Lake and Camp/Tasso Lake dam operations. MNR's Ontario Stream Assessment

Protocol (OSAP) will be utilized as the sampling methodology to assess fish community health in the affected areas. The OSAP approach is being adopted province-wide as the standard stream monitoring techniques, and contains a series of modules that can be selectively applied to assess specific environmental components (i.e., fish community module, benthic community module, etc). The methodology provides a standardized, repeatable technique with which to monitor the potential for long-term change in brook trout populations. The proposed locations and sampling regime are as follows:

- Big East River below McCraney Lake dam – summer 2005, 2010 and 2014
- Tasso Creek below Tasso Lake dam – summer 2005, 2010 and 2014.

The 2005 monitoring will be undertaken to establish baseline data.

## 14.2 Social Objectives Monitoring

### 14.2.1 Lake-Based Recreation Monitoring

The effectiveness monitoring program for this component of the plan would compare post-implementation lake levels with the predictions of change noted in Tables 6.3 and 6.4 of the Muskoka River Water Management Plan Options Report. Parameters to be compared would include:

- maximum daily spring lake level
- number of high water exceedances
- mean daily level during the summer recreation season
- the 80$^{th}$ percentile daily water level range during the summer recreation season
- the minimum and maximum distances to infrastructure during the summer recreation season.

Water level information derived from existing MNR water level monitoring stations on the Huntsville lakes, Mary Lake, Canoe, Smoke and Tea lakes, Kawagama Lake, Lake of Bays, Lakes Joseph and Rosseau, and Lake Muskoka will be utilized to develop the data base required for this analysis. The analysis will be undertaken twice during the term of the WMP, the first time in 2009, using data from 2006 to 2008; and the second time in 2014, using data from 2009 to 2013.

### 14.2.2 River Flow Suitability Monitoring

The effectiveness monitoring program for this component of the plan would compare post-implementation river flows with the predictions of change noted in Tables 6.3, 6.4 and 6.5 of the Options Report. Parameters to be compared would include:

- spring maximum daily flow
- number of exceedances of MNR's Dam Operations Manual flow limits during the spring season
- minimum daily flows (7-day low flow) during the summer recreation season
- number of flow fluctuations during the summer recreation season
- median weekly flows during the summer and winter
- minimum weekly flow ($10^{th}$ percentile) during summer and winter
- flow available for power generation on an annual basis.

There are currently six flow gauges within the watershed that can be utilized to provide the data for this monitoring program. Information derived from this program will be also be used to verify that the new operational plan is meeting anticipated objectives. This analyses will be undertaken once (in 2010) during the plan.

### 14.2.3 Comments Related to Facility Operations

Waterpower facility operators and MNR will maintain a record of public comments and/or concerns related to the operation of their facilities/structures and their responses (if any) to those comments. This information will be summarized and provided for discussion/action at the annual MNR/waterpower review meeting.

## 14.3 Monitoring of Waterpower Production

Industry will be responsible for monitoring the effectiveness of the WMP in optimizing waterpower production and associated revenues. Industry will undertake a comparative analysis of flow available for power production in their monitoring approach.

## 14.4 Data Sharing and Communication

Reporting on the results of the effectiveness monitoring program will occur through submission of the Implementation Report as outlined in Section 16.3.

A formal data sharing agreement will be established between MNR and the four waterpower producers to facilitate sharing of data collected during the WMP. As part of that process, regular meetings will be held throughout the year to discuss operational matters and improve efficiencies. An annual meeting will be scheduled in early February to review the previous year's operations, identify operational strategies that worked well or caused problems, and develop a proactive, adaptive management style approach to communication, issue identification and resolution.

In addition, working arrangements/stewardship agreements will be actively pursued with other watershed stakeholders and members of the research community to assist with monitoring, data analysis and the filling of data gaps. Potential partners include the following organizations/groups:

- Fox Lake Association
- Fairy and Peninsula Lakes Associations
- Kawagama Lake Cottager's Association
- Lake of Bays Association
- Muskoka Lakes Association
- Moon River Property Owners Association
- Muskoka Watershed Council
- Algonquin Ecowatch
- District Municipality of Muskoka
- Trent University (Dr. Dave Evans).

**Table 14.1**
**Effectiveness Monitoring Plan Summary**

| No. | Objective | Actions | Who | How | Section |
|---|---|---|---|---|---|
| **Ecological** | | | | | |
| 1 | Spring Riparian Zone Habitat – achieve high spring water levels for a longer duration that would inundate floodplains and a portion of the riparian zone | Water Level Monitoring | MNR | Automatic water level recording on a daily basis on nine lakes; recording on a less regular basis on other lakes; summary of lake level data will be prepared at year 3 after plan implementation and after year 8 | 14.1.1 |
| 2 | Walleye Spawning Site Flows and Spawning Success – improved consistency of flow for walleye spawning at South Falls and Moon Falls | Flow and Temperature Monitoring | OPG | Hourly flow data collected at South Falls GS during the walleye spawning period | 14.1.2 |
| 3 | Summer Riverine Habitat – higher and more uniform flows in river reaches throughout the summer low flow period | Flow Monitoring | MNR using hourly data from gauges operated by the Water Survey of Canada | Information derived from these gauges will be used to monitor flows in larger reaches of the river system. | 14.1.3 |
| | | | MNR/OPG (Moon Dam only) | Spot measurement will be taken three times during July and August at standardized measurement sites at<br>- McCraney Lake dam<br>- Tasso Lake dam<br>- Fox Lake dam<br>- Burnt Island Lake dam<br>- Tea Lake dam<br>- Kawagama Lake dam<br>- Moon Dam | 14.1.3 |

**Table 14.1**
**Effectiveness Monitoring Plan Summary**

| No. | Objective | Actions | Who | How | Section |
|---|---|---|---|---|---|
| 4 | Lake Trout Habitat and Spawning Success – Kawagama Lake | Lake trout spawning survey – to determine if lake trout are increasing their usage of other shoals within the lake and/or are expanding to new sites | MNR | Lake-wide spawning shoal survey to determine the number and location of spawning groups and shoals that are actively utilized (as well as expansion into new territory) – once during the fall after plan implementation and every 3 to 4 years following | 14.1.4 |
| | | | MNR | An estimate of spawning activity (i.e., number of fish at each shoal. Determination of egg density and mortality due to fall/winter water level differential at highly used shoals – once during the fall after plan implementation and every 3 to 4 years following | 14.1.4 |
| 5 | Fish Community Access | Kawagama Lake – positive change in lake trout population | MNR | Annual Summer Profundal Index Netting (SPIN) and Annual Reduced Creel survey (6 to 7 days of sampling effort) between mid-February to mid-March starting in 2007. Creel survey every 5 years after plan implementation | 14.1.5 |
| | | Matthias Reservoir – improved habitat conditions for spring/early summer spawning species (higher spring levels, more stable early summer levels) | OPGC/DFO | Spring/early summer spawning activity assess-ment in 2006, 2008 and 2013. Aquatic habitat/fish community | 14.1.5 |

**Table 14.1**
**Effectiveness Monitoring Plan Summary**

| No. | Objective | Actions | Who | How | Section |
|---|---|---|---|---|---|
| | | | | assessment in summer 2008 and 2013. | |
| | | Brook Trout Populations - increased brook trout populations in upper portions of the North Branch | MNR | Ontario Stream Assessment Protocol (OSAP) will be used to monitor the potential long-term change in brook trout populations at<br>- Big East River below McCraney Lake dam – summer 2006, 2010 and 2014<br>- Tasso Creek below Tasso Lake dam – summer 2006, 2010 and 2014.<br>Note: 2005 monitoring will be undertaken to establish baseline data. | 14.1.5 |
| **Social** | | | | | |
| 1 | Lake-based Recreation Monitoring | Changes in lake levels | MNR | Comparison of post-implementation lake levels with the predictions of change. Parameters include<br>- maximum daily spring lake level<br>- number of high water exceedances<br>- Mean daily level during the summer recreation season<br>- the 80$^{th}$ percentile daily water level range during the summer recreation season<br>- the minimum and maximum distances to infrastructure | 14.2.1 |

**Table 14.1**
**Effectiveness Monitoring Plan Summary**

| No. | Objective | Actions | Who | How | Section |
|---|---|---|---|---|---|
| | | | | during the summer recreational season | |
| 2 | River flow suitability monitoring | Changes in river flows | MNR | Comparison of post-implementation river flows (from stream flow gauge information) with predictions for change. Analysis undertaken in 2010 | 14.2.2 |
| 3 | Public comments related to operations | Comments/concerns and responses | MNR and industry | Comments and responses will be recorded and summarized and provided for discussion/action at annual MNR/industry review meeting | 14.2.3 |
| **Other** | | | | | |
| 4 | Waterpower production | Effectiveness of the WMP in optimizing waterpower production and associated revenues | Industry | Industry will undertake a comparative analysis of flow available for power production | 14.3 |
| 5 | Data Sharing and Communication | Data sharing agreement between MNR and Industry | MNR, DFO and industry | Agreement will be established to facilitate sharing of data collected during the WMP | 14.4 |
| | | Operations meetings | MNR and industry | Regular meetings will be scheduled throughout the year to discuss operational matters and improve efficiencies. Annual meeting will be scheduled in early February | 14.4 |

## 14.5 Monitoring Program for North Bala GS

SREL is responsible for implementing the following effectiveness monitoring program to assess operational impacts of the North Bala GS and evaluate effectiveness of implemented mitigation measures:

- Ongoing liaison between North Bala GS operator and OPG Ragged Rapids GS operator to ensure no adverse effects on downstream generators.
- Monitoring of the effectiveness of attempts to maintain consistent spawning flows under changing watershed conditions, as watershed conditions permit, in conjunction with minimum flow needs on the Moon River during Walleye and Lake Sturgeon spawning activity and reproduction periods.
- Monitoring of flow distribution will be conducted to assess effectiveness in meeting flow objectives (e.g., scenic flows, fish spawning/incubation).
- Monitoring of Lake Muskoka water levels will be conducted to assess the effectiveness of flood mitigation strategies.
- Monitoring to assess the effectiveness of on/off cycling mode of operation.
- Monitoring to ensure downstream OPG generating station operations are not adversely affected.
- Monitoring to ensure downstream Go Home Lake Dam operations are not adversely affected.

In addition to the above-noted monitoring requirements, dialogue will be ongoing between MNRF, OPG and SREL according to the established Communication Procedure, in order to coordinate flow releases upstream of Lake Muskoka by MNRF and downstream from Lake Muskoka by SREL, to ensure downstream OPG generating station operations and Go Home Lake Dam operations are not adversely affected.