9 EVALUATION OF ALTERNATIVE WATER MANAGEMENT STRATEGIES AND SELECTION OF PRELIMINARY RECOMMENDED CONTROL OPERATING PLAN

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9.1 Overview

The environmental, social and economic indicators and criteria discussed in Section 7.2 were used to evaluate the alternative water management strategies that were identified in Section 8. Using the results obtained from the ARSP computer model, spreadsheets were developed for each alternative strategy. The spreadsheets were used to quantify the resulting changes in lake water levels and river reach flows for the key upstream and downstream locations associated with each of the Magnetawan River dams. Results were tabulated for 11 reservoir and 16 river reach locations along the Magnetawan River system. The spreadsheets corresponding to each alternative strategy are presented in Tables 9.3 to 9.6, located at the end of the section. Each alternative water management strategy was compared to the base case to determine if the result was positive or negative. If the results of a strategy were similar or equal to the base case, it was considered neutral. For each alternative strategy, the total positive ratings were then added to the total negative ratings to produce an overall score. The alternatives were then compared and a preliminary recommended water control operating plan was selected.

9.2 Evaluation Methodology

9.2.1 Ecological Evaluation Methodology

The ecological criteria used for the evaluation of alternative water control strategies were applied to the aquatic and riparian habitat attribute and related to minimum weekly reservoir levels throughout the year and minimum annual flow through the river reaches. The spring minimum reservoir levels for each alternative were related to the spring minimum reservoir levels of the base case and summer levels to summer levels for the purposes of a consistent comparison. The minimum weekly river reach flows were compared using a 7-week moving average to smooth aberrant values while preserving real effects. An increase in the minimum reservoir level of >0.05 m was considered a positive effect and a decrease of the same amount was considered a negative effect. Similarly, an increase in the minimum river flow of >10% was considered a positive effect and a decrease of the same amount was considered a negative effect.

9.2.2 Social Evaluation Methodology

Three indicators, and corresponding criteria for their measurement, were used for the social evaluation of alternative water management strategies. The indicators that were measured by the criteria are flood management capability, tourism and recreational uses and the small hydro potential.

The flood management attribute was evaluated using the maximum daily reservoir levels and maximum daily river reach flows obtained from the 83 years of record simulated by the ARSP model. An increase in maximum daily reservoir level of >0.05 m over the base case was considered a negative effect and a decrease of the same amount was considered a positive effect. Similarly, an increase in maximum daily flow of >10% was considered a negative effect and a decrease of the same amount was considered a positive effect. The tourism/recreation attribute was evaluated based on the criteria that measured changes in average summer reservoir levels, average summer river reach flows and minimum weekly river reach flows through the period of May 15 to October 15. The 7-week moving average was used for the latter criterion to smooth aberrant values while preserving real effects. An increase in minimum reservoir level of >0.05 m over the base case but <0.15 m during the summer period was considered a positive effect and a decrease of >0.05 m or an increase of ≥0.15 m was considered a negative effect. Similarly, an increase in minimum flow of >10% over the base case for average summer river reach flows and >10% over the base case for average summer minimum weekly river reach flows was considered a positive effect. Decreases of the same amount were considered negative effects. The third attribute, small hydro potential, was measured based on an increase or decrease in average annual power at the existing Burk's Falls small hydro facility and at the two potential sites for power generation at Magnetawan and Knoepfli dams. An increase in average annual power of >1% was considered a positive effect and a decrease of the same amount was considered a negative effect.

9.2.3 Economic Evaluation Methodology

The economic attribute was evaluated using an estimation of the average annual operating cost for the control dams within the system. Average annual operating costs were calculated using cost estimates obtained from MNR, which were averaged to obtain a cost per visit per control dam. Using the ARSP model results, the average number of logging visits to each dam per year was obtained for each alternative. The two quantities were then multiplied together and summed to provide an estimate of the total annual operating costs. An increase in average annual operational costs of >5% over the base was considered a negative effect and decrease of >5% was considered a negative effect.

9.3 Evaluation Results

The evaluation results for the four alternative water control strategies are presented in Tables 9.3 to 9.6. The final result was based on the difference between the number of positive and negative results over the total of the reservoirs and river reaches when compared with the base case. A discussion of the analysis of each alternative is presented in the following section.

9.3.1 Alternative 1 – Maintain Minimum Flow of 5 m^3/s Downstream of Ahmic Lake by Staying Within Existing Normal Operating Zone

This strategy involves maintaining a minimum flow of 5 m^3/s below Ahmic Lake 95% of the time while allowing lake levels to fluctuate within the full range of the existing NOZ. The results of this option, compared to the base case are summarized in Table 9.3.

Natural Environment

Aquatic and Riparian Habitat – No noticeable differences in average annual minimum reservoir levels were observed for any of the lakes when the results for Alternative 1 were compared against the base case for the natural environment attribute. In other words, on average, the minimum reservoir levels that occur on each of the lakes would remain approximately the same resulting in no significant changes to aquatic or riparian habitat. In terms of the river reaches, analysis of average minimum flows throughout the year predicted slight increases in minimum flow at different locations through the system. However, only river reaches downstream of Bernard Lake and Ahmic Lake exhibited minimum flow increases that were greater than the threshold of 10%, which constitutes a positive effect. The results showed no change in minimum flow downstream of either off-line dams such as Gooseneck and Kashegaba Lakes where flow increases would not extend, or on the South Magnetawan River which receives only a small percentage of flow from the main branch of the river. Overall score for the natural environment attribute, which has been defined as the sum of the positives and negatives, is +2 for this attribute. This alternative is ranked last for the natural environment attribute.

Social

Flood Management – Changes to the maximum daily reservoir levels resulting from manipulating flows for Alternative 1 were insignificant for all reaches throughout the system when compared with the base case. The modeling results for maximum daily river reach flows also predicted no substantial changes through the system with this alternative. Some slight increases and decreases are predicted but none of sufficient magnitude to be considered positive or negative effects. Thus it is unlikely that Alternative 1 will affect flood management capability in the watershed. Overall score for the flood management attribute was 0 based on a score of 0 for the maximum reservoir level and a score of 0 for river reach flow. The overall score of 0 for this attribute was the same as Alternative 2 and the second highest.

Tourism/Recreation – The evaluation results showed an increase in average summer lake levels at Perry Lake and at Doe Lake. These two locations show an increase of 0.15 m and 0.37 m, respectively. Given that the magnitude of the increase is at least 0.15 m, this predicted increase is considered a negative effect for both of these waterbodies. At all other reservoirs through the system, changes of <0.05 m are predicted and the effects are, therefore, considered neutral. Some slight increases and decreases are predicted for average summer river reach flows, but none of sufficient magnitude to be considered positive or negative effects. The model predicted slight increases in minimum weekly flows throughout the summer period. However, none of the flow increases were of sufficient magnitude to indicate a positive effect, with the exception of the river reach downstream of Bernard Lake, which exhibited an increase in flow of 14.7%. Flow changes were predicted to be zero for reaches downstream of off-line dams such as Gooseneck and Kashegaba Lakes. Similar results were obtained for the reaches located on the South Magnetawan River, which receives only a small percentage of flow from the main branch of the river. Overall score was –1, ranking it fourth of the four alternatives for the tourism/recreation attribute.

Small Hydro Potential – Changes in average annual power generation resulting from Alternative 1 showed no substantial effect for the existing Burk's Falls hydro facility or the two potential sites at Magnetawan and Knoepfli dams. Change in average annual power (or potential) was ≤1% for all locations. Overall score was 0 for this attribute, ranking it last of the three alternatives.

Economic

Operational Cost – No significant changes in average annual operational cost was apparent for Alternative 1. Overall score was 0 for this attribute, making it the same as all other alternatives.

9.3.2 Alternative 2 – Maintain Minimum Flows of 7 m^3/s Downstream of Ahmic Lake by Extending into the Lower Operating Zone

This strategy involves maintaining a minimum flow of 7 m^3/s below Ahmic Lake 95% of the time. Lake levels will be allowed to fluctuate within the full range of the existing NOZ and down into the LOZ to maintain the flow. The results of this option, compared to the base case are summarized in Table 9.4.

Natural Environment

Aquatic and Riparian Habitat – No noticeable differences in average annual minimum weekly reservoir levels were observed for most of the lakes when the results for Alternative 2 were compared against the base case for the natural environment attribute. A positive effect associated with an increase of 0.07 m was predicted for Wahwashkesh Lake. This was attributed to the increased flow from upstream. Results for the minimum weekly river reach flows predicted positive effects downstream of Bernard Lake, Magnetawan, Feighens and Knoepfli and Wahwashkesh Lake dams as well as the Magnetawan River locations downstream of Wahwashkesh Lake. These flow increases are the result of achieving the objective of increased flow to areas downstream of Ahmic Lake and are considered a positive effect. Although minimum river flows increased for locations downstream of Ahmic Lake, there is no quantifiable flow increase to the South Magnetawan River. This is because the flow to the south branch is dependent on flow diversion from the main river, which occurs only during high flow periods. Since the noted increases to minimum flow are below the flow threshold at which diversion occurs, no extra flow is available to spill into the South Magnetawan River. Overall score was +8, tying this alternative for first for the natural environment attribute with Alternative 3.

Social

Flood Management – Changes to maximum daily reservoir levels resulting from manipulating flows for Alternative 2 are predicted to be insignificant for all reaches throughout the system when compared with the base case. The modeling results for this alternative also predicted no substantial changes to maximum daily river reach flows through the system. Some slight increases and decreases are predicted but none of sufficient magnitude to be considered positive or negative effects. Thus it is unlikely that Alternative 2 will affect flood management capability in the watershed. Overall score for this attribute was 0 ranking it the same as Alternative 1 and the second highest score.

Tourism/Recreation – Modeling results for this attribute for Alternative 2 predicted average summer reservoir levels to remain largely unchanged with the exception of Perry Lake and Doe Lake. The predicted increase on Perry Lake is 0.11 m and is considered a positive effect, whereas the larger rise in water level of 0.27 m on Doe Lake is of sufficient magnitude to be considered a negative effect. Average summer river reach flows were predicted to remain largely unchanged with the exception of the Stirling Creek reach downstream of the Bernard Lake dam. This reach exhibited an increase in average summer flow of 10.2%, which is considered to a positive effect. Average weekly minimum flows over the summer period were predicted to increase at river reaches downstream of Bernard Lake, Burk's Falls, Magnetawan, Feighens and Knoepfli and Wahwashkesh dams as well as the Magnetawan River locations downstream of Wahwashkesh Lake. The model results predicted no substantial change at the remaining locations. The increases to average weekly minimum flow are indicative of achieving the objective of an increase in minimum flow to areas downstream of Ahmic Lake and are considered a positive effect. The model predicted no flow increases to the South Magnetawan River for this alternative and in fact, slight decreases were evident, but they were not significant. This is because the flow to the south branch is dependent on flow diversion from the main river, which occurs only during high flow periods. Since the noted increases to minimum flow are below the flow threshold at which diversion occurs, no extra flow is available to spill into the South Magnetawan River. Overall score was +9, ranking this alternative first for the tourism/recreation attribute.

Small Hydro Potential – Modeling results for Alternative 2 predict slight increases in average annual power generation the existing small hydro facility at Burk's Falls and the two potential sites at Magnetawan and Knoepfli dams. The two potential hydro sites showed increases of >1% in average power generation, which is considered a positive effect. Overall score for this attribute was +2 ranking this alternative second.

Economic

Operational Cost – No significant changes in average annual operational cost was apparent for Alternative 2. Overall score was 0 for this attribute, making it the same as all other alternatives.

9.3.3 Alternative 3 – Maintain Minimum Flows of 7 m^3/s Downstream of Ahmic Lake by Operating 150 mm Above the Normal Operating NOZ

This strategy involves maintaining a minimum flow of 7 m^3/s below Ahmic Lake 95% of the time. The lakes will be operated 150 mm above the NOZ and levels will be allowed to fluctuate only within the full range of the existing NOZ in order to maintain the desired flow. The results of this option, compared to the base case are summarized in Table 9.5.

Natural Environment
Aquatic and Riparian Habitat – Modeling results for Alternative 3 predicted no substantial increase in average annual minimum weekly reservoir levels through the year with the exception of Wahwashkesh Lake. A positive effect associated with an increase of 0.07 m was predicted for this lake. This was attributed to the increased flow from upstream. Modeling results for river reach flows predicted increases of >10% at Bernard Lake, Magnetawan, Feighens and Knoepfli and Wahwashkesh Lake dams as well as Magnetawan River locations downstream of Wahwashkesh Lake and at the watershed outlet. These flow increases are the result of achieving the objective of an increase in minimum flow to areas downstream of Ahmic Lake and are considered a positive effect. The model results did not predict flow increases to the South Magnetawan River for this alternative. Flow to this branch of the river is dependent on diversion during high flow periods; however when the flows are below the diversion threshold, no extra flow is available to spill into the south branch. Overall score for this attribute was +8 ranking it first with Alternative 2 for the natural environment attribute.

Social
Flood Management – Changes to maximum daily reservoir levels resulting from manipulating flows for Alternative 3 are predicted to be insignificant for most reaches throughout the system when compared with the base case. Maximum reservoir levels on Bernard Lake and on the 4.5 km Magnetawan River reach upstream of the Burk's Falls dam were predicted to increase by 0.14 m and 0.20 m, respectively, both of which are considered negative effects. The modeling results for maximum daily river reach flows predicted a decrease in flow of 15.6% downstream of Pevensey dam, which is considered a positive effect and an increase in flow of 18.1% downstream of Bernard Lake dam, which is considered a negative effect. Some slight increases and decreases are predicted through other reaches but none of sufficient magnitude to be considered a positive or negative effect. These increases in level and flow are unlikely to affect flood management capability in the watershed, but would warrant further review for

confirmation if this alternative was selected as the preferred. Overall score for this attribute was –2 ranking it the lower of all of the alternatives.

Tourism/Recreation – Modeling results for this attribute predicted increases in average summer reservoir levels in Perry, Doe, Bernard, Cecebe and Ahmic Lakes. Predicted increases are estimated to range from 0.09 to 0.46 m. The predicted 0.09 m increase for Ahmic Lake is considered to be a positive effect, whereas increases at Perry, Doe and Bernard Lakes as well as at Lake Cecebe are considered to be negative effects as the magnitude of predicted change is ≥0.15 m. A slight increase of 0.04 m is predicted for Loon Lake, but is not of sufficient magnitude to be considered a positive effect. These increases are a direct result of increased minimum flows from upstream and the Case 3 operational strategy, which proposes a 150 mm raising of the NOZ. Average summer river reach flows are predicted to remain about the same as the base case for all locations except for downstream of Bernard Lake, which was predicted to experience an increase in flow of 16.2%. Average minimum weekly river reach flows are expected to increase by >10% downstream of Bernard Lake, Magnetawan, Feighens and Knoepfli and Wahwashkesh Lake dams as well as the Magnetawan River locations downstream of Wahwashkesh Lake. The increases to average weekly minimum flow are indicative of achieving the objective of an increase in minimum flow to areas downstream of Ahmic Lake and are considered a positive effect. As with Alternative 2, there is no quantifiable flow increase to the South Magnetawan River since the noted increases to minimum flow are below the flow threshold at which diversion occurs. Overall score +5, ranking this alternative second for the tourism/recreation attribute.

Small Hydro Potential – Changes in average annual power generation resulting from Alternative 3 showed a positive effect for both the existing Burk's Falls small hydro facility and the two potential sites at Magnetawan and Knoepfli dams. Change in average annual power, or power potential was >1% for all locations. Overall score for this attribute was +3 ranking it first of the three alternatives.

Economic

Operational Cost – No significant changes in average annual operational cost was apparent for Alternative 3. Overall score was 0 for this attribute, making it the same as all other alternatives.

9.3.4 Alternative 4 - Maintain Minimum Flows of 6 m^3/s Downstream of Ahmic Lake by Modified Case 1, 2 or 3 on Controlled Lakes

This strategy involves maintaining a minimum flow of 6 m^3/s below Ahmic Lake 95% of the time. The lakes will be operated based on the identified ranges associated with either Case 1, 2 or 3 at a particular control dam, which were modified to reflect the limitations and opportunities identified by the previous modeling results (Section 8). Each of the lakes will be operated according to the modified normal operating range and levels will be allowed to fluctuate within the full range of the modified normal operating zone in order to maintain the desired flow. The results of this option, compared to the base case are summarized in Table 9.6.

Natural Environment
Aquatic and Riparian Habitat – Modeling results for Alternative 4 predicted no substantial changes in minimum weekly reservoir levels through the year with the exception of Bernard Lake. A decrease in the average yearly minimum water level of 0.10 m was predicted for this lake, which was considered a negative effect. This was a result of drawing down the spring IRL 0.10 m Bernard Lake during the spring freshet to reduce maximum flood levels on the lake. Modeling results for the minimum weekly river reach flows predicted increases of >10% at Pevensey, Watts, Magnetawan, Feighens and Knoepfli and Wahwashkesh Lake dams as well as the Magnetawan River downstream of Wahwashkesh Lake, downstream of the flow split and at the watershed outlet. Overall score for this attribute was +8 ranking it second behind Alternatives 2 and 3.

Social
Flood Management – Changes to maximum daily reservoir levels resulting from manipulating flows for Alternative 4 are predicted to be insignificant for most reaches throughout the system when compared with the base case. Maximum daily reservoir levels on Bernard Lake and on the 4.5 km Magnetawan River reach upstream of the Burk's Falls dam were predicted to decrease by 0.15 m and 0.20 m, respectively, both of which are considered positive effects. The modeling results for maximum daily river reach flows predicted decreases in flow of 38.8% downstream of Pevensey dam and 12.2% downstream of Bernard Lake dam, both of which are considered positive effects. An increase in maximum daily flow of 10.3% for the river reach downstream of Ayres dam is also predicted, which is considered a negative effect. Some slight increases and decreases are predicted through other reaches but none of sufficient magnitude to be considered a positive or negative effect. These changes in level and flow are unlikely to affect flood

management capability in the watershed. Overall score for this attribute was +3, ranking it the highest of all of the alternatives.

Tourism/Recreation – Modeling results for this attribute predicted increases in average summer reservoir levels in Perry, Doe, Cecebe and Ahmic Lakes. Predicted increases are estimated to be 0.07-0.20 m. The predicted increase for Perry, Cecebe and Ahmic Lakes are approximately 0.08 m and are considered to be positive effects. The increase at Doe Lake is considered to be a negative effect as the magnitude of predicted change is ≥ 0.05 m. Slight increases are predicted for several other reservoirs, but are not of sufficient magnitude to be considered a negative effect. Average summer river reach flows are predicted to remain about the same as the base case for all locations except in Stirling Creek downstream of Bernard Lake, which was predicted to experience an increase in summer flow of 10.8%. The average summer minimum weekly flows are expected to increase by >10% at locations downstream of Pevensey, Watts, Bernard Lake, Feighens and Knoepfli and Wahwashkesh Lake dams. In addition, increases were predicted at Magnetawan River locations downstream of Wahwashkesh Lake. The increases to average summer weekly minimum flow are indicative of achieving the objective of an increase in minimum flow to areas downstream of Ahmic Lake and are considered a positive effect. As with all other alternatives, there is no quantifiable flow increase to the South Magnetawan River since the noted increases to minimum flow are below the flow threshold at which diversion occurs. Overall score was +11, ranking this alternative first for the tourism/recreation attribute.

Small Hydro Potential – Changes in average annual power generation resulting from Alternative 1 showed a positive effect for the existing small hydro facility at Burk's Falls and the potential site at Knoepfli dam. Change in average annual power, or power potential was >1% for these locations. A decrease in small hydro potential was predicted for the potential site at Magnetawan dam. Overall score for this attribute was +2 ranking it second and the same as Alternative 2.

Economic

Operational Cost – No significant changes in average annual operational cost was apparent for Alternative 4. Overall score was 0 for this attribute, making it the same as all other alternatives.

9.4 Environmental Effects Summary of Alternative Water Control Strategies

Table 9.1 provides a summary of the evaluation results for the four alternative water control strategies, which lists the positive and negative effects for each alternative. Based on the results, Alternative 1 is predicted to have the least number of environmental attributes affected, either positively or negatively. For Alternative 1, the number of negatively affected attributes is just exceeded by the number of positively affected attributes. Alternatives 2, 3 and 4 effect more environmental attributes and to a greater degree compared to Alternative 1, but overall, the number of positively affected attributes is much greater than the number of negatively affected attributes.

For all alternatives, any effects to aquatic and riparian habitats will likely be positive owing to the minimum weekly flow increases predicted for downstream of many of the dams. In particular, for Alternatives 2, 3 and 4, the positive effects associated with minimum flow increases are anticipated to extend to the lower reaches of the Magnetawan River to its outlet. Potentially negative effects on aquatic and riparian habitats associated with decreased average annual minimum reservoir levels are avoided for all alternatives.

With the exception of Alternative 3, any effects to flood management capability through the system are expected to either remain the same as with Alternatives 1 and 2, or to be positive as with Alternative 4. Positive effects are attributed to decreases to the maximum daily water level at Bernard Lake and Burk’s Falls, and/or decreases to maximum daily flows downstream of Pevensey and Bernard Lake dams. For Alternative 3, negative effects to flood management capability are associated with increases to maximum daily reservoir levels and/or flows at Bernard Lake and Burk’s Falls dams.

With the exception of some negative water level effects on individual lakes, any effects to tourism/recreational uses in terms of changes to minimum flows along the river reaches are expected to either remain the same or be positive for all alternatives.

All alternatives exhibit negative effects with predicted water level increases of ≥ 0.15 m on Doe Lake. In addition, Alternative 1 shows an increase on Perry Lake, and Alternative 3 has increases on Perry, Bernard and Cecebe Lakes of this magnitude or greater. Alternatives 2, 3 and 4 showed increases in average summer reservoir levels at Perry Lake; Ahmic Lake; and Perry Cecebe and Ahmic Lakes, respectively of >0.05 m but <0.15 m. **Based on the defined criteria ranges, these increase have been deemed as positive recreational benefits. However, these results would be subject to confirmation since, even minor lake level increases of ± 0.10 m could proved to be**

unsatisfactory for stakeholders on these lakes due to potential impacts on shorelines and fixed structures such as docks and boathouses.

With the exception of Alternative 1, any effects to the small hydro potential in terms of changes to average annual power generation are expected to either remain the same or be positive for all alternatives.

In terms of operational costs, there was no significant difference among the four alternatives relative to the Base Case.

Some of the entries in Table 9.1 in the 'Negative Effects' column refer to objectives that have not been met with a given alternative. An increase in flow to the South Magnetawan River was one of the primary issues pertaining to the mid-lower and lower reaches. Improvements to the minimum summer flow were not predicted with the available flows from upstream areas for any of the alternatives. The morphology of the river at the flow split and the timing of flows are likely the reasons why this issue cannot be addressed. There was a need to consider this aspect in the table in order to provide a complete summary evaluation. This latter point is not reflected in the final score.

Table 9.1
Summary Evaluation Table – Comparison of Alternative Water Control Strategies to Base Case

Case	Positive Effect	Negative Effect
1	• No substantial change in minimum weekly reservoir levels throughout the year therefore no impacts to aquatic habitat. • Increase in average annual minimum and average summer river reach flow downstream of Bernard Lake and Ahmic Lake dams of >10% which may result in minor improvements to aquatic habitats downstream of dams. • No significant increases to maximum daily flood levels or river flows, thus existing flood management capability is maintained.	• No increase in flows or levels in the South Magnetawan River, thus no improvements to water access from South Magnetawan to Harris Lake, stagnant water conditions or recreational use in these lower reaches. • **Increase in average summer reservoir levels of ≥0.15 m at Perry and Doe Lakes. This may be unsatisfactory for stakeholders on these lakes and associated river reaches due to impacts on shorelines and fixed structures such as docks and boathouses.**
2	• No substantial change in minimum weekly water levels throughout the year with the exception of >0.05 m increase at Wahwashkesh Lake which may improve aquatic habitat. • Increase in average weekly minimum river reach flow of >10% downstream of Bernard Lake, Magnetawan, Feighens and Knoepfli, Wahwashkesh Lake dams as well as the Magnetawan River locations downstream of Wahwashkesh Lake. The increase may improve aquatic habitat below these dams and through the lower reaches. • No significant increases to maximum daily flood levels or river flows, thus existing flood management capability is maintained. • Increase in average summer reservoir level of >0.05 m but <0.15 m upstream of Ayres dam, including Perry Lake may improve recreational use without compromising shoreline structures. **Subject to confirmation, this may be unsatisfactory for stakeholders upstream of Ayres dam, including Perry Lake due to potential impacts on shorelines and fixed structures such as docks and boathouses.** • Increase in average weekly minimum river reach flow through the summer period of >10% downstream of Bernard Lake, Magnetawan, Feighens and Knoepfli, Wahwashkesh Lake dams as well as the Magnetawan River locations	• No increase in flows or levels to the South Magnetawan River thus no improvements to boat access from South Magnetawan to Harris Lake, stagnant water conditions or recreational use in these lower reaches. • **Increase in average summer reservoir level of ≥0.15 m at Doe Lake. This may be unsatisfactory for stakeholders on Doe Lake and associated river reaches due to impacts on shorelines and fixed structures such as docks and boathouses.**

Table 9.1
Summary Evaluation Table – Comparison of Alternative Water Control Strategies to Base Case

Case	Positive Effect	Negative Effect
	downstream of Wahwashkesh Lake. These increases may improve recreational use at these locations and through the lower reaches. • Increase in small hydro potential of >1% at the potential Magnetawan dam and Knoepfli damsites.	
3	• No substantial change in minimum weekly water levels throughout the year with the exception of >0.05 m increase at Wahwashkesh Lake which may improve aquatic habitat. • Increase in average weekly minimum river reach flow throughout the year of >10% downstream of Magnetawan, Feighens and Knoepfli, Wahwashkesh Lake dams as well as the Magnetawan River locations downstream of Wahwashkesh Lake. The increase may improve aquatic habitat below these dams and through the lower reaches. • Increase in average summer reservoir levels of >0.05 m but <0.15 m at Ahmic Lakes, which may improve recreational use without compromising shoreline structures. **Subject to confirmation, this may be unsatisfactory for stakeholders on Ahmic Lake due to potential impacts on shorelines and fixed structures such as docks and boathouses.** • Increase in average weekly minimum flows through the summer period of >10% downstream of Bernard, Magnetawan, Feighens and Knoepfli and Wahwashkesh Lake dams as well as Magnetawan River locations downstream of Wahwashkesh Lake. These increases may improve recreational use at these locations and through the lower reaches. • Increase in average annual power generation of >1% at existing Burk's Falls hydro facility and the potential Magnetawan dam and Knoepfli damsites.	• No increase in flow or levels to South Magnetawan River thus no improvements to access from South Magnetawan to Harris Lake, stagnant water conditions or recreational use in these lower reaches. • Increase in maximum daily reservoir level of >0.05 m at Bernard Lake and Magnetawan River upstream of Burk's Falls, and an increase in maximum daily flow >10% downstream of Bernard Lake which may compromise flood management capability at these locations. • **Increase in average summer reservoir levels of ≥0.15 m at Perry, Doe, Bernard and Cecebe Lakes. This may be unsatisfactory for stakeholders on these lakes and associated river reaches due to impacts on shorelines and fixed structures such as docks and boathouses.**

Table 9.1
Summary Evaluation Table – Comparison of Alternative Water Control Strategies to Base Case

Case	Positive Effect	Negative Effect
4	• No substantial change in minimum weekly water levels throughout the year therefore no impacts to aquatic habitat. • Increase in average weekly minimum river reach flow throughout the year of >10% downstream of Pevensey, Watt's, Magnetawan, Feighens and Knoepfli and Wahwashkesh Lake dams as well as the Magnetawan River downstream of Wahwashkesh Lake. The increase may improve aquatic habitat below these dams and through the lower reaches. • Decrease in maximum daily reservoir level of >0.05 m at Bernard Lake and Magnetawan River upstream of Burk's Falls, and a decrease in maximum daily flow of >10% downstream of Pevensey and Bernard Lake dams may improve flood management capability at these locations. • Increase in average summer reservoir levels at Perry, Cecebe and Ahmic Lakes of >0.05 m but <0.15 m, which may improve recreational use. **Subject to confirmation, this may be unsatisfactory for stakeholders on Perry, Cecebe and Ahmic Lake due to potential impacts on shorelines and fixed structures such as docks and boathouses.** • Increase in average minimum summer flows of >10% downstream of Bernard Lake dam which may improve recreational use in downstream areas and may also improve aquatic habitat. • Increase in average minimum weekly minimum flows of >10% through the summer at Pevensey, Watt's, Bernard Lake, Feighens and Knoepfli and Wahwashkesh Lake dams as well as the Magnetawan River locations downstream of Wahwashkesh Lake. These increases may improve recreational use at these locations and through the lower reaches. • Increase in average annual power generation of >1% at the existing Burk's Falls hydro facility and at the potential Knoepfli damsite.	• No increase in flow or levels to South Magnetawan River, thus no improvement to boat access from South Magnetawan to Harris Lake, stagnant water conditions or recreational use in these lower reaches. • No substantial change in minimum weekly water levels throughout the year with the exception of a decrease of >0.05 m at Bernard Lake, this effect is not viewed as significant. • Increase in maximum daily flow of >10% downstream of Ayres dam may warrant further review as flood management capability may be comprised at this location. • **Increase in average summer reservoir level of >0.15 m at Doe Lake. This may be unsatisfactory for stakeholders on Doe Lake and associated river reaches due to impacts on shorelines and fixed structures such as docks and boathouses.** • Decrease in average annual power generation of >1% may reduce small hydro potential at the potential Magnetawan damsite. Since no hydro facility exists or is currently planned at this site, this effect is not viewed as significant.

9.5 Ranking of Alternative Water Control Strategies

The scoring and ranking results for each of the alternative water control operating strategies are presented in Table 9.2. In summary, it was apparent that the objective of increased minimum flows to river reaches downstream of Ahmic Lake was achieved, with particularly high scores for Alternatives 2, 3 and 4. None of the alternatives provided any increase to minimum flow to the South Magnetawan River. This objective seems unattainable given the morphology of the river and operational constraints on the system. These factors limit the extent to which the controlled lakes can be practically raised or lowered to increase the downstream river flows significantly enough to facilitate flow diversion from the main river into the south branch. While Poverty Bay is located immediately downstream of Ahmic Lake, and flows were increased to this reach, further analysis would be required to determine if the flow increases are large enough to translate to measurable increases in water level along this reach and extending into Poverty Bay.

The scores for both annual minimum weekly flows and summer minimum flows were either neutral or positive for the aquatic/riparian habitat and tourism/recreation attributes. The score for Alternative 4 was slightly higher than the other alternatives. Conversely, Alternative 4 showed the only negative score for annual minimum weekly reservoir levels. All other alternatives had scores that were neutral or slightly positive for all six lakes in the upper and middle watershed. Increases in average summer reservoir levels were predicted at some of the reservoirs for all four alternatives. However, several of the increases were of sufficient magnitude (>0.15 m) to be considered negative effects. Alternative 4 had the highest score for this attribute. Three of the increases predicted for this alternative were not of sufficient magnitude to be considered positive effects and the increase at Doe Lake is predicted to be >0.20 m and considered to be a negative effect. Subject to confirmation, the water level increases of >0.05 m, but <0.15 m in Perry, Cecebe and Ahmic Lakes were considered a positive effect for Alternative 4. The maximum daily flow indicators were predicted to improve flood management capability slightly in the upper reaches for Alternative 4 and remain unchanged for all other alternatives. The maximum daily level indicators also predicted an improvement in flood management capability at Bernard Lake dam and Burk's Falls dam for Alternative 4. A decrease in flood management capability was predicted at those same locations for Alternative 3. All other alternatives showed neutral score. Average annual power generation was predicted to increase at the existing Burk's Falls hydro facility and the two potential sites at Magnetawan and Knoepfli dams for Alternatives 1 and 3. In terms of operational costs, there was no significant difference among the four alternatives relative to the Base Case.

Final scores ranked Alternative 4 higher by four points than Alternative 2. Alternative 3 ranked third and Alternative 1 had the lowest score.

Table 9.2
Ranking of Alternative Water Control Strategies by Indicator

Attribute	Indicator	Alternatives			
		1	2	3	4
Natural Environment Aquatic & Riparian Habitat	Annual Minimum Weekly Reservoir Levels	0	+1	+1	-1
	Annual Minimum Weekly River Reach Flows	+2	+7	+7	+8
Social Flood Management	Annual Maximum Daily Reservoir Levels	0	0	-2	+2
	Annual Maximum Daily River Reach Flows	0	0	0	+1
Tourism/Recreation	Average Summer Reservoir Levels	-2	0	-3	+2
	Average Summer River Reach Flows	0	+1	+1	+1
	Average Summer Minimum Weekly River Reach Flows	+1	+8	+7	+8
Small Hydro Potential	Average Annual Power Generation	0	+2	+3	+2
Economic Operational Costs	MNR Annual Operation Costs	0	0	0	0
Summary	**Total Ranked Score**	+1	+19	+14	+23
	Rank	4	2	3	1

9.6 Selection of Preliminary Recommended Water Control Operating Plan

Based on the scoring and ranking of alternatives, Case 4 was selected as the preliminary recommended alternative water control strategy for incorporation into the Magnetawan River Water Control Operating Plan. The selection of Alternative 4 was based on several factors that included environmental effects, effectiveness in meeting the water management plan goals and objectives, and cost.

Table 9.3
Comparison of Base Case to Alternative 1:
Maintain Minimum Flow of 5 m^3/s Downstream of Ahmic Lake for 95% of the Time
by Staying Within Existing Normal Operation Range

Natural Environment Aquatic and Riparian Habitat Reservoir, Lake or River Reach by Dam Location	Average Annual Minimum Weekly Reservoir Levels: Base Case Avg Min Wkly Level (m)	Alt Case Avg Min Wkly Level (m)	Change in Avg Min Wkly Level (m)	Comparison = if <= 0.05 m higher/lower + if >0.05 m higher - if >0.05 m lower	Average Annual Minimum Weekly River Reach Flows: Base Case Avg Min Wkly Flow (m^3/s)	Alt Case Avg Min Wkly Flow (m^3/s)	Change in Avg Min Wkly Flow (m^3/s)	Change in Avg Min Wkly Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower
Shaded Cells are Summer Minimum Levels									
All Others are Spring Drawdown Minimum Levels									
Upper Watershed Reaches									
Pevensey Dam (Loon L., Grass L.)	29.40	29.40	0.00	neutral	0.166	0.166	0.000	0.0	neutral
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	335.00	335.00	0.00	neutral	1.57	1.58	0.01	0.64	neutral
Mid-Upper Watershed Reaches									
Watt's Dam (11.4 km Mag R., Doe L.)	293.42	293.43	0.01	neutral	2.94	2.94	0.00	0.00	neutral
Bernard Lake Dam (Bernard L.)	329.05	329.05	0.00	neutral	0.242	0.268	0.03	10.74	+
Burk's Falls Dam (4.5 km Mag R.)	290.90	290.90	0.00	neutral	4.19	4.35	0.16	3.82	neutral
Middle Watershed Reaches									
Magnetawan Dams (L. Cecebe, Midlothian L.)	282.21	282.21	0.00	neutral	6.00	6.38	0.38	6.33	neutral
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	279.05	279.05	0.00	neutral	6.20	6.84	0.64	10.32	+
Mid-Lower Watershed Reaches									
Gooseneck Lake Dam (Gooseneck L.)	29.69	29.69	0.00	neutral	0.016	0.016	0.000	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesh L.)	224.90	224.94	0.04	neutral	8.94	9.54	0.60	6.71	neutral
Kashegaba Lake Dam (Kashegaba L., Bolger L.)	99.94	99.94	0.00	neutral	0.047	0.047	0.000	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	9.31	9.91	0.60	6.44	neutral
Lower Watershed Reaches									
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	9.15	9.75	0.60	6.56	neutral
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	0.072	0.071	-0.001	-1.39	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	202.45	202.45	0.00	neutral	0.071	0.071	0.000	0.00	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	0.360	0.359	-0.001	-0.28	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	9.74	10.34	0.60	6.16	neutral

Social Flood Management Reservoir, Lake or River Reach by Dam Location	Maximum Daily Reservoir Levels (1916 to 1998): Base Case Maximum Daily Level (m)	Alt Case Maximum Daily Level (m)	Change in Maximum Daily Level (m)	Comparison = if <= 0.05 m higher/lower + if >0.05 m lower - if >0.05 m higher	Maximum Daily River Reach Flows (1916 to 1998): Base Case Maximum Daily Flow (m^3/s)	Alt Case Maximum Daily Flow (m^3/s)	Change in Maximum Daily Flow (m^3/s)	Change in Maximum Daily Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% lower - if % Chg > 10% higher
Upper Watershed Reaches									
Pevensey Dam (Loon L., Grass L.)	30.23	30.23	0.002	neutral	11.09	11.06	-0.04	-0.3	neutral
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	336.4	336.4	0.00	neutral	62.09	62.26	0.18	0.29	neutral
Mid-Upper Watershed Reaches									
Watt's Dam (11.4 km Mag R., Doe L.)	296.77	296.80	0.03	neutral	97.10	98.13	1.03	1.06	neutral
Bernard Lake Dam (Bernard L.)	329.75	329.78	0.03	neutral	27.16	28.52	1.36	5.00	neutral
Burk's Falls Dam (4.5 km Mag R.)	291.10	291.10	0.00	neutral	145.56	154.18	8.63	5.93	neutral
Middle Watershed Reaches									
Magnetawan Dams (L. Cecebe, Midlothian L.)	283.65	283.65	0.00	neutral	248.53	248.53	0.00	0.00	neutral
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	280.45	280.46	0.01	neutral	269.44	271.28	1.85	0.69	neutral
Mid-Lower Watershed Reaches									
Gooseneck Lake Dam (Gooseneck L.)	30.12	30.12	0.00	neutral	8.96	8.96	0.00	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesk L.)	228.27	228.28	0.003	neutral	401.17	400.93	-0.25	-0.06	neutral
Kashegaba Lake Dam (Kashegaba L., Bolger L.)	100.53	100.53	0.00	neutral	6.73	6.73	0.00	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	418.66	418.41	-0.25	-0.06	neutral
Lower Watershed Reaches									
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	335.82	336.11	0.29	0.09	neutral
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	79.52	79.59	0.07	0.09	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	203.19	203.19	-0.001	neutral	25.13	25.03	-0.10	-0.39	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	71.81	71.54	-0.27	-0.37	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	381.56	380.88	-0.68	-0.18	neutral

Table 9.3
Comparison of Base Case to Alternative 1:
Maintain Minimum Flow of 5 m^3/s Downstream of Ahmic Lake for 95% of the Time
by Staying Within Existing Normal Operation Range

Social **Tourism/Recreation** Reservoir, Lake or River Reach by Dam Location	Average Summer Reservoir Levels (May 15 to Oct 15)				Average Summer River Reach Flows (May 15 to Oct 15)					Average Summer Min. Weekly River Reach Flows (May 15 to Oct 15)				
	Base Case Avg Summer Level (m)	Alt Case Avg Summer Level (m)	Change in Avg Summer Level (m)	Comparison = if <= 0.05 m higher/lower + if >0.05 m & < 0.15 m higher - if >0.05 m lower or >=0.15 m higher	Base Case Avg Summer Flow (m^3/s)	Alt Case Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower	Base Case Avg Summer Flow (m^3/s)	Alt Case Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower
Upper Watershed Reaches														
Pevensey Dam (Loon L., Grass L.)	29.86	29.90	0.04	neutral	0.478	0.492	0.014	2.93	neutral	0.202	0.202	0.000	0.00	neutral
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	335.14	335.29	0.15	-	4.09	4.11	0.02	0.49	neutral	1.72	1.73	0.01	0.58	neutral
Mid-Upper Watershed Reaches														
Watt's Dam (11.4 km Mag R., Doe L.)	293.99	294.36	0.37	-	8.07	7.93	-0.14	-1.73	neutral	3.18	3.24	0.06	1.89	neutral
Bernard Lake Dam (Bernard L.)	329.39	329.44	0.05	neutral	0.998	1.050	0.052	5.21	neutral	0.251	0.288	0.037	14.74	+
Burk's Falls Dam (4.5 km Mag R.)	290.90	290.90	0.00	neutral	11.81	11.66	-0.15	-1.27	neutral	4.57	4.78	0.21	4.60	neutral
Middle Watershed Reaches														
Magnetawan Dams (L. Cecebe, Midlothian L.)	282.71	282.75	0.04	neutral	17.78	17.69	-0.09	-0.51	neutral	6.52	6.90	0.38	5.83	neutral
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	279.44	279.47	0.03	neutral	20.08	19.99	-0.09	-0.45	neutral	6.80	7.38	0.58	8.53	neutral
Mid-Lower Watershed Reaches														
Gooseneck Lake Dam (Gooseneck L.)	29.77	29.77	0.00	neutral	0.203	0.203	0.000	0.00	neutral	0.018	0.018	0.000	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesh L.)	225.21	225.21	0.00	neutral	28.85	28.73	-0.12	-0.42	neutral	9.69	10.26	0.57	5.88	neutral
Kashegaba Lake Dam (Kashegaba L., Bolger L.)	100.03	100.03	0.00	neutral	0.416	0.416	0.000	0.00	neutral	0.050	0.050	0.000	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	30.08	29.96	-0.12	-0.40	neutral	10.09	10.66	0.57	5.65	neutral
Lower Watershed Reaches														
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	27.72	27.64	-0.08	-0.29	neutral	9.84	10.41	0.57	5.79	neutral
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	2.44	2.39	-0.05	-2.05	neutral	0.150	0.149	-0.001	-0.67	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	202.51	202.51	0.00	neutral	0.980	0.965	-0.015	-1.53	neutral	0.102	0.102	0.000	0.00	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	2.67	2.63	-0.04	-1.50	neutral	0.434	0.434	0.000	0.00	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	30.12	30.03	-0.09	-0.30	neutral	10.49	11.07	0.58	5.53	neutral

Social **Small Hydro Potential** Reservoir, Lake or River Reach by Dam Location	Average Annual Power Generation				
	Base Case Avg Annual Power (MWh)	Alt Case Avg Annual Power (MWh)	Change in Avg Annual Power (MWh)	Change in Average Annual Power (%)	Comparison = if % Chg is within 1% + if % Chg > 1% higher - if % Chg > 1% lower
Existing Burk's Falls Small Hydro Facility	4841	4857	16	0.3	neutral
Potential Site at Magnetawan Dam (Cecebe L.)	2968	2999	31	1.0	neutral
Potential Site at Knoepfli Dam (Ahmic L.)	7339	7414	75	1.0	neutral

Economic **Operational Costs** Reservoir, Lake or River Reach by Dam Location	MNR Annual Operational Cost				
	Base Case Avg Annual Cost ($)	Alt Case Avg Annual Cost ($)	Change in Avg Annual Cost ($)	Change in Average Annual Cost (%)	Comparison = if % Chg is within 5% + if % Chg > 5% lower - if % Chg > 5% higher
Control Dams (Pevensey, Ayres, Watts, Bernard, Magnetawan & Ahmic Dams)	$34,800	$34,400	$400	1.2	neutral

Table 9.4
Comparison of Base Case to Alternative 2:
Maintain Minimum Flows of 7 m^3/s Downstream of Ahmic Lake for 95% of the Time
by Extending into the Lower Buffer Range

Natural Environment **Aquatic and Riparian Habitat** Reservoir, Lake or River Reach by Dam Location	Average Annual Minimum Weekly Reservoir Levels				Average Annual Minimum Weekly River Reach Flows				
	Base Case Avg Min Wkly Level (m)	Alt Case Avg Min Wkly Level (m)	Change in Avg Min Wkly Level (m)	Comparison = if <= 0.05 m higher/lower + if >0.05 m higher - if >0.05 m lower	Base Case Avg Min Wkly Flow (m^3/s)	Alt Case Avg Min Wkly Flow (m^3/s)	Change in Avg Min Wkly Flow (m^3/s)	Change in Avg Min Wkly Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower
Shaded Cells are Summer Minimum Levels									
All Others are Spring Drawdown Minimum Levels									
Upper Watershed Reaches									
Pevensey Dam (Loon L., Grass L.)	29.40	29.40	0.00	neutral	0.166	0.170	0.00	2.41	neutral
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	335.00	335.00	0.00	neutral	1.57	1.64	0.07	4.46	neutral
Mid-Upper Watershed Reaches									
Watt's Dam (11.4 km Mag R., Doe L.)	293.42	293.43	0.01	neutral	2.94	2.93	-0.01	-0.34	neutral
Bernard Lake Dam (Bernard L.)	329.05	329.05	0.00	neutral	0.242	0.292	0.05	20.66	+
Burk's Falls Dam (4.5 km Mag R.)	290.90	290.90	0.00	neutral	4.19	4.56	0.37	8.83	neutral
Middle Watershed Reaches									
Magnetawan Dams (L. Cecebe, Midlothian L.)	282.21	282.20	-0.01	neutral	6.00	7.08	1.08	18.00	+
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	279.05	279.05	0.00	neutral	6.20	7.76	1.56	25.16	+
Mid-Lower Watershed Reaches									
Gooseneck Lake Dam (Gooseneck L.)	29.69	29.69	0.00	neutral	0.016	0.016	0.00	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesh L.)	224.90	224.97	0.07	+	8.94	10.46	1.52	17.00	+
Kashagaba Lake Dam (Kashagaba L., Bolger L.)	99.94	99.94	0.00	neutral	0.047	0.047	0.00	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	9.31	10.84	1.53	16.43	+
Lower Watershed Reaches									
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	9.15	10.69	1.54	16.83	+
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	0.072	0.069	-0.003	-4.17	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	202.45	202.45	0.00	neutral	0.071	0.071	0.00	0.00	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	0.360	0.358	0.00	-0.56	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	9.74	11.27	1.53	15.71	+

Social **Flood Management** Reservoir, Lake or River Reach by Dam Location	Maximum Daily Reservoir Levels (1916 to 1998)				Maximum Daily River Reach Flows (1916 to 1998)				
	Base Case Maximum Daily Level (m)	Alt Case Maximum Daily Level (m)	Change in Maximum Daily Level (m)	Comparison = if <= 0.05 m higher/lower + if >0.05 m lower - if >0.05 m higher	Base Case Maximum Daily Flow (m^3/s)	Alt Case Maximum Daily Flow (m^3/s)	Change in Maximum Daily Flow (m^3/s)	Change in Maximum Daily Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% lower - if % Chg > 10% higher
Upper Watershed Reaches									
Pevensey Dam (Loon L., Grass L.)	30.23	30.23	0.00	neutral	11.09	11.06	-0.04	-0.3	neutral
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	336.4	336.4	0.00	neutral	62.09	62.26	0.18	0.29	neutral
Mid-Upper Watershed Reaches									
Watt's Dam (11.4 km Mag R., Doe L.)	296.77	296.80	0.03	neutral	97.10	98.13	1.03	1.06	neutral
Bernard Lake Dam (Bernard L.)	329.75	329.78	0.03	neutral	27.16	28.52	1.36	5.00	neutral
Burk's Falls Dam (4.5 km Mag R.)	291.10	291.10	0.00	neutral	145.56	154.18	8.63	5.93	neutral
Middle Watershed Reaches									
Magnetawan Dams (L. Cecebe, Midlothian L.)	283.65	283.65	0.00	neutral	248.53	248.53	0.00	0.00	neutral
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	280.45	280.46	0.01	neutral	269.44	271.28	1.85	0.69	neutral
Mid-Lower Watershed Reaches									
Gooseneck Lake Dam (Gooseneck L.)	30.12	30.12	0.00	neutral	8.96	8.96	0.00	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesh L.)	228.27	228.28	0.003	neutral	401.17	400.93	-0.25	-0.06	neutral
Kashegaba Lake Dam (Kashegaba L., Bolger L.)	100.53	100.53	0.00	neutral	6.73	6.73	0.00	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	418.66	418.41	-0.25	-0.06	neutral
Lower Watershed Reaches									
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	335.82	336.11	0.29	0.09	neutral
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	79.52	79.59	0.07	0.09	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	203.19	203.19	0.00	neutral	25.13	25.03	-0.10	-0.39	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	71.81	71.54	-0.27	-0.37	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	381.56	380.88	-0.68	-0.18	neutral

Table 9.4
Comparison of Base Case to Alternative 2:
Maintain Minimum Flows of 7 m^3/s Downstream of Ahmic Lake for 95% of the Time
by Extending into the Lower Buffer Range

Social Tourism/Recreation	Average Summer Reservoir Levels (May 15 to Oct 15)				Average Summer River Reach Flows (May 15 to Oct 15)					Average Summer Min. Weekly River Reach Flows (May 15 to Oct 15)				
Reservoir, Lake or River Reach by Dam Location	Base Case Avg Summer Level (m)	Alt Case Avg Summer Level (m)	Change in Avg Summer Level (m)	Comparison = if <= 0.05 m higher/lower + if >0.05 m & < 0.15 m higher - if >0.05 m lower or >=0.15 m higher	Base Case Avg Summer Flow (m^3/s)	Alt Case Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower	Base Case Avg Summer Flow (m^3/s)	Alt Case Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower
Upper Watershed Reaches														
Pevensey Dam (Loon L., Grass L.)	29.86	29.87	0.01	neutral	0.478	0.503	0.025	5.23	neutral	0.202	0.219	0.017	8.42	neutral
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	335.14	335.25	0.11	+	4.09	4.13	0.04	0.98	neutral	1.72	1.81	0.09	5.23	neutral
Mid-Upper Watershed Reaches														
Watt's Dam (11.4 km Mag R., Doe L.)	293.99	294.26	0.27	-	8.07	8.10	0.03	0.37	neutral	3.18	3.29	0.11	3.46	neutral
Bernard Lake Dam (Bernard L.)	329.39	329.43	0.04	neutral	0.998	1.100	0.102	10.22	+	0.251	0.322	0.071	28.29	+
Burk's Falls Dam (4.5 km Mag R.)	290.90	290.90	0.00	neutral	11.81	11.83	0.02	0.17	neutral	4.57	5.04	0.47	10.28	+
Middle Watershed Reaches														
Magnetawan Dams (L. Cecebe, Midlothian L.)	282.71	282.72	0.01	neutral	17.78	17.93	0.15	0.84	neutral	6.52	7.63	1.11	17.02	+
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	279.44	279.45	0.01	neutral	20.08	20.28	0.20	1.00	neutral	6.80	8.30	1.50	22.06	+
Mid-Lower Watershed Reaches														
Gooseneck Lake Dam (Gooseneck L.)	29.77	29.77	0.00	neutral	0.203	0.203	0.000	0.00	neutral	0.018	0.018	0.000	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesk L.)	225.21	225.22	0.01	neutral	28.85	29.03	0.18	0.62	neutral	9.69	11.18	1.49	15.38	+
Kashegaba Lake Dam (Kashegaba L., Bolger L.)	100.03	100.03	0.00	neutral	0.416	0.416	0.000	0.00	neutral	0.050	0.050	0.000	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	30.08	30.26	0.18	0.60	neutral	10.09	11.58	1.49	14.77	+
Lower Watershed Reaches														
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	27.72	27.95	0.23	0.83	neutral	9.84	11.34	1.50	15.24	+
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	2.44	2.38	-0.060	-2.46	neutral	0.150	0.147	-0.003	-2.00	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	202.51	202.51	0.00	neutral	0.980	0.962	-0.018	-1.84	neutral	0.102	0.101	-0.001	-0.98	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	2.67	2.63	-0.04	-1.50	neutral	0.434	0.433	-0.001	-0.23	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	30.12	30.33	0.21	0.70	neutral	10.49	11.99	1.50	14.30	+

Social Small Hydro Potential	Average Annual Power Generation				
Reservoir, Lake or River Reach by Dam Location	Base Case Avg Annual Power (MWh)	Alt Case Avg Annual Power (MWh)	Change in Avg Annual Power (MWh)	Change in Average Annual Power (%)	Comparison = if % Chg is within 1% + if % Chg > 1% higher - if % Chg > 1% lower
Existing Burk's Falls Small Hydro Facility	4841	4868	27	0.6	neutral
Potential Site at Magnetawan Dam (Cecebe L.)	2968	3002	34	1.1	+
Potential Site at Knoepfli Dam (Ahmic L.)	7339	7441	102	1.4	+

Economic Operational Costs	MNR Annual Operational Cost				
Reservoir, Lake or River Reach by Dam Location	Base Case Avg Annual Cost ($)	Alt Case Avg Annual Cost ($)	Change in Avg Annual Cost ($)	Change in Average Annual Cost (%)	Comparison = if % Chg is within 5% + if % Chg > 5% lower - if % Chg > 5% higher
Control Dams (Pevensey, Ayres, Watts, Bernard, Magnetawan & Ahmic Dams)	$34,800	$34,400	$400	1.2	neutral

Table 9.5
Comparison of Base Case to Alternative 3:
Maintain Minimum Flows of 7 m^3/s Downstream of Ahmic Lake for 95% of the Time
by Operating 150 mm above the Normal Operating Range

Natural Environment / Aquatic and Riparian Habitat — Reservoir, Lake or River Reach by Dam Location	Average Annual Minimum Weekly Reservoir Levels: Base Case Avg Min Wkly Level (m)	Alt Case Avg Min Wkly Level (m)	Change in Avg Min Wkly Level (m)	Comparison = if <= 0.05 m higher/lower; + if >0.05 m higher; - if >0.05 m lower	Average Annual Minimum Weekly River Reach Flows: Base Case Avg Min Wkly Flow (m^3/s)	Alt Case Avg Min Wkly Flow (m^3/s)	Change in Avg Min Wkly Flow (m^3/s)	Change in Avg Min Wkly Flow (%)	Comparison = if % Chg is within 10%; + if % Chg > 10% higher; - if % Chg > 10% lower
Shaded Cells are Summer Minimum Levels									
All Others are Spring Drawdown Minimum Levels									
Upper Watershed Reaches									
Pevensey Dam (Loon L., Grass L.)	29.40	29.40	0.00	neutral	0.166	0.163	-0.003	-1.8	neutral
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	335.00	335.00	0.00	neutral	1.57	1.59	0.02	1.27	neutral
Mid-Upper Watershed Reaches									
Watt's Dam (11.4 km Mag R., Doe L.)	293.42	293.42	0.00	neutral	2.94	3.09	0.15	5.10	neutral
Bernard Lake Dam (Bernard L.)	329.05	329.05	0.00	neutral	0.242	0.294	0.05	21.49	+
Burk's Falls Dam (4.5 km Mag R.)	290.90	290.90	0.00	neutral	4.19	4.57	0.38	9.07	neutral
Middle Watershed Reaches									
Magnetawan Dams (L. Cecebe, Midlothian L.)	282.21	282.21	0.00	neutral	6.00	6.97	0.97	16.17	+
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	279.05	279.05	0.00	neutral	6.20	7.75	1.55	25.00	+
Mid-Lower Watershed Reaches									
Gooseneck Lake Dam (Gooseneck L.)	29.69	29.69	0.00	neutral	0.016	0.016	0.000	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesh L.)	224.90	224.97	0.07	+	8.94	10.51	1.57	17.56	+
Kashagaba Lake Dam (Kashagaba L., Bolger L.)	99.94	99.94	0.00	neutral	0.047	0.047	0.000	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	9.31	10.89	1.58	16.97	+
Lower Watershed Reaches									
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	9.15	10.73	1.58	17.27	+
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	0.072	0.074	0.002	2.78	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	202.45	202.45	0.00	neutral	0.071	0.071	0.000	0.00	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	0.360	0.359	-0.001	-0.28	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	9.74	11.32	1.58	16.22	+

Social / Flood Management — Reservoir, Lake or River Reach by Dam Location	Maximum Daily Reservoir Levels (1916 to 1998): Base Case Maximum Daily Level (m)	Alt Case Maximum Daily Level (m)	Change in Maximum Daily Level (m)	Comparison = if <= 0.05 m higher/lower; + if >0.05 m lower; - if >0.05 m higher	Maximum Daily River Reach Flows (1916 to 1998): Base Case Maximum Daily Flow (m^3/s)	Alt Case Maximum Daily Flow (m^3/s)	Change in Maximum Daily Flow (m^3/s)	Change in Maximum Daily Flow (%)	Comparison = if % Chg is within 10%; + if % Chg > 10% lower; - if % Chg > 10% higher
Upper Watershed Reaches									
Pevensey Dam (Loon L., Grass L.)	30.23	30.26	0.03	neutral	11.09	9.36	-1.73	-15.6	+
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	336.4	336.40	0.00	neutral	62.09	62.29	0.20	0.32	neutral
Mid-Upper Watershed Reaches									
Watt's Dam (11.4 km Mag R., Doe L.)	296.77	296.77	0.00	neutral	97.10	97.12	0.02	0.02	neutral
Bernard Lake Dam (Bernard L.)	329.75	329.89	0.14	-	27.16	32.08	4.92	18.10	-
Burk's Falls Dam (4.5 km Mag R.)	291.10	291.30	0.20	-	145.56	145.34	-0.22	-0.15	neutral
Middle Watershed Reaches									
Magnetawan Dams (L. Cecebe, Midlothian L.)	283.65	283.65	0.00	neutral	248.53	248.53	0.00	0.00	neutral
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	280.45	280.43	-0.02	neutral	269.44	265.23	-4.21	-1.56	neutral
Mid-Lower Watershed Reaches									
Gooseneck Lake Dam (Gooseneck L.)	30.12	30.12	0.00	neutral	8.96	8.96	0.00	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesk L.)	228.27	228.24	-0.04	neutral	401.17	393.88	-7.29	-1.82	neutral
Kashegaba Lake Dam (Kashegaba L., Bolger L.)	100.53	100.53	0.00	neutral	6.73	6.73	0.00	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	418.66	411.37	-7.29	-1.74	neutral
Lower Watershed Reaches									
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	335.82	331.49	-4.33	-1.29	neutral
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	79.52	78.21	-1.31	-1.64	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	203.19	203.18	-0.01	neutral	25.13	24.62	-0.51	-2.01	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	71.81	70.43	-1.37	-1.91	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	381.56	375.17	-6.38	-1.67	neutral

Table 9.5
Comparison of Base Case to Alternative 3:
Maintain Minimum Flows of 7 m^3/s Downstream of Ahmic Lake for 95% of the Time
by Operating 150 mm above the Normal Operating Range

Social **Tourism/Recreation**	Average Summer Reservoir Levels (May 15 to Oct 15)				Average Summer River Reach Flows (May 15 to Oct 15)					Average Summer Min. Weekly River Reach Flows (May 15 to Oct 15)				
Reservoir, Lake or River Reach by Dam Location	Base Case Avg Summer Level (m)	Alt Case Avg Summer Level (m)	Change in Avg Summer Level (m)	Comparison = if <= 0.05 m higher/lower + if >0.05 m & < 0.15 m higher - if >0.05 m lower or >=0.15 m higher	Base Case Avg Summer Flow (m^3/s)	Alt Case Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower	Base Case Avg Summer Flow (m^3/s)	Alt Case Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower
Upper Watershed Reaches														
Pevensey Dam (Loon L., Grass L.)	29.86	29.90	0.04	neutral	0.478	0.496	0.018	3.77	neutral	0.202	0.196	-0.006	-2.97	neutral
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	335.14	335.37	0.23	-	4.09	4.14	0.05	1.22	neutral	1.72	1.74	0.02	1.16	neutral
Mid-Upper Watershed Reaches														
Watt's Dam (11.4 km Mag R., Doe L.)	293.99	294.45	0.46	-	8.07	8.05	-0.02	-0.25	neutral	3.18	3.34	0.16	5.03	neutral
Bernard Lake Dam (Bernard L.)	329.39	329.56	0.17	-	0.998	1.160	0.162	16.23	+	0.251	0.338	0.087	34.66	+
Burk's Falls Dam (4.5 km Mag R.)	290.90	290.90	0.00	neutral	11.81	11.79	-0.02	-0.17	neutral	4.57	4.94	0.37	8.10	neutral
Middle Watershed Reaches														
Magnetawan Dams (L. Cecebe, Midlothian L.)	282.71	282.86	0.15	-	17.78	17.99	0.21	1.18	neutral	6.52	7.50	0.98	15.03	+
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	279.44	279.53	0.09	+	20.08	20.27	0.19	0.95	neutral	6.80	8.34	1.54	22.65	+
Mid-Lower Watershed Reaches														
Gooseneck Lake Dam (Gooseneck L.)	29.77	29.77	0.00	neutral	0.203	0.203	0.000	0.00	neutral	0.018	0.018	0.000	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesh L.)	225.21	225.22	0.01	neutral	28.85	28.96	0.11	0.38	neutral	9.69	11.25	1.56	16.10	+
Kashegaba Lake Dam (Kashegaba L., Bolger L.)	100.03	100.03	0.00	neutral	0.416	0.416	0.000	0.00	neutral	0.050	0.050	0.000	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	30.08	30.18	0.10	0.33	neutral	10.09	11.64	1.55	15.36	+
Lower Watershed Reaches														
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	27.72	27.89	0.17	0.61	neutral	9.84	11.40	1.56	15.85	+
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	2.44	2.36	-0.08	-3.28	neutral	0.150	0.150	0.000	0.00	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	202.51	202.51	0.00	neutral	0.980	0.957	-0.023	-2.35	neutral	0.102	0.102	0.000	0.00	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	2.67	2.61	-0.06	-2.25	neutral	0.434	0.435	0.001	0.23	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	30.12	30.26	0.14	0.46	neutral	10.49	12.05	1.56	14.87	+

Social **Small Hydro Potential**	Average Annual Power Generation				
Reservoir, Lake or River Reach by Dam Location	Base Case Avg Annual Power (MWh)	Alt Case Avg Annual Power (MWh)	Change in Avg Annual Power (MWh)	Change in Average Annual Power (%)	Comparison = if % Chg is within 1% + if % Chg > 1% higher - if % Chg > 1% lower
Existing Burk's Falls Small Hydro Facility	4841	4924	83	1.7	+
Potential Site at Magnetawan Dam (Cecebe L.)	2968	3070	102	3.4	+
Potential Site at Knoepfli Dam (Ahmic L.)	7339	7546	207	2.8	+

Economic **Operational Costs**	MNR Annual Operational Cost				
Reservoir, Lake or River Reach by Dam Location	Base Case Avg Annual Cost ($)	Alt Case Avg Annual Cost ($)	Change in Avg Annual Cost ($)	Change in Average Annual Cost (%)	Comparison = if % Chg is within 5% + if % Chg > 5% lower - if % Chg > 5% higher
Control Dams (Pevensey, Ayres, Watts, Bernard, Magnetawan & Ahmic Dams)	$34,800	$34,100	$700	2.1	neutral

Table 9.6
Comparison of Base Case to Alternative 4:
Maintain Minimum Flows of 6 m^3/s Downstream of Ahmic Lake for 95% of the Time
by Modified Case 1, 2 or 3 on Controlled Lakes

Natural Environment **Aquatic and Riparian Habitat**	Average Annual Minimum Weekly Reservoir Levels				Average Annual Minimum Weekly River Reach Flows				
Reservoir, Lake or River Reach by Dam Location	Base Case Avg Min Wkly Level (m)	Alt Case Avg Min Wkly Level (m)	Change in Avg Min Wkly Level (m)	Comparison = if <= 0.05 m higher/lower + if >0.05 m higher - if >0.05 m lower	Base Case Avg Min Wkly Flow (m^3/s)	Alt Case Avg Min Wkly Flow (m^3/s)	Change in Avg Min Wkly Flow (m^3/s)	Change in Avg Min Wkly Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower
Shaded Cells are Summer Minimum Levels									
All Others are Spring Drawdown Minimum Levels									
Upper Watershed Reaches									
Pevensey Dam (Loon L., Grass L.)	29.40	29.38	-0.02	neutral	0.166	0.197	0.031	18.7	+
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	335.00	334.99	-0.01	neutral	1.57	1.62	0.05	3.18	neutral
Mid-Upper Watershed Reaches									
Watt's Dam (11.4 km Mag R., Doe L.)	293.42	293.41	-0.01	neutral	2.94	3.27	0.33	11.22	+
Bernard Lake Dam (Bernard L.)	329.05	328.95	-0.10	-	0.242	0.233	-0.01	-3.72	neutral
Burk's Falls Dam (4.5 km Mag R.)	290.90	290.90	0.00	neutral	4.19	4.57	0.38	9.07	neutral
Middle Watershed Reaches									
Magnetawan Dams (L. Cecebe, Midlothian L.)	282.21	282.20	-0.01	neutral	6.00	6.60	0.60	10.00	+
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	279.05	279.05	0.00	neutral	6.20	7.32	1.12	18.06	+
Mid-Lower Watershed Reaches									
Gooseneck Lake Dam (Gooseneck L.)	29.69	29.69	0.00	neutral	0.016	0.016	0.000	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesk L.)	224.90	224.95	0.05	neutral	8.94	10.07	1.13	12.64	+
Kashagaba Lake Dam (Kashagaba L., Bolger L.)	99.94	99.94	0.00	neutral	0.047	0.047	0.000	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	9.31	10.45	1.14	12.24	+
Lower Watershed Reaches									
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	9.15	10.29	1.14	12.46	+
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	0.072	0.080	0.008	11.11	+
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	202.45	202.45	0.00	neutral	0.071	0.074	0.003	4.23	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	0.360	0.366	0.006	1.67	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	9.74	10.94	1.20	12.32	+

Social **Flood Management**	Maximum Daily Reservoir Levels (1916 to 1998)				Maximum Daily River Reach Flows (1916 to 1998)				
Reservoir, Lake or River Reach by Dam Location	Base Case Maximum Daily Level (m)	Alt Case Maximum Daily Level (m)	Change in Maximum Daily Level (m)	Comparison = if <= 0.05 m higher/lower + if >0.05 m lower - if >0.05 m higher	Base Case Maximum Daily Flow (m^3/s)	Alt Case Maximum Daily Flow (m^3/s)	Change in Maximum Daily Flow (m^3/s)	Change in Maximum Daily Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% lower - if % Chg > 10% higher
Upper Watershed Reaches									
Pevensey Dam (Loon L., Grass L.)	30.23	30.23	0.00	neutral	11.09	6.79	-4.30	-38.8	+
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	336.40	336.40	0.00	neutral	62.09	68.48	6.39	10.29	-
Mid-Upper Watershed Reaches									
Watt's Dam (11.4 km Mag R., Doe L.)	296.77	296.74	-0.03	neutral	97.10	96.35	-0.75	-0.78	neutral
Bernard Lake Dam (Bernard L.)	329.75	329.60	-0.15	+	27.16	23.90	-3.26	-12.02	+
Burk's Falls Dam (4.5 km Mag R.)	291.10	290.90	-0.20	+	145.56	144.55	-1.01	-0.69	neutral
Middle Watershed Reaches									
Magnetawan Dams (L. Cecebe, Midlothian L.)	283.65	283.65	0.00	neutral	248.53	248.55	0.01	0.01	neutral
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	280.45	280.44	-0.02	neutral	269.44	270.62	1.18	0.44	neutral
Mid-Lower Watershed Reaches									
Gooseneck Lake Dam (Gooseneck L.)	30.12	30.12	0.00	neutral	8.96	8.96	0.00	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesh L.)	228.27	228.25	-0.02	neutral	401.17	397.34	-3.83	-0.96	neutral
Kashegaba Lake Dam (Kashegaba L., Bolger L.)	100.53	100.53	0.00	neutral	6.73	6.73	0.00	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	418.66	414.15	-4.51	-1.08	neutral
Lower Watershed Reaches									
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	335.82	334.59	-1.22	-0.36	neutral
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	79.52	79.14	-0.38	-0.48	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	203.19	203.18	-0.01	neutral	25.13	24.79	-0.34	-1.37	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	71.81	70.87	-0.93	-1.30	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	381.56	378.13	-3.43	-0.90	neutral

Table 9.6
Comparison of Base Case to Alternative 4:
Maintain Minimum Flows of 6 m^3/s Downstream of Ahmic Lake for 95% of the Time
by Modified Case 1, 2 or 3 on Controlled Lakes

Social **Tourism/Recreation**	Average Summer Reservoir Levels (May 15 to Oct 15)				Average Summer River Reach Flows (May 15 to Oct 15)					Average Summer Min. Weekly River Reach Flows (May 15 to Oct 15)				
Reservoir, Lake or River Reach by Dam Location	Base Case Avg Summer Level (m)	Alt Case Avg Summer Level (m)	Change in Avg Summer Level (m)	Comparison = if <= 0.05 m higher/lower + if >0.05 m & < 0.15 m higher - if >0.05 m lower or >=0.15 m higher	Base Case Avg Summer Flow (m^3/s)	Alt Case Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower	Base Case Avg Summer Flow (m^3/s)	Alt Case Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (m^3/s)	Change in Avg Summer Flow (%)	Comparison = if % Chg is within 10% + if % Chg > 10% higher - if % Chg > 10% lower
Upper Watershed Reaches														
Pevensey Dam (Loon L., Grass L.)	29.86	29.87	0.01	neutral	0.478	0.495	0.017	3.56	neutral	0.202	0.240	0.038	18.81	+
Ayres Dam (3.2 km Mag R., Perry L., Hassard L.)	335.14	335.22	0.08	+	4.09	4.12	0.03	0.73	neutral	1.72	1.78	0.06	3.49	neutral
Mid-Upper Watershed Reaches														
Watt's Dam (11.4 km Mag R., Doe L.)	293.99	294.19	0.20	-	8.07	8.14	0.07	0.87	neutral	3.18	3.51	0.33	10.38	+
Bernard Lake Dam (Bernard L.)	329.39	329.44	0.05	neutral	0.998	1.106	0.108	10.82	+	0.251	0.286	0.035	13.94	+
Burk's Falls Dam (4.5 km Mag R.)	290.90	290.90	0.00	neutral	11.81	11.88	0.07	0.59	neutral	4.57	4.95	0.38	8.32	neutral
Middle Watershed Reaches														
Magnetawan Dams (L. Cecebe, Midlothian L.)	282.71	282.79	0.08	+	17.78	17.96	0.18	1.01	neutral	6.52	7.09	0.57	8.74	neutral
Feighens & Knoepfli Dams (Ahmic L., Beaver L., Crawford L.)	279.44	279.51	0.07	+	20.08	20.29	0.21	1.05	neutral	6.80	7.84	1.04	15.29	+
Mid-Lower Watershed Reaches														
Gooseneck Lake Dam (Gooseneck L.)	29.77	29.77	0.00	neutral	0.203	0.203	0.000	0.00	neutral	0.018	0.018	0.000	0.00	neutral
Wahwashkesh Lake Dam (Wahwashkesh L.)	225.21	225.22	0.01	neutral	28.85	29.02	0.17	0.59	neutral	9.69	10.77	1.08	11.15	+
Kashegaba Lake Dam (Kashegaba L., Bolger L.)	100.03	100.03	0.00	neutral	0.416	0.416	0.000	0.00	neutral	0.050	0.050	0.000	0.00	neutral
Magnetawan River d/s of Wawashkesh Lake	n/a	n/a	n/a	n/a	30.08	30.24	0.16	0.53	neutral	10.09	11.17	1.08	10.70	+
Lower Watershed Reaches														
Magnetawan River d/s of Trout Lake (after S. Mag flow split)	n/a	n/a	n/a	n/a	27.72	27.92	0.20	0.72	neutral	9.84	10.91	1.07	10.87	+
South Magnetawan River d/s of Trout Lake	n/a	n/a	n/a	n/a	2.44	2.4	-0.04	-1.64	neutral	0.150	0.157	0.007	4.67	neutral
American Trail & Harris Lake Dams (Harris L., 10.5 km South Mag R.)	202.51	202.51	0.00	neutral	0.980	0.968	-0.012	-1.22	neutral	0.102	0.104	0.002	1.96	neutral
Harris Creek d/s of Harris Lake Dams	n/a	n/a	n/a	n/a	2.67	2.64	-0.03	-1.12	neutral	0.434	0.439	0.005	1.15	neutral
Watershed Outlet d/s of Highway 69 (at WSC 02EA011)	n/a	n/a	n/a	n/a	30.12	30.38	0.26	0.86	neutral	10.49	11.64	1.15	10.96	+

Social **Small Hydro Potential**	Average Annual Power Generation				
Reservoir, Lake or River Reach by Dam Location	Base Case Avg Annual Power (MWh)	Alt Case Avg Annual Power (MWh)	Change in Avg Annual Power (MWh)	Change in Average Annual Power (%)	Comparison = if % Chg is within 1% + if % Chg > 1% higher - if % Chg > 1% lower
Existing Burk's Falls Small Hydro Facility	4841	4903	62	1.3	+
Potential Site at Magnetawan Dam (Cecebe L.)	2968	2857	-111	-3.7	-
Potential Site at Knoepfli Dam (Ahmic L.)	7339	7422	83	1.1	+

Economic **Operational Costs**	MNR Annual Operational Cost				
Reservoir, Lake or River Reach by Dam Location	Base Case Avg Annual Cost ($)	Alt Case Avg Annual Cost ($)	Change in Avg Annual Cost ($)	Change in Average Annual Cost (%)	Comparison = if % Chg is within 5% + if % Chg > 5% lower - if % Chg > 5% higher
Control Dams (Pevensey, Ayres, Watts, Bernard, Magnetawan & Ahmic Dams)	$34,800	$34,400	$400	1.2	neutral

10 PRELIMINARY RECOMMENDED WATER CONTROL OPERATING PLAN

10 PRELIMINARY RECOMMENDED WATER CONTROL OPERATING PLAN

10.1 Overview

Alternative 4 was selected as the recommended water control operating plan for the Magnetawan River system based on the results of the alternative evaluation presented in Section 9. The recommended water control operating plan was deemed preliminary since at its development stage in the study process, there had been no opportunity for formal public consultation or MNR management-level review of the proposed operational changes. To provide a complete documentation of the evolution of the Magnetawan River Water Control Operating Plan, **the preliminary recommended water control operating plan presented in this section is the same as that presented to the public at the Summer 2002 open houses.** Using the feedback obtained from the public open houses, the results from field reconnaissance activities and MNR review input, several changes to the preliminary operational strategy were made. These aspects are discussed in Section 11. The revised Recommended Water Control Operating Plan is presented in Section 12.

10.2 Preliminary Recommended Water Control Operating Plan

The preliminary recommended water control operating plan proposes changes to the previously established operating rules at the Ministry's control dams, including Pevensey dam (Loon and Grass Lakes), Ayres dam (Perry and Hassard Lakes), Watts dam (Doe and Little Doe Lakes) and Bernard Lake dam (Bernard Lake), Magnetawan dams (Lake Cecebe and Midlothian Lake), and Feighens and Knoepfli dams (Ahmic, Beaver and Crawford Lakes). No operational changes are proposed for the Burk's Falls dam or any of the spill dams located on Wahwashkesh, Kashegaba, Gooseneck or Harris Lakes.

For the preliminary recommended operating plan, the general premise is to

- redefine the operating levels for each of the controlled dams/lakes to allow a 0.30 m fluctuation in normal water levels during the summer recreation season (0.25 m below the IRL and 0.05 m above the IRL)

- maintain a minimum specified discharge from each of the control dams/lakes such that the minimum summer discharge objective of 6 m^3/s will be provided downstream of Ahmic Lake for 95% of the time

- maintain operations for flood management by lowering water levels prior to the spring freshet and capturing flood water to the extent possible (within NOZ) at each of the control dams during the freshet.

Table 10.1 summaries the specific operational protocols proposed at each of the control dams. Figures 10.1 to 10.4 depict the preliminary recommended operating regimes for the control dams, along with the expected changes to average weekly water levels as predicted by the ARSP model based on the 83 years of flow data. Although no operational changes are proposed for the spill dams, graphs of the self-regulated water level ranges are provided in Figures 10.4 to 10.6 and discussed in Section 10.2.8.

10.2.1 Pevensey Dam (Loon Lake, Grass Lake)

The proposed operating range for Pevensey dam is shown in Figure 10.1 and would involve an increase in the IRL from 29.95 m to 30.05 m for the summer recreation period. Both the NOZ and operating levels remain unchanged through the remainder of the year. A minimum flow demand of 0.2 m^3/s was established to enhance low flows in the river reach extending downstream of Pevensey dam to Sand Lake.

Average lake water levels are predicted to increase very slightly by 0.01 m through the summer recreation months, but otherwise will remain unchanged. The slow release of the additional lake storage as a means to maintain the minimum flow objective is expected to provide a slight increase in low flows downstream of the dam.

Implementation of this operating method will continue to preserve brook trout rearing habitat in both Loon and Grass Lakes, maintain summer water levels on the lakes within an acceptable range for recreational uses, and reduce the frequency of low flows during drought periods.

10.2.2 Ayres Dam (Perry Lake, Hassard Lake)

The proposed operating range for Ayres dam is shown in Figure 10.1 and would an increase in the lower bound of the NOZ from 335.00 m to 335.05 m during the summer recreation season. The IRL was changed from 335.14 m to 335.30 m for the summer season up to September 1. After September 1, the IRL is gradually brought back down to its Base Case level of 335.15 m by October 14 to reduce potential flood problems in the fall. A minimum flow demand of 1.1 m^3/s was established to enhance flows directly downstream of Ayres dam.

Average water levels are predicted to increase by 0.16 m during the months of May and June, but will then begin to decrease during the remainder of the summer recreation season as the lake is drawn down. On average, the lake levels are expected to increase 0.08 m through the summer recreation months, but otherwise will remain unchanged. The slow release of the additional lake storage

Table 10.1
Proposed Operational Changes to Control Dams

Control Dam (Lake)	Normal Operating Zone (Recreational Season)						Ideal Regulated Level (Recreational Season)		Minimum Flow Release (95% Exceedance)	
	Upper Limit		Lower Limit		Range					
	Existing (m)	Proposed (m)	Existing (m)	Proposed (m)	Existing (m)	Proposed (m)	Existing (m)	Proposed (m)	Existing* (m^3/s)	Proposed (m^3/s)
Pevensey Dam (Loon Lake, Grass Lake)	30.1	30.1 (No Change)	29.8	29.8 (No Change)	0.30	0.30 (No Change)	29.95	30.05	0.1	0.2
Ayres Dam (Perry Lake, Hassard Lake)	335.35	335.35 (No Change)	335.00	335.05	0.35	0.30	335.14	335.30	0.9	1.1
Watts Dam (Doe Lake, Little Doe Lake)	294.40	294.40 (No Change)	293.80	293.90	0.60	0.50	293.95	294.20	1.6	1.9
Bernard Lake Dam (Bernard Lake)	329.55	329.60	329.35	329.35 (No Change)	0.20	0.25	329.45	329.55	0.1	0.1
Burk's Falls Dam (Magnetawan River)	291.12 (No Change)	291.12 (No Change)	290.75 (No Change)	290.75 (No Change)	0.37 (No Change)	0.37 (No Change)	290.90	290.90 (No Change)	2.3	2.7
Magnetawan Dams (Cecebe Lake, Midlothian Lake)	282.76	282.90	282.66	282.60	0.10	0.30	282.71	282.85	3.0	3.7
Feighens and Knoepfli Dams (Ahmic Lake, Crawford Lake, Beaver Lake)	279.46	279.60	279.36	279.31	0.10	0.29	279.41	279.56	2.7	6.0

* Minimum flow releases estimated from flow duration curves. Existing minimum flows provided for comparison purposes. Under the existing operating conditions, no specific operational objective for a specific minimum flow release has been quantified. Minimum flow releases from the dams are principally a result of stop-log leakage through the dams, except for Bernard Lake dam which has valve operated outlet pipe.

as a means to maintain the minimum flow objective is expected to provide a slight increase in low flows downstream of the dam.

Implementation of this operating method will maintain adequate lake levels for water taking for fire protection for the Town of Kearney, maintain summer water levels on the lakes within an acceptable range for recreational uses, and reduce the frequency of low flows during drought periods. An additional benefit not evident in Figure 10.1, but identified in Section 8.5.2 will be the reduction in the frequency of high water levels on the lake during spring freshet.

10.2.3 Watts Dam (Doe Lake and Little Doe Lake)

The proposed operating range for Watts dam is shown in Figure 10.2 and would involve an increase in the lower bound of the NOZ from 393.80 m to 293.90 m during the summer recreation season. The IRL was changed from 293.95 m to 294.20 m during the summer season up to September 1. After September 1, the IRL is gradually brought back down to its Base Case level of 293.95 m by October 14 to reduce potential flood problems in the fall.

Operating constraints on the dam relate to flood storage during high flow periods, flood prevention in the Town of Katrine and in Doe Lake, and maintaining boat navigation between Doe Lake and Little Doe Lake, and between Little Doe Lake and the Magnetawan River. While no specific constraints exist for fish and wildlife habitat, there are general minimum flow requirements for water quality downstream and lake levels must be maintained within an acceptable range for recreational use.

Implementation of this operating method could not reduce the spring high water levels on the Magnetawan River reach upstream of the dam and on Doe Lake. These high levels are a result of the naturally restricted capacity of the Magnetawan River below Watts dam. The proposed operational changes would provide a slight increase in minimum flows downstream of the dam, thereby maintaining existing water quality conditions. The moderate increase in average summer water level of 0.20 m would help ensure that boat navigation between the two lakes and the river is maintained. However, several low-lying docks and docks in need of repair would be susceptible to the 0.20 m lake level increase and would necessitate raising the structures. Further review and consultation with shoreline residents is recommended in this regard.

10.2.4 Burk's Falls Dam (Magnetawan River)

The operating range for the Burk's Falls dam is shown in Figure 10.2. No operational changes are proposed for the dam due to the lack of storage upstream of this dam and the limited operational range, which must be maintained for power generation at the small hydro facility. In this regard, maintaining adequate flow for power generation constitutes the main operating constraint for this dam. In addition, provision for a minimum flow spill over the stop logs during summer low flow periods for scenic viewing from the covered bridge is recognized as an objective. Based on the modeling results, these objectives have been met and in fact, enhanced by the recommended strategy, through increased minimum flows, which provide a slight increase in hydro potential at this site.

10.2.5 Bernard Lake Dam (Bernard Lake)

The proposed operating range for Bernard Lake dam is shown in Figure 10.3 and would involve an increase in the top of the NOZ from 329.55 m to 329.60 m during the summer recreation season. From mid-March to mid-April, the IRL was dropped to 328.95 and the lower bound of the NOZ was changed from 328.95 m to 328.90 m to help reduce spring flood levels on the lake. In addition, the IRL was raised from 329.45 m to 329.55 m for the summer period. A minimum flow demand of 0.2 m^3/s was established to enhance low flows in Stirling Creek downstream of the dam.

The main operating constraint is a minimum flow requirement for the maintenance of brook trout rearing habitat downstream of the dam in Stirling Creek. For the most part, flows will remain unchanged; however summer flows are predicted to increase slightly. On average, therefore some additional flow may be available over the dam and into Stirling Creek. There is also a request by cottagers at the north end of the lake to maintain water levels below 329.50 m to maintain a dry beach area. A slight increase of 0.05 m in average summer lake level is predicted, but on average, the lake level will be approximately 329.44 m through the summer recreation months. An additional benefit not evident in Figure 10.3, but identified in Section 8.5.5 would be the reduction in the frequency and magnitude of high water levels on the lake during spring freshet.

10.2.6 Magnetawan Dams (Lake Cecebe)

The proposed operating range for the Magnetawan dams is shown in Figure 10.3 and would involve raising the top of the NOZ from 282.76 m to 282.90 m and lowering the bottom of the NOZ from 282.66 m to 282.60 m during the summer recreation season. The IRL was raised from 282.71 m to 282.85 m for the

summer period up to September 1. After September 1, the top level of the NOZ and the IRL were gradually lowered to their existing Base Case levels by October to reduce potential flood problems in the fall. In addition, the IRL was adjusted during the spring to maintain water low levels until the freshet.
The main concerns regarding the operation of the Magnetawan dams focused on potential fall and spring flooding problems, preservation of walleye spawning beds immediately downstream of the dams and maintenance of acceptable summer recreation levels on Cecebe Lake.

Maximum daily water levels and flows indicate no changes to the existing flooding conditions; therefore flood management capability is expected to continue as is, although the frequency of some of the lower magnitude flood events will be reduced. A predicted minimum flow increase over the dams will contribute to the preservation of flow over the walleye spawning beds in the shallows immediately downstream of the dams. The moderate increase in average summer water level of 0.08 m for Cecebe Lake is viewed as beneficial for existing water-based tourism and recreation uses. However, average water levels are predicted to increase by 0.14 m during the months of May, June and July. Several low-lying docks and docks in need of repair would be susceptible to the 0.14 m lake level increase and would necessitate raising the structures. It is likely that numerous additional shoreline structures would be susceptible to wave action with the 0.14 m increase in lake level. Further review and consultation with shoreline residents is recommended in this regard.

10.2.7 Feighens and Knoepfli Dams (Ahmic Lake)

The proposed operating range for Feighens and Knoepfli dams is shown in Figure 10.4 and would involve raising the top of the NOZ from 279.46 m to 279.60 m and lowering the bottom of the NOZ from 279.46 to 279.31 m for the summer recreation season. The IRL was raised from 279.41 m to 279.56 m for the summer period up to September 1. After September 1 the top level of NOZ and the IRL are gradually lowered to their existing Base Case levels by October to reduce potential flood problems in the fall. In addition, the IRL was adjusted during the spring freshet to maintain low water levels until the freshet.

The main concerns regarding the operation of the dams focused on potential fall and spring flooding problems, preservation of walleye spawning conditions below the Magnetawan dams, maintenance of acceptable summer recreation levels on Ahmic Lake, and a reduction in the fluctuation of water levels and flows in areas downstream of the dams. The fluctuations relate to the preservation of walleye spawning beds and other aquatic habitat downstream of the dams as well as maintaining water levels in Poverty Bay for summer recreation purposes.

Maximum daily water levels and flows indicate no changes to the existing flooding conditions; therefore flood management capability is expected to continue as is. The predicted increase in minimum summer low flows will likely preserve the spawning beds downstream of Feighens and Knoepfli dams and could contribute to a moderate improvement to flow conditions and possibly low water levels in Poverty Bay and downstream during drought conditions.

Average water levels are predicted to increase by 0.15 m during the month of July, but would be no different than those experienced in May following the spring freshet. After July, lake levels will then begin to decrease during the remainder of the summer recreation season as the lake in drawn down. On average, the lake level is expected to increase 0.07 m through the summer recreation months. The increase in average summer water level of 0.07 m for Ahmic Lake is viewed as beneficial for existing water-based tourism and recreation uses, and would also contribute to the preservation of the walleye spawning beds immediately downstream of the Magnetawan dams during late May and early June. However, several low lying docks and boathouses in need of repair due to past settling of support cribs would be susceptible to the 0.15 m summer lake level increase and would necessitate raising the structures. It is likely that numerous additional shoreline structures would be susceptible to wave action with the 0.15 m increase in lake level. Further review and consultation with shoreline residents is recommended in this regard.

10.2.8 Spill Dams

The remainder of the dams on the Magnetawan River system are self-regulated spill dams. These are Wahwashkesh Lake, Gooseneck Lake, Kashegaba Lake, Harris Lake and American Trail dams. No operational changes are proposed for these spill dams. Because of the self-regulating nature of these dams, the lake levels are established by the amount of flow spilling over the dams. An increase in flow results in an increase in lake level. The self-regulating water level ranges and the changes to water levels resulting from increased flow from the upstream control dams are depicted in Figures 10.4 to 10.6.

As shown in Figure 10.5, the increase in minimum summer flows will result in a slight 0.05 m increase in the Wahwashkesh Lake level during low flow periods. This may provide some marginal ecological benefit for near shore areas that would otherwise be exposed and dry out during droughts. For normal flow conditions, no significant increase in the summer water level is predicted for Wahwashkesh Lake and therefore, existing tourism and recreation uses will be maintained as they are. The minimum flow increases are expected to provide noticeable benefit through the Magnetawan River reaches extending downstream from Wahwashkesh Lake to the watershed outlet at Byng Inlet. These effects may be beneficial to aquatic and riparian habitat and may also address stagnant water and recreational concerns. As shown in Figure 10.5, neither Kashegaba Lake nor Gooseneck Lake will experience any changes in flow or level given their location off-line from the river -- conditions will remain unchanged from the present situation. As for the Harris Lake and American Trail dams located on the South Magnetawan River, downstream of the flow split at Trout Lake, these locations will experience no significant changes to flows and/or water levels. This is illustrated by Figure 10.7, which shows that no measurable change on Harris Lake water levels compared to the existing conditions. In this regard, concerns related to low summer river levels and difficult boat access from the Magnetawan River into the south branch would not be addressed by the proposed operational changes at the upstream control dams.

10.3 Net Environmental Effects

The following section summarizes the overall expected net environmental, social and economic effects associated with the implementation of the recommended water control operating plan. The identification of net environmental effects provides an important guide to those aspects of the environment where significant changes are expected and/or where environmental sensitivities may be present. Since these areas are anticipated to exhibit the greatest change in terms of flows and/or water levels, they may warrant further review prior to the plan's implementation and may become priority areas for environmental monitoring.

Net environmental effects were identified based on the predicted effects identified from the alternative evaluations conducted in Section 9. Since the effects identified in Section 9 were largely the result of numerical criteria applied uniformly to the environmental indicators, the effects were reviewed herein based on the present understanding of the Magnetawan River system environment. In many instances, the predicted effects are small and may not result in a discernable or measurable alteration to the existing environment. Such examples may include a ±5% increase in flow or a ±0.05 m increase in water level. In other instances, the predicted effects are moderate and are anticipated to result in a measurable change to some aspect of the environment. Such examples include a ±10% increase in flow or a ±0.15 m increase in water level.

10.3.1 Natural Environment

Aquatic and riparian habitat was the primary attribute used to assess impacts to the natural environment. Average annual minimum weekly reservoir levels and average annual minimum weekly river reach flows were the two criteria used to measure these potential impacts. Annual minimum reservoir levels and flows measured on a weekly basis provided information over four seasons. The model compared spring minimum levels to spring minimum levels, summer-to-summer etc to avoid the prediction of large changes in water levels that were really the result of a comparison of low winter levels and higher spring or summer levels. This method of analysis allowed the assessment of potential impacts to spawning habitat of fall-spawning species such as lake trout and brook trout, spring spawners such as walleye as well as impacts to wetlands and other riparian habitats that are inundated in the spring. A decrease in water level was perceived as a negative effect. For the recommended strategy, a change in water level was predicted at Bernard Lake, but no other changes were predicted throughout the system. The current water level management regime appears to be favourable for the maintenance of good fisheries and the predicted spring decrease of 0.1 m at Bernard Lake to reduce spring flood levels is unlikely to affect critical areas such as spawning, nursery and rearing habitat. Modeling results for average minimum flows predicted that flows will increase slightly or remain unchanged at all reservoirs, lakes and river reaches within the study area on an annual basis. Overall, the potential effects resulting from the minimum flow increases for the preferred strategy will likely result in a net benefit to aquatic and riparian habitat through the system.

10.3.2 Social Environment

Flood management, tourism/recreation and small hydro potential were the attributes selected to assess potential impacts of changes in dam operations to the social environment.

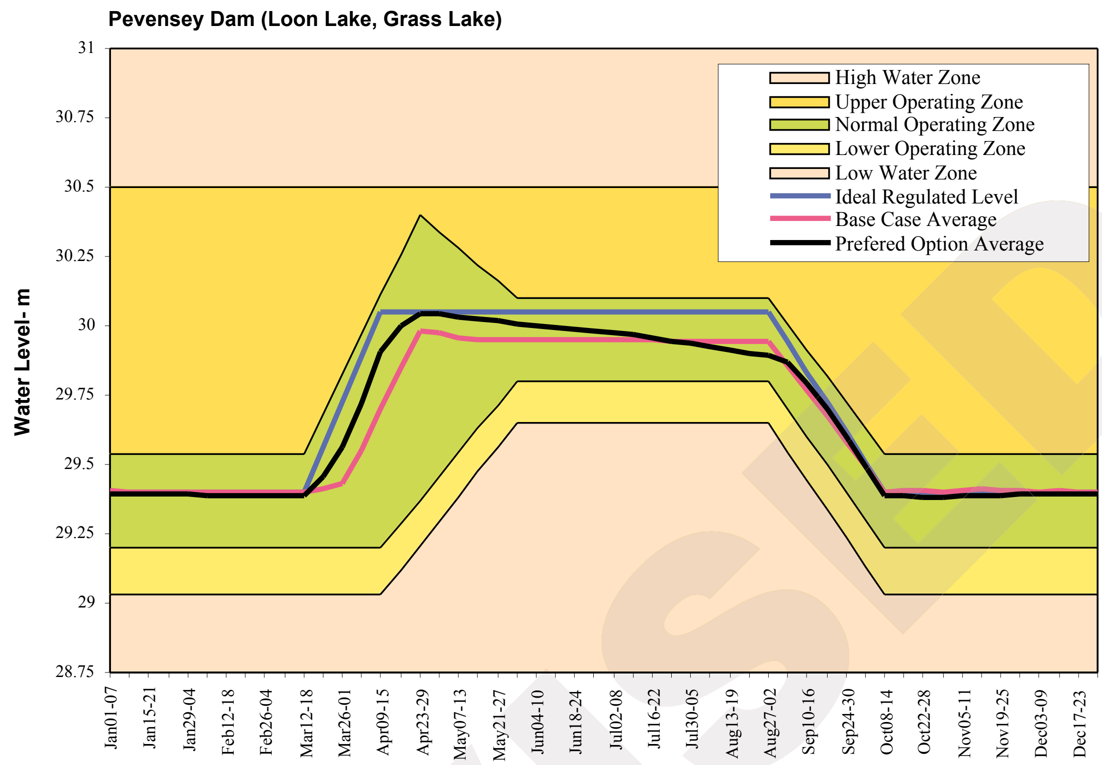
Impacts to flood management capability as a result of changes to maximum water levels and flows were predicted by the computer model. The implementation of the recommended strategy is predicted to result in only minimal changes to maximum daily reservoir levels and river reach flows. A slight decrease in the frequency and magnitude of high water levels was predicted at both Bernard Lake (0.15 m) and the 4.5 km Magnetawan River reach upstream of Burk's Falls dam (0.20 m) which translates to a potential improvement to flood management capability at these locations. In addition, the frequency of high water levels upstream of Ayres dam on Perry and Hassard Lakes were predicted to decrease during spring freshet. Similarly, the decreases in maximum flows predicted downstream of Pevensey dam (39%) and Bernard Lake dam (12%) may have a positive impact on flood management. The slight increase in maximum flow predicted downstream of Ayres dam (10%) is not expected to significantly increase the flood risk along the Magnetawan River reach extending to Watts dam since the water level changes predicted upstream of Watts dam do not exhibit a measurable increase over the Base Case. Nevertheless, since low-lying areas are present along this reach near Katrine, the potential flooding effect of the Ayres dam flow increase should be reviewed further and alterations to the proposed Ayres dam operations made if necessary.

Impacts to the tourism/recreation attribute focused on changes to water level and flow through the summer season (May 15 to October 15). An increase in the average recreation season water level equal to or beyond 0.15 m was considered a negative impact to fixed structures such as docks and boathouses, and possibly shoreline properties. A decrease in water level of >0.05 m was also predicted to negatively impact shoreline properties and may compromise water-based recreational activities, including boat launch facilities, boat access in shallow lake areas or connecting channels as well as certain docks and boathouses. Based on the applied indicator criteria, the evaluation results indicate that average summer lake levels will increase for the 3.2 km Magnetawan River reach upstream of Ayres dam, which includes Perry and Hassard Lakes (0.08 m), Bernard Lake (0.05 m), Cecebe Lake (0.08 m) and Ahmic Lake (0.07 m). Although these effects are considered to be positive when considering the entire May to October recreation season, Cecebe and Ahmic Lakes could experience increases of 0.15 m and Doe Lake a 0.20 m increase during the initial summer months prior to the lake draw downs. Pending the findings of a shoreline structure reconnaissance, these levels could negatively affect low-lying docks and boathouses on these lakes unless the structures were to be raised. **Further review and consultation with shoreline residents and cottage associations is recommended as part of the planned Summer 2002 public open houses.** In terms of the river reach flows, implementation of the recommended strategy will only slightly affect tourism/recreation uses in the upper, mid-upper or middle reaches of the watershed. The impacts were mainly predicted to be small increases in the minimum droughts flows, all of which are considered to have positive effects on tourism/recreation uses. Downstream of Ahmic Lake, the model predicts a net increase in flow through the Magnetawan River reaches below the flow split. No flow increases are likely to occur through the South Magnetawan River reaches.

The main concern regarding the small hydro potential attribute focused on maintaining or increasing river flows and water levels upstream of the existing small hydro station at Burk’s Falls and the two potential locations at Magnetawan and Knoepfli dams. An increase in flow at these locations of any magnitude is perceived as an increase in the ability to generate power. The increases of nearly 1% in power generation that are predicted at the existing facility at Burk’s Falls and the potential facility at Knoepfli dam are considered a positive effect. A decrease in average annual power generation of 3.7% was predicted for the small hydro potential at the potential Magnetawan damsite. Since no hydro facility exists or is currently planned at this site, this effect is not viewed as significant.

10.3.3 Economics

The implementation of the recommended plan is predicted to result in only minimal changes to the cost of operations of the control dams. In fact, at some of the dams, the strategy of maintaining higher ideal regulated levels on the lakes will result in fewer manipulations of the stoplogs and therefore reduced costs.



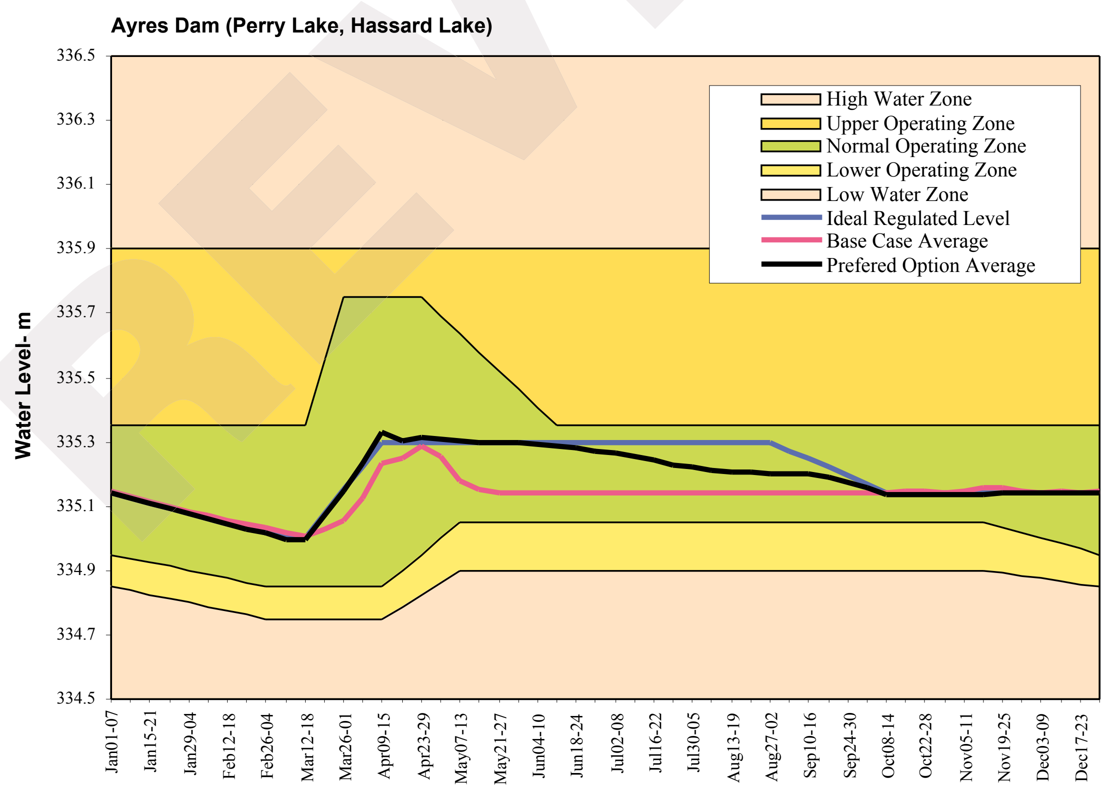
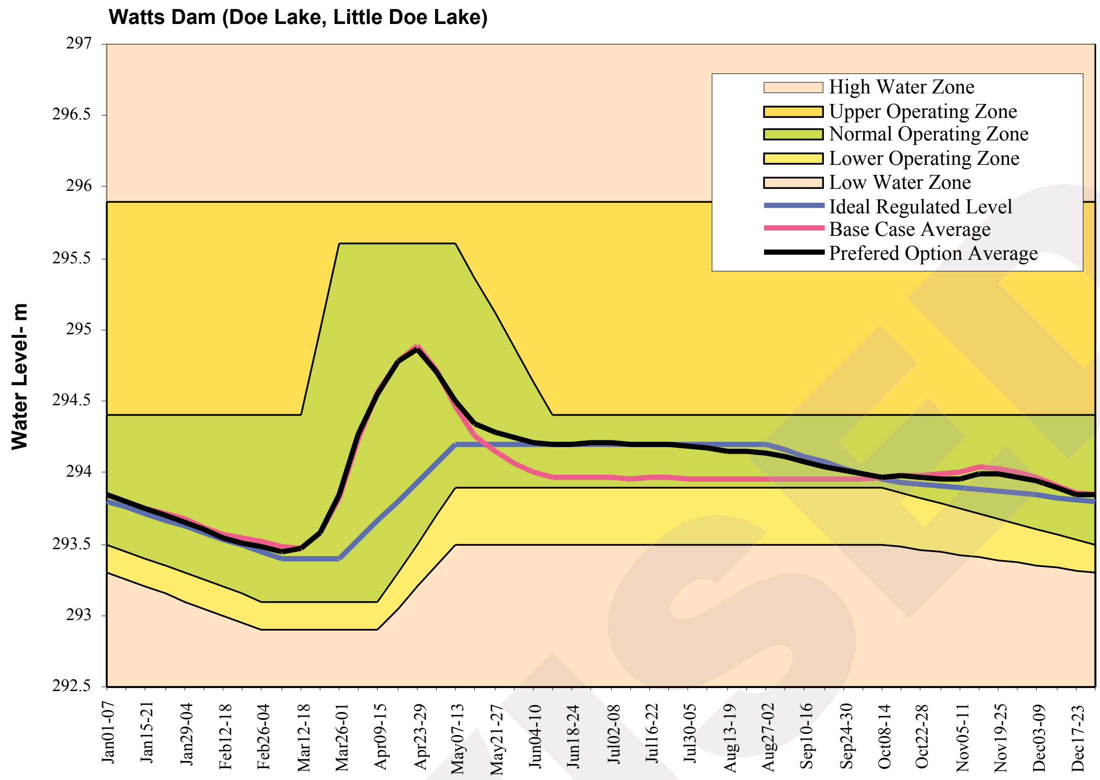


Figure 10.1
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan

Recommended Operating Range for Pevensey Dam and Ayres Dam

ACRES International



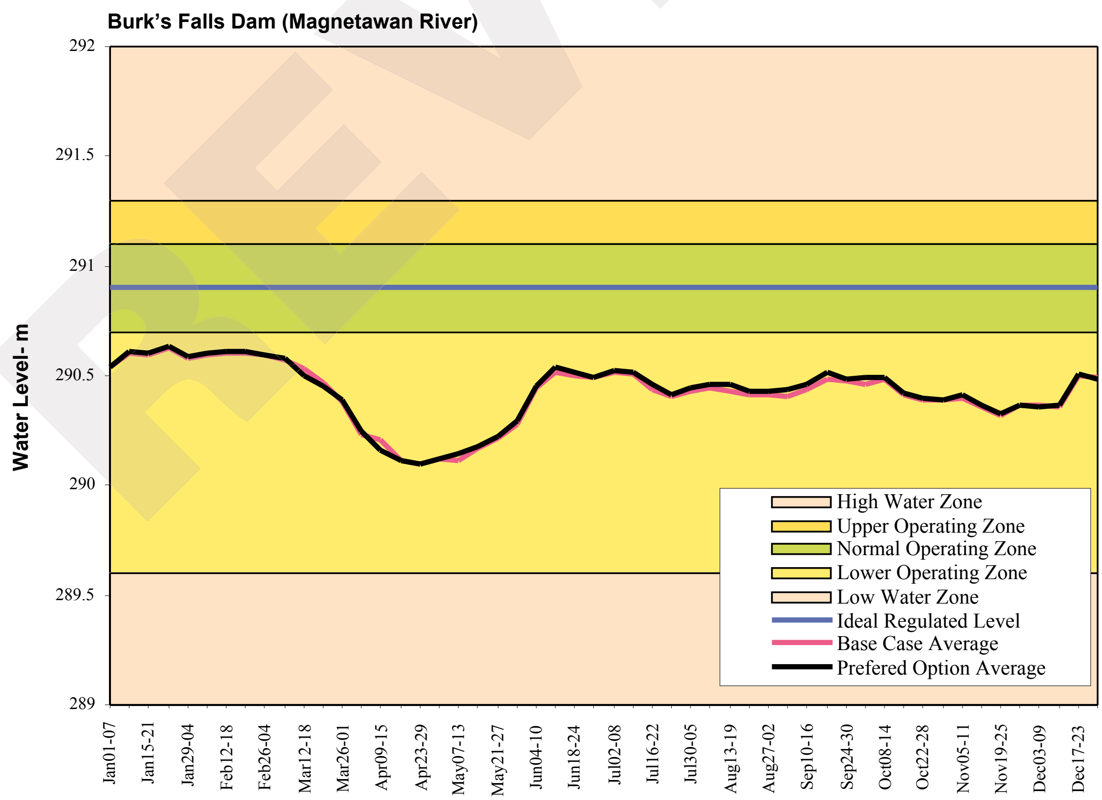
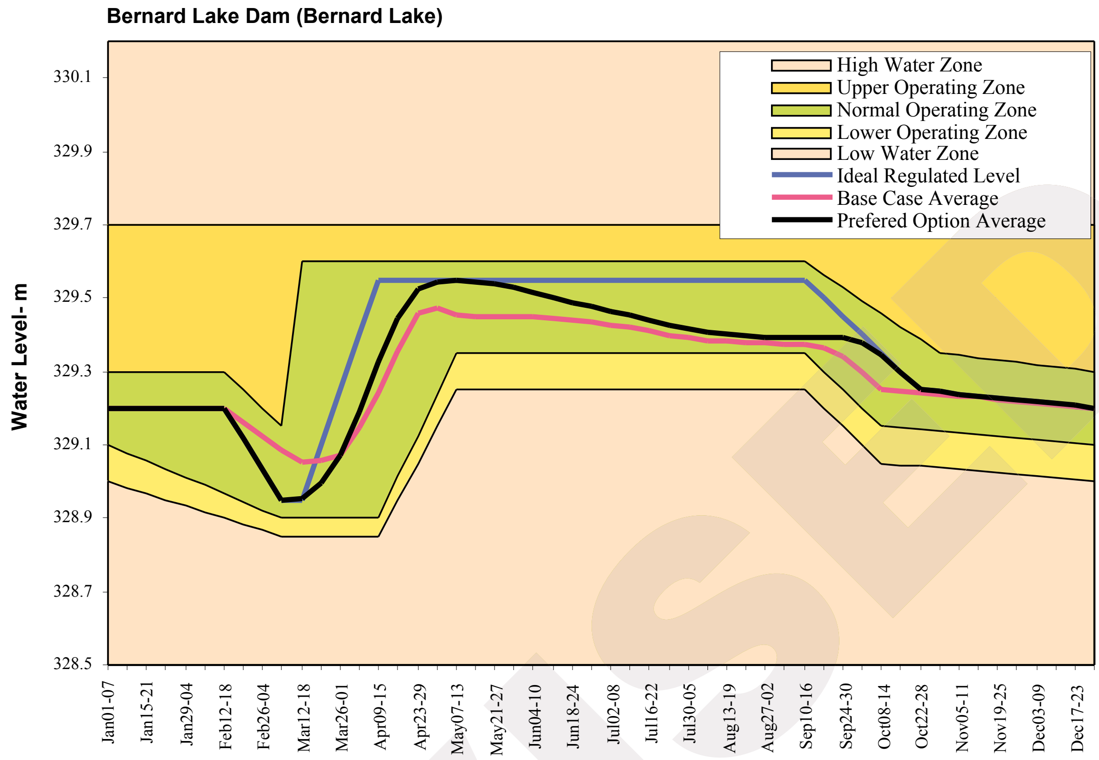


Figure 10.2
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Recommended Operating Range for Watts Dam and Burk's Falls Dam

ACRES International



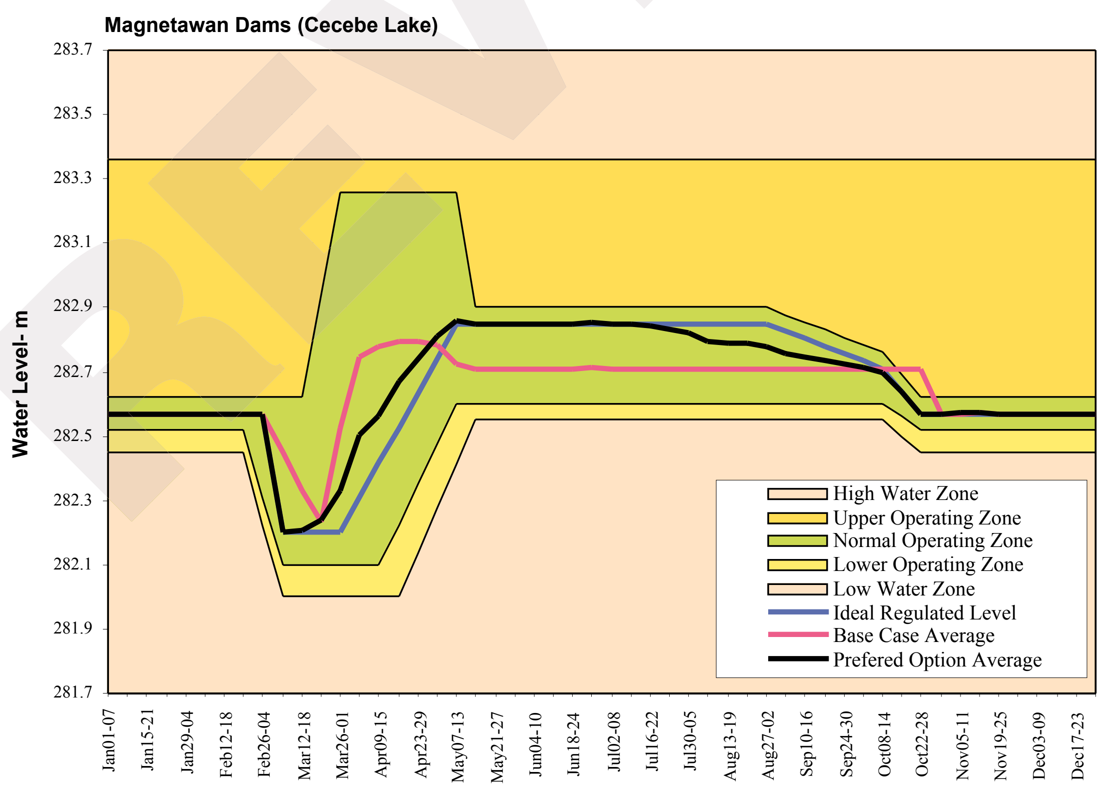
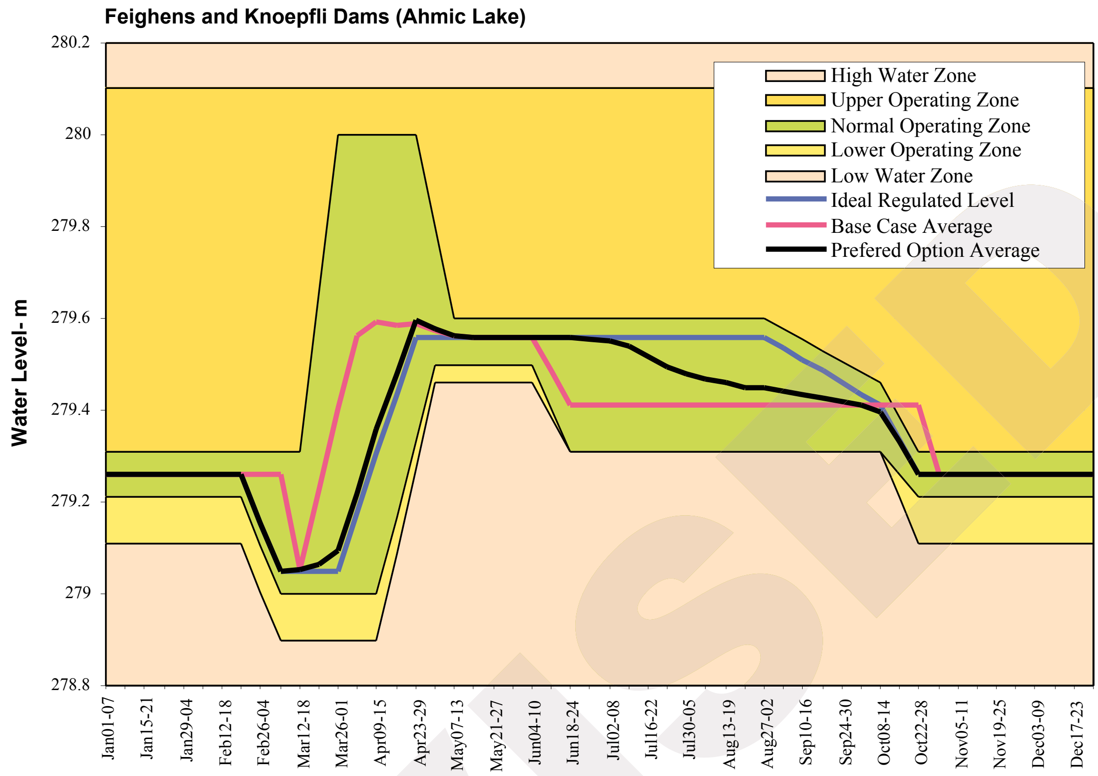


Figure 10.3
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Recommended Operating Range for Bernard Lake Dam and Magnetawan Dams

ACRES International



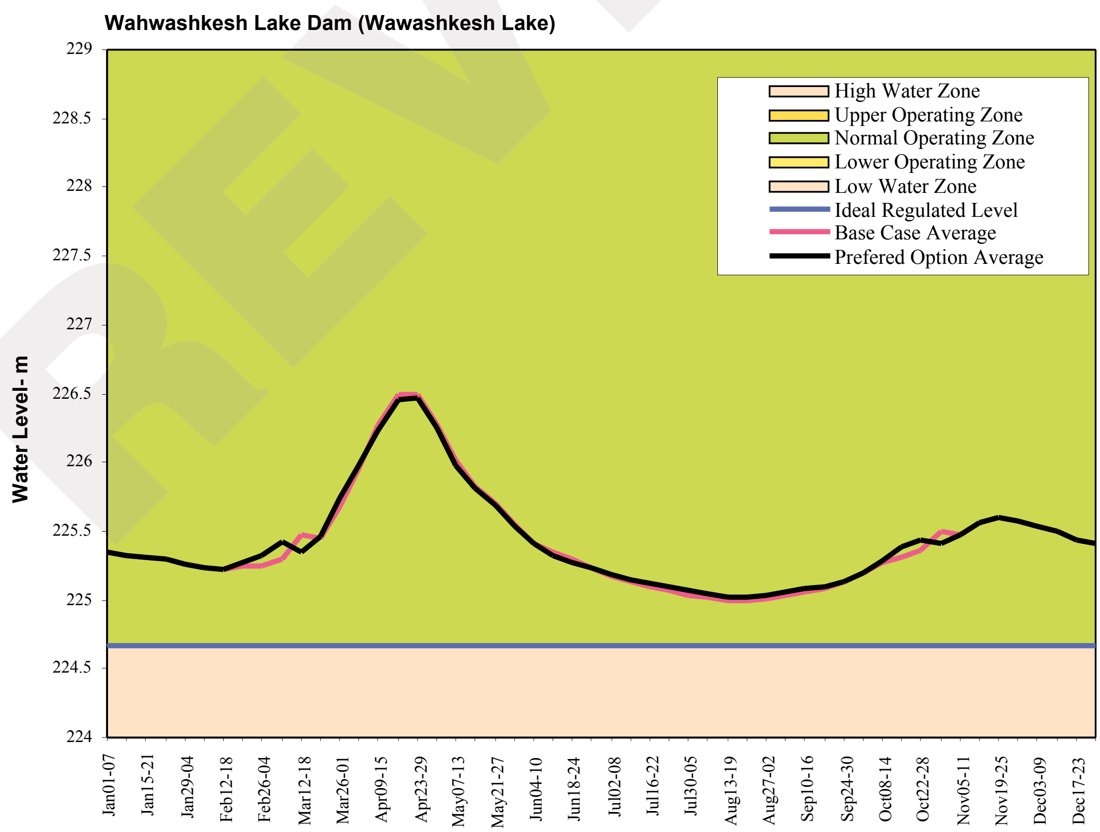
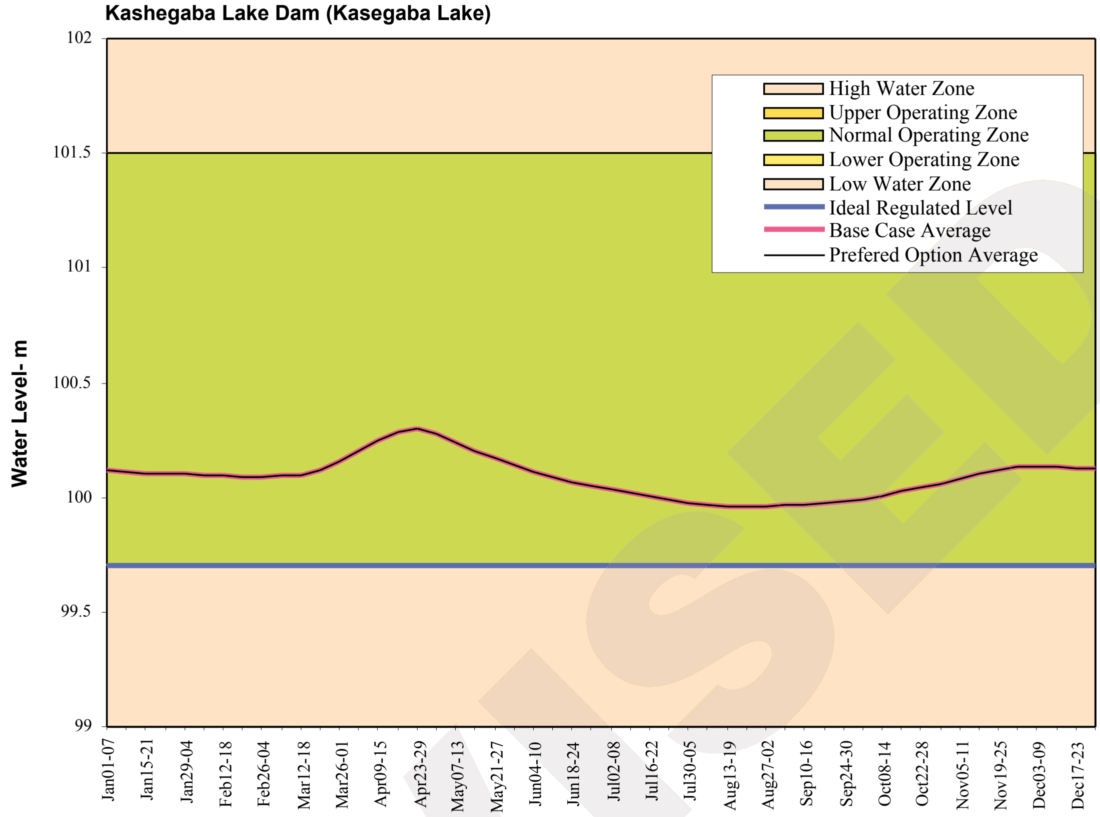


Figure 10.4
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan

Recommended Operating Range for Feighens and Knoepfli Dams and Non-Operable Range for Wahwashkesh Lake Dam

ACRES International



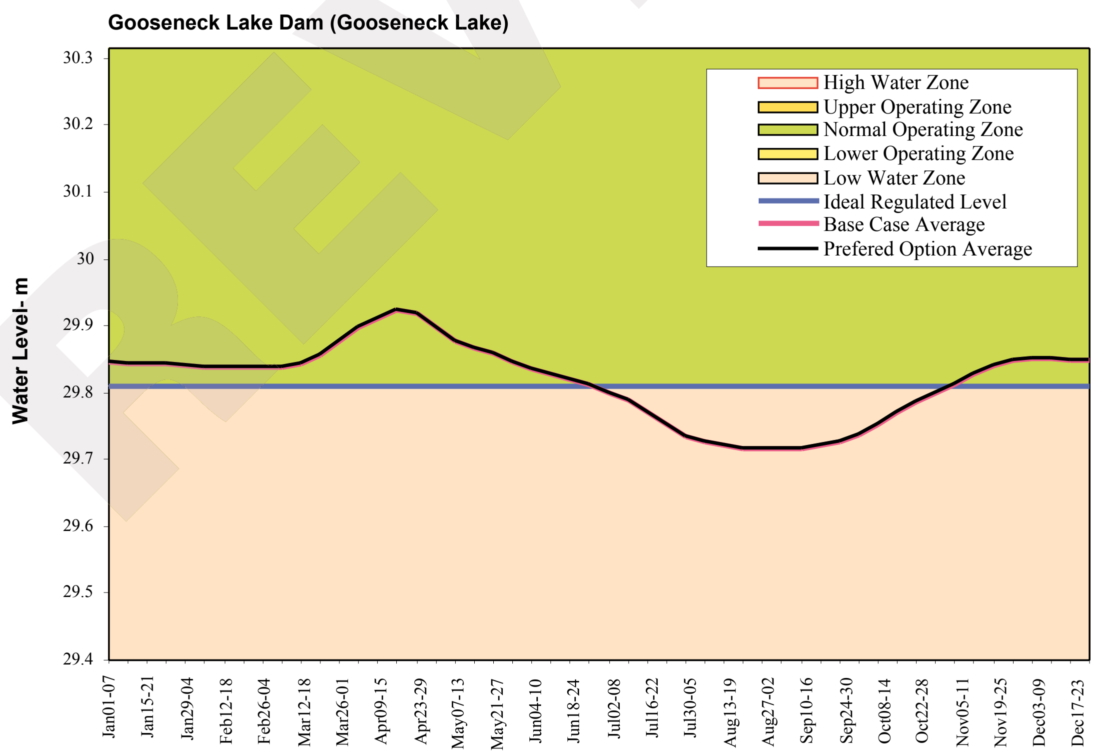


Figure 10.5
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Recommended Non-Operable Range for Kashegaba Lake Dam and Gooseneck Lake Dam

ACRES International

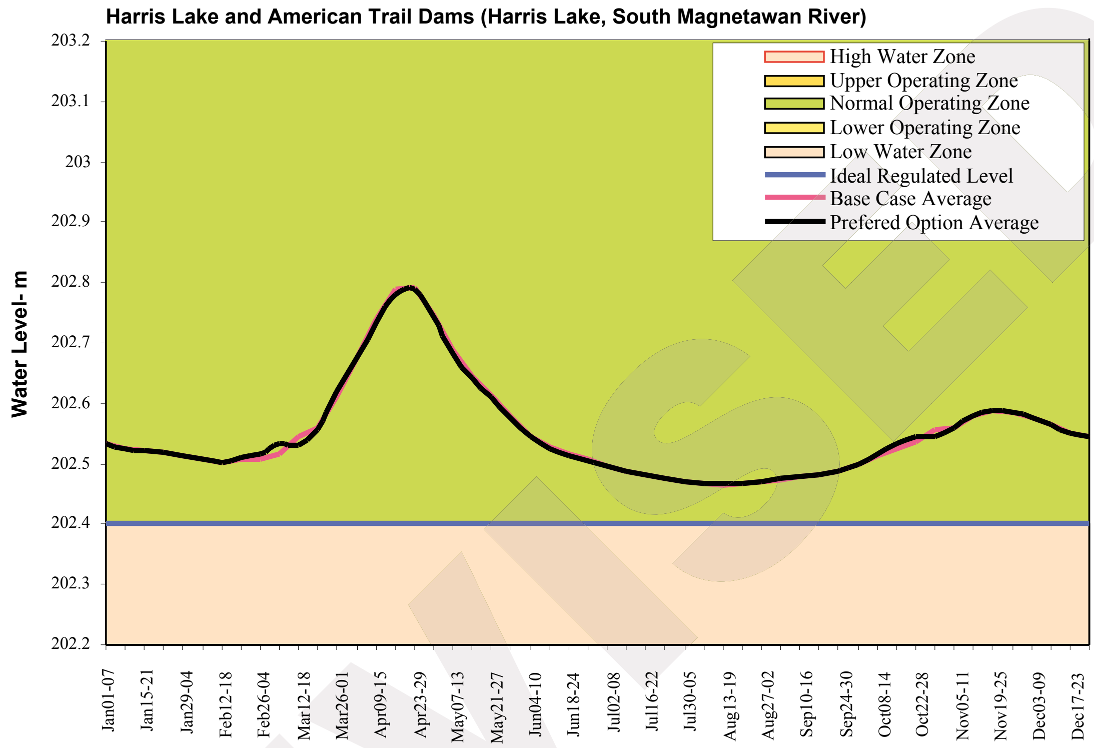


Figure 10.6
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Recommended Non-Operable Range for Harris Lake Dams and American Trail Dam

11 REFINEMENTS TO PRELIMINARY RECOMMENDED WATER CONTROL OPERATING PLAN BASED ON FIELD INVESTIGATIONS, PUBLIC CONSULTATION AND MNR REVIEW

11 REFINEMENTS TO PRELIMINARY RECOMMENDED WATER CONTROL OPERATING PLAN BASED ON FIELD INVESTIGATIONS, PUBLIC CONSULTATION AND MNR REVIEW

11.1 Overview

Section 10 presents the preliminary recommended water control operating plan for the Magnetawan River system. Using the results obtained from the Spring/Summer 2002 field reconnaissance activities, feedback obtained from the Summer 2002 public open houses and MNR review input, several changes to the preliminary operational strategy were made. These aspects are discussed below as follows:

- Shoreline Structure Reconnaissance
- Knoepfli Dam Flow Test
- Public Consultation
- MNR Review
- Summary.

The revised Magnetawan River Water Control Operating Plan is presented in Section 12.

11.2 Shoreline Structure Reconnaissance

A reconnaissance of shoreline structures situated on Ahmic Lake (Feighens and Knoepfli dams), Cecebe Lake (Magnetawan dams) and Doe Lake (Watts dam) was conducted in May 2002 to characterize the number and type of shoreline structures on each lake and to assess the relative number of structures that could potentially be flooded by an increase in the summer regulated water level on the lakes. Based on the results of the ARSP computer modeling of the preliminary recommended water management strategy (i.e., Alternative 4), late-spring/early-summer water levels on Doe, Cecebe and Ahmic Lakes were predicted to increase by 0.25 m, 0.14 m and 0.15 m, respectively. These water level increases were associated with the water management objective to improve ecological conditions in the downstream reaches of the Magnetawan River (see below). Given this, there was concern on behalf of the Project Team and the PAC that the water level increases may not be acceptable to shoreline residents situated on the lakes.

Members of the Project Team conducted the shoreline structure reconnaissance by boat. The participants made visual observations of the numbers and types of shoreline structures including boathouses, fixed crib docks, pole dock and floating docks. In addition, photographs were taken of various candidate structures on Doe, Cecebe and Ahmic Lakes. For each structure, a visual assessment of its potential to be affected by the anticipated water level increases was made. A total of 860 structures were assessed on the lakes. The results of the structure reconnaissance were reviewed by the PAC at a subsequent meeting. A detailed discussion of the shoreline structure reconnaissance is contained in Appendix H1.

Based on the findings, it was evident that the proposed water level increases on the lakes could flood an estimated 48 shoreline structures or 6% of the 860 structures assessed. However, these impacts would increase significantly to 282 shoreline structures or 33% of the 860 structures assessed based on the assumption of 0.15 m high waves acting on top of the proposed water level increases. As a means to avoid negative impacts to shoreline structures, the Project Team and the PAC concluded that the preliminary recommended water management strategy should be revised to maintain the currently established upper limits of the summer NOZs on Doe, Cecebe and Ahmic Lakes at 294.40 m, 282.76 m and 279.46 m, and the currently established summer IRLs at 293.95 m, 282.71 m and 279.41 m, respectively.

11.3 Knoepfli Dam Flow Test

A flow test at the Knoepfli dam was conducted in July 2002 to confirm the benefits of maintaining a minimum summer flow of 6 m^3/s, 95% of the time in the Magnetawan River reach extending downstream of Ahmic Lake. This flow had been established in the preliminary recommended water management strategy based on the results of the ARSP computer modeling as a possible target flow to address the water management objectives for low flow augmentation in the downstream reaches of the Magnetawan River during periods of low flows. The targeted minimum flow of 6 m^3/s was directly linked to the extent to which the water levels on Doe, Cecebe and Ahmic Lakes would have to be increased during late-spring/early-summer as a means to store water for release during dry periods. As such, there was concern on behalf of the Project Team and the PAC that an unacceptable trade-off between the social uses of the lakes subject to water level increases versus the ecological benefits of low flow augmentation in the river reaches may ensue. Hence, it was necessary to confirm the potential ecological benefits of the 6 m^3/s flow and assess whether a lower flow could achieve the same benefits.

Members of the Project Team and the PAC conducted the flow test. The participants made visual assessments of the river conditions and took photographs at various locations between the Knoepfli dam and Maple Island. Photographs were taken at flows of 3 m^3/s and 6 m^3/s, and comparisons were made to photographs taken by MNR during August 2001, when the river flows were estimated to be approximately 1.5 m^3/s. The results of the flow test were reviewed by the PAC at a subsequent meeting. A detailed discussion of the flow test and photographs of the river under various flow conditions are contained in Appendix H2.

Based on the findings, it was evident that a flow of 6 m^3/s did not result in a significant difference in the 'ecological health' of the river in terms of water levels, wetted areas and/or flow velocities, than those conditions observed with a flow of 3 m^3/s. However, compared to the 2001 photographs of the river at the 1.5 m^3/s flow, a significant improvement in the apparent health of the river was evident. The Project Team and the PAC concluded that the preliminary recommended water management strategy should be revised to reflect a minimum summer flow target of 3 m^3/s in the Magnetawan River reach extending downstream of Ahmic Lake.

11.4 Public Consultation

A second series of Public Open Houses were held August 9, 10 and 11, 2002 in Burk's Falls, Magnetawan and Byng Inlet respectively, to present the various components of the draft Magnetawan River Water Control Operating Plan. At the open houses, specific emphasis was placed on the presenting and discussing the proposed operational changes to the controlled lakes. A total of 116 people attended the open houses with 27 people attending the Burk's Falls open house, 76 attending the Magnetawan open house and 13 people attending the Byng Inlet open house. Questionnaires were distributed to the public and information was provided on the project website to solicit feedback from the public. A total of 108 questionnaires and letters were received from the public.

Table 11.1 summarizes the level of public support for the proposed operational changes that were presented. It is important to note that the results reflect communication to the public that no increases to the Bernard Lake rule curve would occur as a consequence of the Plan. As evident by Table 11.1, there was moderate public support for the draft Magnetawan River Water Control Operating Plan. 67 respondents, or 62% of the total number of questionnaires received, indicated 'strong support' or 'some support' for the Plan's initiatives. Not surprisingly, the majority of respondents who were supportive of the Plan are located on the Magnetawan River downstream of Ahmic Lake (i.e., Poverty Bay, South Magnetawan River, Harris Lake, etc.) and therefore welcomed the initiative to augment low flow conditions during periods of summer droughts. In contrast, 39 respondents, or 36% of the questionnaires received, were either 'strongly opposed' or 'mildly opposed' to the Plan.

The majority of respondents who opposed the Plan are located on Ahmic Lake[1]. This result strongly echoed the findings of the Ahmic Lake shoreline structure reconnaissance that was conducted in May 2002. In this regard, Ahmic Lake shoreline property owners were very concerned that their boathouses, fixed crib docks, and shorelines would be

[1] Aside from their concerns regarding potential flooding of shoreline structures, the majority of Ahmic Lake respondents were generally supportive of MNR's overall water management planning initiative for the Magnetawan River.

negatively affected by the proposed 0.14 m increase to the regulated summer lake level. As a means to avoid negative impacts to shoreline structures on Ahmic Lake, Crawford and Beaver Lakes, the Project Team and the PAC concluded that the preliminary recommended water control strategy for Ahmic Lake (Feighens and Knoepfli dams) should be revised to maintain the currently established upper limit of the summer (June 15 to October 10) NOZ at 279.46 m, and the currently established summer (June 15 to October 10) IRL at 279.41 m.

Table 11.1
Summary of Public Reponses to
Draft Magnetawan River Water Control Operating Plan
Summer 2002 Open Houses

Level of Support	Location on Magnetawan River							
	Lake Bernard	Doe Lake	Lake Cecebe	Ahmic Lake	Poverty Bay	Wahwashkesh Lake	South Magnetawan/ Harris Lake	Other (not stated)
Strongly Support	1	1	1		21	3	6	27
Somewhat support				2	2	1		2
Indifferent					1			
Mildly Opposed				5	1			
Strongly Opposed			1	32				
Don't Understand				1				

11.5 MNR Review

During MNR's review of the draft Magnetawan River Water Control Operating Plan report issued in August 2002, several file letters and internal memos were identified. The letters identified stakeholder concerns and discussed previous operating agreements established between the MNR and the Lake Bernard Property Owners' Association Inc. (LBPOAI), and the Amour Township Council. This information had not previously been identified during the development of the preliminary recommended water control plan. Review of this information provided additional insight into the environmental sensitivities on Bernard and Doe Lakes, and identified potential new problems that could arise with the proposed operational changes for the Bernard Lake dam (Bernard Lake) and Watts dam (Doe Lake). As a consequence, the planned operating changes for the Bernard Lake and Watts dams, proposed by the preliminary recommended water control plan were revised.

Bernard Lake

The MNR letter to the LBPOAI dated November 3, 2000 confirmed a partnership agreement regarding water level management on Lake Bernard. The agreement was based on maintaining a "…summer target lake elevation [IRL] of 329.45 m while maintaining required minimum flows downstream of the dam". Previous MNR correspondence to the LBPOAI (October 2, 2000) noted that the LBPOAI's request to change the upper limit of the summer NOZ from 329.55 to 329.50 m would be "…given due regard", but "…the previous upper normal operating level of 329.55 m will continue to be illustrated on each year's rule curve to recognize the discharge capacity constraints of the dam during periods of high rainfall". In more recent correspondence from the LBPOAI to the MNR (August 26, 2002), the LBPOAI restated their concern that "…[water] levels in the order of 329.50 m and above lead to considerable shoreline erosion, submergence of beaches, shoreline property damage and loss".

The Project Team and the PAC concluded that the preliminary recommended operational strategy for Bernard Lake (Bernard Lake dam) should be revised to maintain the currently established upper limit of the summer NOZ at 329.50 m and the currently established summer (June 1 to September 15) IRL at 329.45 m.

Doe Lake

An internal MNR file memo dated March 16, 2000 discussed potential high water concerns regarding water level management on Doe Lake and the Magnetawan River that arose from MNR's 1998 modification to the Doe Lake rule curve. The memo stated that in 1998 the target IRL line on the Doe Lake rule curve had been modified to slope the spring IRL from the freshet peak (April 15) to June 15, instead of the previous June 1 target date. The change was in response to 1996 concerns from residents that "…water level management practices on Doe Lake were destroying walleye eggs on the spawning shoals due to receding water levels after the peak of the freshet". The memo stated that following the 1999 spring freshet, the MNR had received numerous complaints of high water levels on Doe Lake during the months of May and June. "Residents and businesses were finding it very difficult to install their docks during this time period due to high, unstable water levels in both the lake and the Magnetawan River". In response to this, the memo noted that the MNR conducted a fisheries assessment of the Lake's walleye population and concluded that "…the walleye population in the lake was very strong" and that reverting back to the original, pre 1998 rule curve as a means to reduce the May/June high water levels "…would not adversely affect walleye reproduction and recruitment in the [Doe] lake". The memo stated that the Armour Township Council was advised of this decision at the March 14, 2000 council meeting. Although not stated in the memo, the 1998 change to the Watts dam rule curve had the effect of raising the May/June water level on Doe Lake by 0.25 m. This effect was similar to what was proposed by the preliminary recommended operational strategy for Doe Lake and therefore confirmed that similar high water level impacts could occur to shoreline residents and business attempting to install their docks in May/June.

The Project Team and the PAC concluded that the preliminary recommended operational strategy for Doe Lake (Watts dam) should be revised to maintain the currently established upper limit of the summer NOZ at 294.40 m and the summer (June 1 to November 15) IRL at 293.95 m.

Pevensey Dam and Ayres Dam

Based on MNR's review of the preliminary recommended water control operating plan and in recognition of the previous decisions to maintained the established summer NOZs and IRLs on the controlled lakes including Doe, Cecebe, Ahmic, and Bernard Lakes, it was decided to also maintain the currently established IRLs for Pevensey dam (Loon and Grass Lakes) and Ayres dam (Perry and Hassard Lakes) for consistency. The previously recommended operational strategy for these two dams had only proposed a small increase to the summer IRLs and no changes to the NOZs.

The Project Team and the PAC concluded that the preliminary recommended water control operating plan should be revised to maintain the currently established summer IRL for Pevensey dam (Loon and Grass Lakes) and Ayres dam (Perry and Hassard Lakes) at 29.95 m and 335.15 m, respectively.

11.6 Summary

The preliminary recommended operation strategy described in Section 10 had investigated raising the water levels on the controlled lakes as a means to store water in the spring for its release during dry periods in the summer. Although the strategy would have met the water management plan objectives for minimum flow, it was subsequently revised based on information obtained from field investigations, public concern from shoreline residents over increased lake levels, MNR recommendations stemming from their review of the draft Magnetawan River Water control operating plan (A&A, 2002) and previously established operating agreements for some of the controlled lakes.

As a consequence, the Project Team, PAC and MNR concluded that the basis for the recommended operational strategy should be to operate the controlled lakes as they are now based on the currently established rule curves contained in the Magnetawan River Dam Operation Manual (Abacus, 2000), but allow for provision of a drawdown in lake level during drought years to meet the water management plan objectives for minimum flow.

This type of operational strategy had been investigated as part of the analysis of alternative water management strategies (Case 2, Section 8) and had been ranked second compared to the other alternatives (Section 9).

12 RECOMMENDED MAGNETAWAN RIVER WATER CONTROL OPERATING PLAN

12 RECOMMENDED MAGNETAWAN RIVER WATER CONTROL OPERATING PLAN

12.1 Overview

The recommended Magnetawan River Water Control Operating Plan is the end product of a 2-yr, MNR directed water management planning exercise for the water control structures within the Magnetawan River watershed. The study purpose was to review the Ministry's existing operating strategy for the dams on the Magnetawan River system and develop a recommended water control plan for the integrated operation of the control dams that supports MNR's objectives for ecological structure and functions balanced with economic and social factors. This objective was used as the basis for the study and refined through agency and public consultation. Input from the public and the PAC identified numerous issues pertinent to the Magnetawan River system and its users. Issues, specific to the operation of the dams, were prioritized and operational alternatives developed to improve or maintain flow and water level conditions along the river. Computer modeling was used to simulate the potential flow and water level changes along the river. The results for each operational alternative were then analyzed and compared. From this, a preliminary recommended water control plan was presented to the public for review in the form of a draft Magnetawan River Water Control Operating Plan (A&A, 2002). The draft water control plan was subsequently refined based on input provided by the public.

The recommended water control plan presented herein is by no means an entirely new plan for the dams within the Magnetawan River watershed. The MNR has had established operational plans for all of the control dams and many of the spill dams in place for several decades. The MNR recently consolidated these operational protocols in the Magnetawan River Dam Operational Manual (Abacus, 2000). Over the years, the Ministry has operated the dams within the established rules and continually sought to improve the overall management of the river through ongoing dialogue with the public and concerned stakeholders, including municipalities and cottage and lake associations. The result of this open process has been minor revisions to some of the operating procedures for some of the dams. The purpose of these changes has been to improve the net environmental, social and economic benefits to the users on the system. The identification of further refinements and improvements to the current operation of the dams offered by the Magnetawan River Water Control Operating Plan is indicative of an ongoing process through adaptive management.

The following section explains the recommended Magnetawan River Water Control Operating Plan and identifies a recommended operational strategy for the control dams on the Magnetawan River system. In addition, a series of recommendations are provided that, if implemented, could further improve flow and water level conditions on the Magnetawan River system.

12.2 Basis of the Recommended Water Control Operating Plan

Based on the findings of the water management planning process, it is concluded that the MNR's current operational practices of the Magnetawan River control dams have provided, and will continue to provide, an adequate level of flood protection given the natural flood producing characteristics of the Magnetawan River watershed and the physical and operational limitations associated with the control dams. No significant problems in terms of the flood operation of the control dams have been identified, although opportunities to improve the identification of natural hazards associated with flooding (i.e., floodplain mapping), enhancements to the Ministry's abilities to forecast floods and ongoing commitments to ensure that all water control structures are structural sound and safe to operate are recommended. Operationally, recreational and ecological problems that have arisen such as a low river flows and levels have been attributed to past operational practices that have emphasized lake level management rather than lake level and river flow management. Although naturally occurring during dry summer months, low river flows and levels have in some instances been worsened due to operational practices such as stop log jacking and measures such as wood chips to seal the dams to limit outflows and retain water in the lakes. This in turn, has had the potential to worsen low flow conditions in the downstream reaches of the river beyond what might be expected during 'normal' drought conditions. **Therefore, it is the intent of the Magnetawan River Water Control Operating Plan to adopt a recommended operational strategy for the control dams that reflects a more balanced operational emphasis on both lake level management and river[1] flow management through the provision of minimum discharges through the control dams.**

The previously recommended operation strategy (Section10) had investigated raising the water levels on the controlled lakes as a means to store water in the spring for its release during dry periods in the summer. Although the strategy would have met the water management plan objectives for minimum flow, it was subsequently revised based on information obtained from field investigations, public consultation and MNR review recommendations (Section 11). **The basis of the recommended operational strategy is to operate the controlled lakes as they are now, based on the currently established rule curves contained in the Magnetawan River Dam Operation Manual (Abacus, 2000), but allow for provision of a drawdown in lake level during drought years to meet the water management plan objectives for minimum flow.** This type of operational strategy would therefore maintain the status quo in terms of the operation of

[1] The intent to recognize and consider opportunities to manage the effects of water control structures on both levels and flows along a given river system is advocated by many new MNR initiatives including the recently prescribed document Water Management Planning Guideline for Waterpower (MNR, 2002).

the controlled lakes under normal and high flow conditions. Under low flow conditions, this strategy would provide for operational flexibility to address the identified ecological and social problems associated with low river flows during drought conditions.

12.3 Details of the Recommended Operational Strategy

Table 12.1 summaries the specific operational protocols proposed at each of the control dams. Important aspects are discussed in detail in Section 12.4. Figures 12.1 to 12.7 depict the recommended operating regimes for the control dams, along with the expected changes to average weekly water levels as predicted by the ARSP model based on the 83 years of flow data. Although no operational changes are proposed for the spill dams, graphs of the self-regulated water level ranges are provided in Figures 12.8 to 12.11 and discussed in Section 12.3.8.

The recommended operational strategy proposes to maintain the existing rule curves for the control dams as currently established by the MNR in its Magnetawan River Dam Operation Manual (Abacus, 2000). Some minor adjustments to the fall draw down were made at some of the control dams to provide better flood passage capability and to minimize lake flooding. Other than those, no rule curve changes to the existing NOZs are proposed for any of the Ministry's control dams, including Pevensey dam, Ayres dam, Watts dam, Bernard Lake dam, Magnetawan dams, Feighens dam or Knoepfli dam. No rule curve changes are proposed for the Burk's Falls dam or to any of the spill dams located on Wahwashkesh Lake, Kashegaba Lake, Gooseneck Lake or Harris Lake.

Operationally, during high flow conditions, the controlled lakes would continue to be operated in accordance with MNR's established rules and operational policies for flood management as is currently done. No operational changes to the current management of the dams, other than what could be expected through the implementation of improved flood forecasting (Section 12.4.6) would occur. Likewise, during normal flow periods, the controlled lakes would continue to be managed to stay within the established NOZs for each control dam.

The only significantly new operating change for the control dams would occur during drought years of below average low river flows. On average, drought years are predicted to occur once every 8 years. Under these circumstances, the controlled lakes associated Pevensey dam (Loon and Grass Lakes), Ayres dam (Perry and Hassard Lakes), Watts dam (Doe and Little Doe Lakes), Bernard Lake dam (Bernard Lake), Magnetawan dams (Cecebe and Midlothian Lakes), and Feighens and Knoepfli dams (Ahmic, Crawford and Beaver Lakes) would be allowed to decline below the summer IRL by as much as 0.15 m as a means to meet the ecological objectives for minimum flows in the river reaches downstream of each control dam. The minimum flow objective determined through the water management planning process is based on providing a specified discharge from each of the control dams/lakes such that a minimum summer discharge objective of 3 m^3/s will be provided downstream of Ahmic Lake for 95% of the time.

12.3.1 Pevensey Dam (Loon Lake, Grass Lake)

The operating range for Pevensey dam is shown in Figure 12.1. No changes to the previously established rule curve (Abacus, 2000) are proposed for this dam. The specific flow and water level operating constraints are listed in Table 12.1. Operating level constraints relate to flood passage during high flow periods, flood prevention on Loon and Sand Lakes and summer recreational uses. A fisheries level constraint to draw down the lake no later than October 15 for lake trout spawning is identified. A minimum flow objective for downstream water quality and to preserve the downstream brook trout habitat during dry periods has been identified. In this regard, a minimum flow target of 0.15 m^3/s is recommended to enhance low flows in the river reach extending downstream of Pevensey dam to Sand Lake.

Under high flow and normal summer flow conditions, the lake water levels and outflows from the dam are predicted to be similar to those previously experienced on the lake.

Under summer drought conditions, a slight decline in lake level could be expected as the lake is drawn down as much as 0.15 m below the IRL to the lower limit of the NOZ in order to maintain the minimum flow objective to the downstream river reaches. This could be expected to occur for 11 years of the 83 years simulated or, on average, once every 8 years. For drought years, the slow release of lake storage is expected to provide a slight increase in low flows downstream of the dam, thereby enhancing water quality and preserving brook trout habitat during dry periods.

12.3.2 Ayres Dam (Perry Lake, Hassard Lake)

The operating requirement for Ayres dam is shown in Figure 12.2. No changes to the previously established rule curve (Abacus, 2000) are proposed for this dam. The specific flow and water level operating constraints are listed in Table 12.1. Operating level constraints relate to flood passage during high flow periods, flood prevention on Perry and Hassard Lakes and the Town of Kearney, and summer recreational uses. No specific level constraints for fish or wildlife habitat are identified, but there is a minimum flow objective for downstream water quality. In this regard, a minimum flow target of 1.0 m^3/s is recommended to enhance low flows in the river reach extending downstream of the dam.

Table 12.1
Recommended Flow and Water Level Operating Constraints for Magnetawan River Dams

Area of Watershed	Control Structure	Uses	Flooding	Fisheries and Wildlife	Water Quality	Recreation	Municipal/Industrial/Other
Upper Watershed Reaches: Loon Lake to Ayres Dam including Sand Lake, the Town of Kearney, Hassard Lake and Perry Lake	Pevensey Dam controls Loon Lake and Grass Lake. Outflow from dam is into Pevensey Creek. 1 - 4.27 m wide sluices with stop logs 1 - 18.3 m wide spillwall	Recreation	• Start of flood damage zone (FDZ) for Loon Lake is 30.5 m (LCD). • High water in winter can cause major damage around Loon Lake. • Some limited flood plain mapping done for Sand Lake.	• Lake must not be drawn down after October 15th to protect lake trout spawning. • Maintain *minimum flow of 0.15 m^3/s during dry periods to preserve downstream brook trout habitat.	• Maintain *minimum flow of 0.15 m^3/s for downstream water quality in Pevensey Creek.	• Maintain summer IRL of 29.95 m (LCD) to within ±0.15 m during normal summer flow conditions.	
	Ayres Dam controls 3.2 km of Magnetawan River, Perry Lake and Hassard Lake in Town of Kearney. 4 - 4.27 m wide sluices with stop logs 3 - 3.67 m wide spillwall	Recreation Fire Protection for Village of Kearney	• Start of FDZ for Perry and Hassard Lakes is 335.85 m (GSD). • Low-lying property floods at high flows in the spring. • Some limited flood plain mapping done for Kearney. • Flooding occurs downstream in Katrine and Burk's Falls under high flows, cannot open Ayres Dam to reduce flooding in Kearney or will cause worse flooding in Katrine.	• No specified flow or water level requirements for fish or wildlife considerations.	• Maintain *minimum flow of 1.0 m^3/s for downstream water quality in Magnetawan River.	• Maintain summer IRL of 335.15 m (GSD) to within ±0.175 m during normal summer flow conditions.	• Maintain adequate water level for water taking for fire protection for the Town Kearney.
Mid-Upper Watershed Reaches: Ayres Dam to Village of Burk's Falls including the Town of Katrine, Doe Lake, Little Doe Lake, Three Mile Lake and Bernard Lake	Watts Dam controls 11.4 km of Magnetawan River, Doe Lake and Little Doe Lake. 5 - 4.27 m wide sluices with stop logs no spillwall 2 - wingwalls, total length is 13.4 m	Recreation Domestic Water Supply on River	• Start of FDZ for Doe Lake is 295.90 m (GSD). • With rising river levels, flow reversal occurs at outlet of Doe Lake and river flows into lake providing significant flood storage for the river. • Flooding can occur on Doe Lake if the dam is closed too rapidly in the spring. • Katrine is susceptible to flooding. • Some limited flood plain mapping done for Katrine.	• No specified flow or water level requirements for fish or wildlife considerations.	• Maintain *minimum flow of 1.0 m^3/s for downstream water quality in Magnetawan River	• Maintain summer IRL of 294.00 m (GSD) to within ±0.30 m during normal summer flow conditions. • Do not lower Doe Lake below 293.8 m to avoid restricting boat access through the shallow connecting channel between Big Doe and Little Doe Lakes.	
	Burk's Falls Dam controls 4.5 km of Magnetawan River. 3 - 4.27 m wide sluices with stop logs 1 - powerhouse intake pipe no spillwall 2 - wingwalls, total length is 31.7 m	Waterpower Industrial Water Supply	• Start of FDZ for Burk's Falls Dam headpond is 291.30 m (GSD). • Some flooding can occur upstream of the Yonge Street bridge at east end of the village (due to natural channel restriction, not dam). • Flooding of low-lying property can occur downstream of the dam under high flows due to low channel gradient.	• No specified flow or water level requirements for fish or wildlife considerations.	• No specified flow or water level requirements for water quality. Hydro facility is operated as run-of-the-river plant and therefore passes whatever flow is received from upstream.	• Maintain annual IRL of 291.13 m (GSD) to within ±0.15 m during normal summer flow conditions.	• Maintain water levels to within 0.50 m below top of wingwall for maximum power production (291.13 m) except in spring and summer high water periods. • Maintain minimum flow of ±0.1 m^3/s over stop logs required by Village of Burk's Falls for scenic viewing from covered bridge below dam.
	Bernard Lake Dam controls Bernard Lake. Outflow from dam is into Stirling Creek. Combined dam and 6 m roadway 4 - 3.66 m wide sluices with stop logs 1 - 760 mm m diameter valve no spillwall, no wingwalls	Recreation	• Start of FDZ for Bernard Lake is 329.70 m (GSD). • Prolonged high lake levels after heavy rainfall or high spring runoff can cause flooded beaches and some shoreline erosion. • Lake is slow to drop following high lake levels due to natural downstream channel restrictions. • Flood storage capacity in Bernard Lake is large in spring.	• Maintain *minimum flow of 0.2 m^3/s using valve (1/3 open) during dry periods to preserve downstream fish habitat in Stirling Creek.	• *Maintain minimum flow of 0.2 m^3/s using valve (1/3 open) during summer for downstream water quality in Stirling Creek.	• Maintain summer IRL of 329.45 m (GSD) to within ±0.1 m during normal summer flow conditions. • Try to operate below of 329.50 m (GSD) to provide dry beach area on beaches on north end of lake.	• Sundridge sewage lagoons are discharged twice annually Stirling Creek downstream of Bernard Lake dam. Discharges are timed to occur when creek flows are high in the spring and fall.
Middle Watershed Reaches: Burk's Falls to Poverty Bay at Highway 124 including Cecebe Lake, Midlothian Lake, Ahmic Lake, Beaver Lake, Crawford Lake and Magnetawan River to Burk's Falls	Magnetawan Dams (Main Dam, Centre Dam and East Dam) controls Cecebe Lake and Midlothian Lake, and Magnetawan River to Burk's Falls 4 - 6.5 m wide sluices with stop logs 5 - 4.27 m wide sluices with stop logs 1 - marine lock located in Main Dam 6 - spillwalls, total length is 47.8 m	Recreation Navigation (Main Dam)	• Start of FDZ for Cecebe Lake is 283.36 m (GSD). • Magnetawan Dams have higher discharge capacity than Ahmic Lake Dams and gate openings must be restricted to avoid flooding on Ahmic Lake. • Flow restriction caused by downstream Magnetawan bridge can cause backwater and flooding of local businesses (e.g. marina). • Minimization of spring flood levels is important to prevent ice damage.	• Maintain minimum attraction flow from April 15 to June 15 for walleye spawning on rocks below the Main Dam and Centre Dam.	• Maintain *minimum flow of 2.5 m^3/s for downstream water quality in Magnetawan River.	• Maintain summer IRL of 282.71 m (GSD) to within ±0.05 m during normal summer flow conditions. • Boat entrance to and exit from navigation lock is difficult due to strong currents if sluiceways 1 & 2 are used.	
	Ahmic Lake Dams (Feighens and Knoepfli) control Ahmic Lake, Crawford and Beaver Lake. <u>Feighens Dam</u> 2 - 3.10 m wide sluices with stop logs 1 - 4.57 m wide sluices with stop logs 1 - 19.3 m wide spillway, one wingwall <u>Knoepfli Dam</u> 1 - 4.06 m wide sluices with stop logs 4 - 5.44 m wide sluices with stop logs no spillwall, 2 wingwalls	Recreation Fisheries Enhancement	• Start of FDZ for Ahmic Lake is 282.10 m (GSD). • Under high flow periods, overflow around end of north spillway of Feighens Dam has occurred, washing out access road to dam. New spillway in 1998 should resolve this. • Flooding (mainly of docks) on Ahmic Lake can occur at high lake levels. • Flooding to properties downstream on Poverty Bay can be a problem since both dams outlet to this location. • During draw down operations, remove stop logs gradually over a period of 5 days to prevent rapid fluctuation on Poverty Bay and Wahwashkesh Lake	• Maintain Ahmic Lake level of 279.61 m (GSD, 0.20 m above summer IRL) from May 1 to June 15 for walleye spawning at Magnetawan below Magnetawan Dams. Do this by maintaining Knoepfli dam gauge at 279.54 m.	• Maintain *minimum flow of 3.0 m^3/s for downstream water quality in Magnetawan River.	• Maintain summer IRL of 279.41m (GSD) to within ±0.05 m during normal summer flow conditions. • Natural rock restriction above gates 6 and 7 on Feighens Dam causes high velocities 30 m upstream creating a danger for boats travelling to Ahmic Lake Lodge.	

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Table 12.1
Recommended Flow and Water Level Operating Constraints
for Magnetawan River Dams

Area of Watershed	Control Structure	Uses	Flooding	Fisheries and Wildlife	Water Quality	Recreation	Municipal/Industrial/Other
Mid-Lower Watershed Reaches: Poverty Bay to Trout Lake, including Wahwashkesh Lake, Bolger Lake, The Big Lake, Gooseneck Lake and Kashegaba Lake	Gooseneck Lake Dam controls Gooseneck Lake. Outflow from dam is into south end of Wahwashkesh Lake at The Big Lake. 1 - 4.27 m wide sluices with stop logs 1 - 30.41 m wide spillwall, 2 wingwalls	Recreation	• No established FDZ for Gooseneck Lake. • Self-regulation spill dam with no apparent flooding problems on lake. • A timber bridge on Auld's Road, located 18 m downstream of dam, is prone to washout in high flow periods.	• No specified flow or water level requirements for fish or wildlife considerations.	• $^{+}$Minimum flow for downstream water quality (i.e., Wahwashkesh Lake) is maintained by flow over spillwall.	• Maintain summer IRL of 29.81 m (LCD) to within ±0.075 m during normal summer flow conditions.	Initially built for aircraft accessibility for fire protection.
	Wahwashkesh Lake Dam controls Wahwashkesh Lake and The Big Lake. Outflow from dam is into Magnetawan River. no sluices 1 - 27-m wide concrete spillwall with low flow notch, not operated.	Recreation	• Start of FDZ for Wahwashkesh Lake is 228.65 m (GSD). • Self-regulation spill dam with no apparent flooding problems on lake. • Large annual spring water level fluctuations can occur on the lake of about 1.8 m. Most shoreline development is located above the flood level.	• No specified flow or water level requirements for fish or wildlife considerations.	• $^{+}$Minimum flow for downstream water quality in Magnetawan River is assisted by flow through low flow notch in dam.	• Maintain summer IRL of 224.67 m (GSD) to within ±0.20 m. • Dam was reconstructed in summer 2002. Previous low lake levels associated with leakage through the dam should now be eliminated.	
	Kashegaba Lake Dam controls Kashegaba Lake and Bolger Lake. Outflow from dam is into Whites Lake then into Magnetawan River 3 km downstream. No sluices 13.9 m stepped timber crib overflow structure with 3.3 m central lower section	Recreation	• No established FDZ for Kashegaba Lake. • Self-regulation spill dam with no apparent flooding problems on lake.	• No specified flow or water level requirements for fish or wildlife considerations.	• $^{+}$Minimum flow for downstream water quality in Magnetawan River is maintained by leakage through the dam.	• Maintain summer IRL of 99.7 m (LCD) to within ±0.15 m (assumed).	
Lower Watershed Reaches: Trout Lake to Byng Inlet including Magnetawan River and Island Lake, and South Magnetawan River, Harris Lake and Miner Lake	American Trail Dam in conjunction with Harris Lake Dams control 10.5 km of the South Magnetawan River including Big Bay to 2 km above the CNR bridge as well as Harris Lake on the Harris Lake Tributary. Outflow from dam is into Magnetawan River. 2 - 2.74 m wide sluices, 2 stop logs – not operated 3 - spillways, total length is 18.6 m	Recreation	• No established FDZ for South Magnetawan River or Harris Lake. • Self-regulation spill dam with no apparent flooding problems.	• No specified flow or water level requirements for fish or wildlife considerations.	• $^{+}$Minimum flow for downstream water quality in South Magnetawan River is maintained by leakage through the dam.	• Maintain summer IRL of 30.2 m (LCD) to within ±0.15 m (assumed). • South Magnetawan River is prone to low water levels during dry summer periods, difficult for navigation.	
	Harris Lake Dams in conjunction with the American Trail Dam control 10.5 km of the South Magnetawan River including Big Bay to 2 km above the CNR bridge as well as Harris Lake on the Harris Lake Tributary. Outflow from dam is into the South Magnetawan River. 3 – separate spill dams (2 concrete, 1 timber) Spill #2 filled with one stop log opening 1 - plug dam (rock and gravel)	Recreation	• No established FDZ for South Magnetawan River or Harris Lake. • Self-regulation spill dam with no apparent flooding problems on lake. • Seasonal overflow of the 3 Harris Lake spill dams into the Harris River (a tributary of the Naiscoot River) occurs.	• No specified flow or water level requirements for fish or wildlife considerations.	• $^{+}$Minimum flow for downstream water quality is maintained by leakage through the dam.	• Maintain summer IRL of 30.2 m (LCD) to within ±0.15 m (assumed). • South Magnetawan River is prone to low water levels during dry summer periods, difficult for navigation.	

Note: FDZ - Flood Damage Zone
IRL - Ideal Regulated Water Level for Summer Recreational Season
LCD - Local Construction Datum
GSD - Geodetic Survey Datum
*Minimum Flow – Provided by stop log adjustments, valve (Bernard Lake dam) and/or by leakage through dam and/or through stop logs.
Recommended minimum flows as estimated from ARSP model based on 3 m^3/s target flow 95% of the time downstream of Ahmic Lake.
$^{+}$Minimum Flow – Provided by leakage through dam and/or through stop logs.
No flow quantities are provided since dams are spill dams and are not operated.

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Under high flow and normal summer flow conditions, the lake water levels and outflows from the dam are predicted to be similar to those previously experienced on the lake.

Under summer drought conditions, a slight decline in lake level could be expected as the lake is drawn down as much as 0.15 m below the IRL to the lower limit of the NOZ in order to maintain the minimum flow objective to the downstream river reaches. This could be expected to occur for 11 years of the 83 years simulated or, on average, once every 8 years. For drought years, the slow release of lake storage is expected to provide a slight increase in low flows downstream of the dam, thereby enhancing water quality.

12.3.3 Watts Dam (Doe Lake and Little Doe Lake)

The operating requirement for Watts dam is shown in Figure 12.3. No changes to the previously established rule curve (Abacus, 2000) are proposed for this dam. The specific flow and water level operating constraints are listed in Table 12.1. Operating level constraints relate to flood passage during high flow periods, flood prevention in the Town of Katrine and in Doe Lake, and recreational uses. A summer level constraint not to draw down Doe Lake more than 293.80 m is identified for boat navigation between Doe Lake and Little Doe Lake, and between Little Doe Lake and the Magnetawan River[1]. No specific level constraints for fish or wildlife habitat are identified, but there is a minimum flow objective for downstream water quality. In this regard, a minimum flow target of 1.0 m^3/s is recommended to enhance low flows in the river reach extending downstream of the dam.

Under high flow conditions, the Magnetawan River reach (upstream of the dam to Doe Lake) and Doe Lake water levels and outflows from the dam are predicted to be similar to those previously experienced on the lake. Spring high water levels on the Magnetawan River reach upstream of the dam and on Doe Lake would not be changed since high water levels are a result of the naturally restricted capacity of the Magnetawan River below Watts dam.

Under normal summer flow conditions, the Magnetawan River reach and Doe Lake water levels and outflows from the dam are predicted to fluctuate in the same manner as has typically been experienced on the lake.

Under summer drought conditions, a slight decline in Magnetawan River reach and Doe Lake water levels could be expected as these waterbodies are drawn

[1] The current lower limit of the NOZ is 293.8 m. The lowest summer water level recorded on July 18, 2001 on Doe Lake was 293.9 m. Reconnaissance of the boat channels at this time confirmed that boat access was still possible, but only for small boats. Any further lowering of the lake below 293.8 m would significantly restrict, if not completely eliminate, boat access through the shallow connecting channels.

down as much as 0.15 m below the IRL to the lower limit of the NOZ in order to maintain the minimum flow objective to the downstream river reaches. This could be expected to occur 9 years of the 83 years simulated or, on average, once every 9 years. For drought years, the slow release of lake storage is expected to provide a slight increase in low flows downstream of the dam, thereby enhancing water quality.

12.3.4 Burk's Falls Dam (Magnetawan River)

The operating requirement for the Burk's Falls dam is shown in Figure 12.4. The small head pond at Burk's Falls dam is regulated to maintain a level of 291.13 m. The Dam Operation Manual (Abacus, 2000) indicates the rule curve as a constant head pond level of 290.9 m over the whole year. The Dam Operation Manual should be changed to reflect the present operations. The specific flow and water level operating constraints are listed in Table 12.1. No operational changes are proposed for the Burk's Falls dam due to the lack of storage upstream of this dam and the limited operational range. Flood passage and maintaining adequate flow for power generation constitutes the main operating constraint for this dam. Since the hydro facility is operated as a run-of-the-river facility there is no specified minimum flow constraint other than to pass whatever river flow is received from upstream. A provision for a minimum flow spill over the stop logs during summer low flow periods for scenic viewing from the covered bridge is recognized as an objective. In this regard, a minimum flow target of 0.1 m^3/s is recommended.

Under high flow and normal summer flow conditions, the head pond water levels and outflows from the dam are predicted to be similar to those previously experienced on the river. Spring high water levels on the Magnetawan River reach upstream of the dam would not be changed since high water levels are a result of a natural channel restriction upstream of the dam. No water level changes are anticipated upstream of the dam under summer drought conditions beyond that previously experienced on the river. In fact, the slight increase in minimum flows released from the upstream lakes may provide a slight increase in hydro potential at this site.

Improved communication is recommended between MNR and the operators of the Burk's Falls small hydro facility to provide earlier notification of log changes at the upstream Watts dam. With earlier notification and more gradual changes, the operators may be able to take better advantage of the available water and increase energy generation. Likewise, MNR and/or its dam contractor at Ahmic and Cecebe Lakes would benefit from improved notification of pending log changes at the Burk's Falls facility such as during shutdown periods for maintenance. With earlier notification, the dam operator at Ahmic and Cecebe Lakes would be better able to anticipate flow changes from upstream and incorporate these into the logging operations at the Magnetawan and Ahmic Lake dams.

12.3.5 Bernard Lake Dam (Bernard Lake)

The operating requirement for Bernard Lake dam is shown in Figure 12.5. No changes to the previously established rule curve (Abacus, 2000) are proposed for this dam. The specific flow and water level operating constraints are listed in Table 12.1. Operating level constraints relate to flood passage during high flow periods, flood prevention on Bernard Lake, shoreline/beach erosion and summer recreational uses. No specific level constraints for fish or wildlife habitat are identified, but a minimum flow objective for downstream water quality and to preserve the downstream brook trout habitat during dry periods will be maintained at existing rates with the valve in the dam. In this regard, a minimum flow target of 0.2 m^3/s is recommended to enhance low flows in Stirling Creek downstream of the dam.

Under high flow conditions, the lake water levels and outflows from the dam are predicted to be similar to those previously experienced on the lake. High water levels on Bernard Lake would not be changed since high water levels are a result of a natural channel restriction downstream of the dam. Due to this restriction, fully opening the dam one week prior to the spring freshet would help to reduce high water levels on Lake Bernard.

Under normal summer flow and drought conditions, lake water levels and outflows from the dam are predicted to fluctuate in the same manner as has typically been experienced on the lake. Bernard Lake typically experiences declining lake levels throughout the summer due to lake evaporation and low inflows associated with its small drainage area. Thus, declining lake levels are more a reflection of natural conditions rather than an operational change to purposely draw down the lake. Therefore, under the proposed operating strategy, the lake will continue to be allowed to decline as much as 0.15 m below the IRL to the lower limit of the NOZ in order to maintain the minimum flow objective to the downstream river reaches. This could be expected to occur for 35 years of the 83 years simulated or, on average, once every 3 years. For drought years, the slow release of lake storage is expected to provide the same flows downstream of the dam, thereby maintaining water quality.

12.3.6 Magnetawan Dams (Cecebe Lake, Midlothian Lake)

The operating requirement for the Magnetawan dams is shown in Figure 12.6. No changes to the previously established rule curve (Abacus, 2000) are proposed for this dam. The specific flow and water level operating constraints are listed in

Table 12.1. Operating level constraints relate to flood passage during high flow periods, flood prevention in the Village of Magnetawan, recreational uses and boat navigation through the marine locks. No specific level constraints for fish or wildlife habitat are identified. A minimum flow objective is identified to provide a constant attraction flow for walleye spawning on the rocks below the Main dam and the Centre dam from April 15 to June 15. In addition, a minimum flow objective for downstream water quality during dry periods has been identified. In this regard, a minimum flow target of 2.5 m^3/s is recommended to enhance low flows in the river reach extending downstream of the dam.

Under high flow and normal summer flow conditions, the Cecebe Lake water levels and outflows from the Magnetawan dams are predicted to be similar to those previously experienced on the lake.

Under summer drought conditions, a slight decline in lake level could be expected as the lake is drawn down into the LOZ as much as 0.15 m below the IRL in order to maintain the minimum flow objective to the downstream river reaches. This could be expected to occur for 9 years of the 83 years simulated or, on average, once every 9 years. For drought years, the slow release of lake storage is expected to provide a slight increase in low flows downstream of the dam, thereby enhancing water quality.

12.3.7 Feighens and Knoepfli Dams (Ahmic Lake, Crawford and Beaver Lakes)

The operating requirement for Feighens and Knoepfli dams is shown in Figure 12.7. No changes to the previously established rule curve (Abacus, 2000) are proposed for this dam. Some caution should be exercised when interpreting the rules curves for Ahmic Lake since the Dam Operation Manual (Abacus, 2000) indicates the rule curve spring IRL (May 1 to June 15) at 279.54 m, however the operator rule curve reporting sheets indicates the spring IRL at 279.61 m. The difference is attributed to the river/lake gradient at high flows that occurs between the Knoepfli dam gauge (i.e., Dam Operation Manual rule curve) versus the operator rule curve, which plots Ahmic Lake levels based on water levels readings from the AWLR gauge located downstream of the Magnetawan dams.

The specific flow and water level operating constraints are listed in Table 12.1. Operating level constraints relate to flood passage during high flow periods, flood prevention on Ahmic Lake and recreational use. A fisheries level constraint to maintain the Ahmic Lake level at 279.61 m from May 1 to June 15 is identified to enhance walleye spawning downstream of the Magnetawan dams. A minimum flow objective for downstream water quality during dry periods has been identified. In this regard, a minimum flow target of 3.0 m^3/s is recommended to enhance low flows in the river reach extending downstream of the dam.

Under high flow and normal summer flow conditions, the Ahmic Lake water levels and outflows from the Knoepfli and Feighens dams are predicted to be similar to those previously experienced on the lake.

Under summer drought conditions, a slight decline in lake level could be expected as the lake is drawn down into the LOZ as much as 0.15 m below the IRL in order to maintain the minimum flow objective to the downstream river reaches. This could be expected to occur for 9 years of the 83 years simulated or, on average, once every 9 years. For drought years, the slow release of lake storage is expected to provide a slight increase in low flows downstream of the dam, thereby enhancing water quality.

12.3.8 Spill Dams

The remainder of the dams on the Magnetawan River system are self-regulated spill dams. These are Wahwashkesh Lake, Gooseneck Lake, Kashegaba Lake, Harris Lake and American Trail dams. No operational changes are proposed for these spill dams. Because of the self-regulating nature of these dams, the lake levels are established by the amount of flow spilling over the dams. The self-regulating water level ranges and the changes to water levels resulting from the proposed operational changes to the upstream control dams are depicted in Figures 12.8 to 12.11.

As shown in Figure 12.8, the increase in minimum summer flows will result in a slight increase in the Wahwashkesh Lake level during low flow periods. This may provide some marginal ecological benefit for near shore areas that would otherwise be exposed and dry out during droughts. The minimum flow increases are expected to provide some noticeable water level benefits at rapids and shallow river sections elsewhere along the Magnetawan River extending downstream from Wahwashkesh Lake to the watershed outlet at Byng Inlet. These water level increases are not likely to be significant enough to translate into direct recreational benefits, but are expected to provide some incremental benefits to aquatic and riparian habitats, and to water quality conditions (i.e., stagnant water) by reducing the frequency and magnitude of the very low drought flows. For normal and high flow conditions, no significant increases in the summer water levels are predicted for Wahwashkesh Lake or the downstream river reaches and therefore, existing tourism and recreation uses will be maintained as they are.

As shown in Figure 12.9, neither Kashegaba Lake nor Gooseneck Lake will experience any changes in flow or level given their location off-line from the Magnetawan River -- conditions will remain unchanged from the present situation. As for the Harris Lake and American Trail dams located on the South Magnetawan River, these locations will experience no significant changes to flows and/or water levels. This is illustrated by Figure 12.10, which shows that no measurable change on Harris Lake water levels compared to the existing conditions. In this regard, concerns related to low summer river levels and difficult boat access from the Magnetawan River into the south branch would not be addressed by the proposed operational changes at the upstream control dams.

12.4 Operational Requirements

The following section summarizes the overall operational requirements for implementation of the recommended water control plan. The recommended operational strategy for the control dams is founded on MNR's established policies and operating protocols for dams, operator experience specifically related to the operational management of the Magnetawan River dams, information contained in the Magnetawan River Dam Operation Manual (Abacus, 2000) and recommendations based on the findings of this water management planning process. It is anticipated that the changes required to implement the recommended operational strategy will only involve changes to operational management of the control dams; structural changes to the dam themselves are not required.

12.4.1 Monitoring and Analysis

Each of the controlled dams will require appropriate monitoring to achieve the goals of the recommended water management strategy. During average flow periods, there will be no appreciable change to the weekly monitoring of water levels that is presently used to monitor the dams. During high flow periods, it is recommended that each of the dams be surveyed daily or automatic water level recorders be installed so that the dams can be monitored remotely. During low flow periods, weekly monitoring of water levels and analysis of dam discharges will be required to determine appropriate stop log settings and/or leakage allowance through the dams to achieve the required downstream minimum flow requirements. During extreme dry periods this may have to be done daily at specific damsites such as at the dams on Ahmic Lake.

12.4.2 Operations Manual

The existing Magnetawan River Dam Operation Manual (Abacus, 2000) requires updating to reflect the new hydraulic information associated with the 2002 reconstruction of the Wahwashkesh Lake and to correct the operating range for the Burk's Falls dam noted previously in this section. In addition, the manual needs updating to reflect the minimum discharge requirements at each of the control dams (Table 12.1). For each of the controlled lakes, the operational changes would involve the following:

- During high flow flood conditions, the lake water levels would continue to be managed on a best-effort basis to stay below the High Water Zone in accordance with the MNR's established operational policies for flood management as is currently done.

- During normal high flow conditions, the lake water levels would continue to be managed on a reasonable-effort basis to stay close to the NOZ with an emphasis on minimizing the frequency of water level increases into the Upper Operating Zone as is currently done.

- During normal flow conditions, the lake water levels would continue to be managed to stay within the NOZ with emphasis on a reasonable-effort basis to remain close to the IRL as is currently done. If possible, before the onset of drought conditions, the outflows of the lakes would be regulated to raise the lakes by 0.05 m above the IRL to provide additional storage for drought releases and to help minimize the extent to which the lakes may be drawn down below the IRL.

- During low flow drought conditions when the Magnetawan River flow downstream of Ahmic Lake is anticipated to fall below 3 m^3/s, the lake water levels would be allowed to decline by as much as 0.15 m below the IRL as a means to release water from storage to provide the minimum flow discharge requirements downstream of each control dam.

- At dams where the NOZ allows spill to occur over the spillwalls, this capability should be used in the summer to pass water to the extent possible without utilizing the stop logs. This method of operation will reduce the number of stop log operations (and cost of operations) during periods of normal river flow conditions.

A new section will also need to be included in the Dam Operation Manual to provide details on the drawdown strategy to be implemented during low drought flow periods. The drawdown strategy that was used in the final ARSP modeling of the basin performed a balanced drawdown of Ahmic, Cecebe, and Doe Lakes. It is recommended that the drawdown of these three lakes be performed in a balanced manner where each of the lakes is drawn down by equal amounts of 0.05 m below the IRL to a maximum of 0.15 m below the IRL. Performing the drawdown in this manner would minimize the week-to-week fluctuations in the water levels on the three lakes and provide a more gradual drawdown rate on each of the lakes.

The Dam Operation Manual would also have to address the method of operation during the extreme dry years since the provision of the minimum flow objectives downstream of Ahmic Lake could only be met by drawing down Ahmic and

Cecebe lakes beyond the lower limit of the NOZ and into the LOZ. Under such circumstances, the MNR would have to consider the ecological heath of the river system and determine if the incremental benefits to the river ecology merit the potential effects to shoreline residents that might arise from the additional lowering of the lakes into the LOZ. Lake users could be advised of such potential action through the issuance of low water advisory using the same communication channels as done for flood advisories.

12.5 Additional Recommendations

In addition to operational changes, other modifications are recommended to address deficiencies not related to dam operations. These recommendations, if implemented, will fill information gaps, improve the overall safety and increase operating efficiency on the system.

12.5.1 Potential Dam Rehabilitation Projects

Based on previous MNR inspections and a recent dam safety assessment of the Magnetawan River dams (Acres 2001 a, b, c), several dams have been cited to be in poor condition and do not meet current dam safety guidelines. These include Pevensey, Knoepfli, American Trail, and the Harris Lake spill dam. With respect to American Trail and Harris Lake dams, the public has echoed these concerns regarding the poor condition of these dams through the Magnetawan River Water Control Operating Plan planning process. Accordingly, it is expected that the MNR will proceed to implement the various dam safety recommendations to ensure the safe and efficient operation of the dams.

Since there is a possibility that dam rehabilitation works could alter the existing flow and water level conditions established in the recommended Magnetawan River Water Control Operating Plan, it will be necessary to review the planning of these works within the proper operational and environmental context. If significant structural and/or operational changes to a dam are proposed, the MNR's *Class Environmental Assessment for MNR Resource Stewardship and Facility Development Projects* (MNR 2003) would be triggered. The Ministry's Class EA provides an established process to examine the environmental effects associated with various alternative solutions for various projects including dam rehabilitation projects. Public and agency consultation is a requirement of the Class EA process.

The following recommendations are provided to serve as a guide when considering the potential dam rehabilitation projects.

12.5.2 Pevensey Dam

A Class EA was completed in January 2003 by the MNR for the Pevensey dam (AMEC, 2003). Potential options considered for the dam included remedial repairs to maintain the dam, conversion of the dam to an overflow weir, and the possible removal of dam. Based on the outcome of the EA, the recommended solution for the dam was to repair and maintain the dam in its existing configuration. Implementation of the recommended option will maintain the existing operational rule curve for Pevensey dam, thereby maintaining the same water levels on Loon and Grass lakes as currently experienced (AMEC, 2003). In addition, the recommended option involves the installation of a telemetric water level monitoring system. Operationally, this would eliminate the approximate 15 trips per year to the dam to manually read water levels from the staff gauge at the dam. The number of trips to conduct stop log adjustments at the dam would remain the same. Implementation of the recommended option for Pevensey dam will be consistent with the intended operational strategy for the Magnetawan River Water Control Operating Plan.

12.5.3 Knoepfli Dam

The MNR has recently completed a Class EA to investigate remedial options for the Knoepfli dam (Acres and A&A, 2003a, b). As part of the preparation of this water control operating plan, the selected Knoepfli dam option, which is to construct a new replacement dam, was reviewed to ensure its operation will be consistent with the recommended Magnetawan River Water Control Operating Plan.

12.5.4 American Trail Dam

The American Trail dam was identified to be in poor condition and was recommended for reconstruction based on the findings of a dam safety study (Acres, 2001 a, b, c). The poor condition of the dam was also identified as a priority public issue through the Magnetawan River Water Control Operating Plan planning process. It is recommended that the MNR conduct a feasibility review of remedial options for the American Trail dam. Depending upon the options identified, a Class EA may be required if significant changes to the dam are proposed. During the EA process, the selected dam option must be reviewed to ensure it is consistent with the recommended Magnetawan River Water Control Operating Plan.

12.5.5 Harris Lake Spill Dam #3

The Harris Lake spill dam #3 was identified to be in poor condition and was recommended for reconstruction based on the findings of a dam safety study

(Acres, 2001 a, b, c). In keeping with the objectives of the Magnetawan River Water Control Operating Plan, it is recommended that the MNR conduct a feasibility review of remedial options for the Harris Lake spill dam #3. Depending on the options identified, it is recommended that the MNR review the need to conduct a Class EA, if significant changes to the dam are proposed. During the EA process, the selected dam option must be reviewed to ensure it is consistent with the recommended Magnetawan River Water Control Operating Plan.

12.5.6 Flood Forecasting

MNR currently has no flow or flood forecasting technology for the Magnetawan River watershed. The implementation of flood forecasting would allow more proactive operation of the control dams and would provide the ability to operate the dams as an integrated system. At present, except for the winter/spring drawdown and refilling operations, the dam operations are reactionary in that stop-log settings are adjusted only after water level increases/decreases indicate that an adjustment is required. In order to implement effective flood forecasting on the Magnetawan River system, computer modeling of the dam operations with flow forecasting is necessary.

With appropriate precipitation data, the HEC-1 model developed for the Magnetawan River watershed (Section 6) could be used by MNR staff to predict the flows and water levels at locations throughout the watershed for flood events. In the upper reaches of the watershed (Bernard Lake, Loon Lake, and Perry Lake) the HEC-1 model can be used to predict runoff flows and take precautionary action if needed to respond to forecasted precipitation events. In the middle and lower reaches of the watershed downstream of Doe Lake to Georgian Bay, the response of the basin is slow enough (more than 24 hours) that operators can use the HEC-1 model to predict flows using real precipitation data and have enough time to adjust stop-log settings to manage floods. The HEC-1 model can be used alone, or the predicted sub-basin runoffs can be used as input to the ARSP model. The use of the HEC-1 model by itself will alert the operators to required flow releases (dam operations) for high flood events. For medium to small flood events the use of the ARSP model will help in the management of the flow releases from the dams to balance water levels throughout the basin.

Presently, there are not enough precipitation gauges in the basin to provide sufficient data for flood forecast modeling. To implement a reliable forecasting system, there must be at least three precipitation gauges spaced throughout the basin. As well, a snow course station in the basin would increase the reliability of the model to predict spring flood events. Recommendations in this regard are discussed in Section 13.2.

12.5.7 Floodplain Mapping

The Provincial Policy Statement, issued under the *Planning Act* 1997, sets out overall policy directions on matters of provincial interest related to land use planning and development. The *Planning Act* requires that municipalities, provincial ministries, the Ontario Municipal Board and other decision-makers "have regard" to the Provincial Policy Statement when making decisions on land use planning matters. Municipalities are delegated with the responsibility of identifying areas that may be subjected to natural hazards and developing measures to limit exposure to public health and safety risks (MNR 2001). Once identified, these areas must be considered in planning documents, such as Official Plans. The actual limits of the hazard lands along rivers and stream systems that could be impacted by flooding and erosion should be based on flood hazard limits and erosion hazard limits. Lands susceptible to flooding should be defined by the Regulatory Flood, which for the Magnetawan River is the greater of the flood produced by the Timmins Storm or the 100-year flood.

There is a need for floodplain mapping for the Magnetawan River watershed. Preliminary regulatory flood elevations for the lakes controlled by dams have been established by Acres (2002a) during the course of this study. Although these flood elevations provide information on the maximum expected water level rise on the lakes, they do not identify the specific flood hazard areas around each lake. Also, flood hazards along the river reaches, upstream or downstream of the influence of a controlled dam/lake, were not identified during the process. To do so would require the delineation the regulatory flood elevations onto suitable detailed topographic mapping in a study process, commonly referred to as floodplain mapping.

One of the problems associated with the task of developing floodplain mapping for an entire watershed, is the need to coordinate between the municipalities on the system in order to avoid a piecemeal product. Normally this task would be completed by a conservation authority, but given the absence of a conservation authority in the study area, it is recommended that the Ministry of Municipal Affairs coordinate this task such that each municipality within the watershed is responsible for generating floodplain mapping for its area.

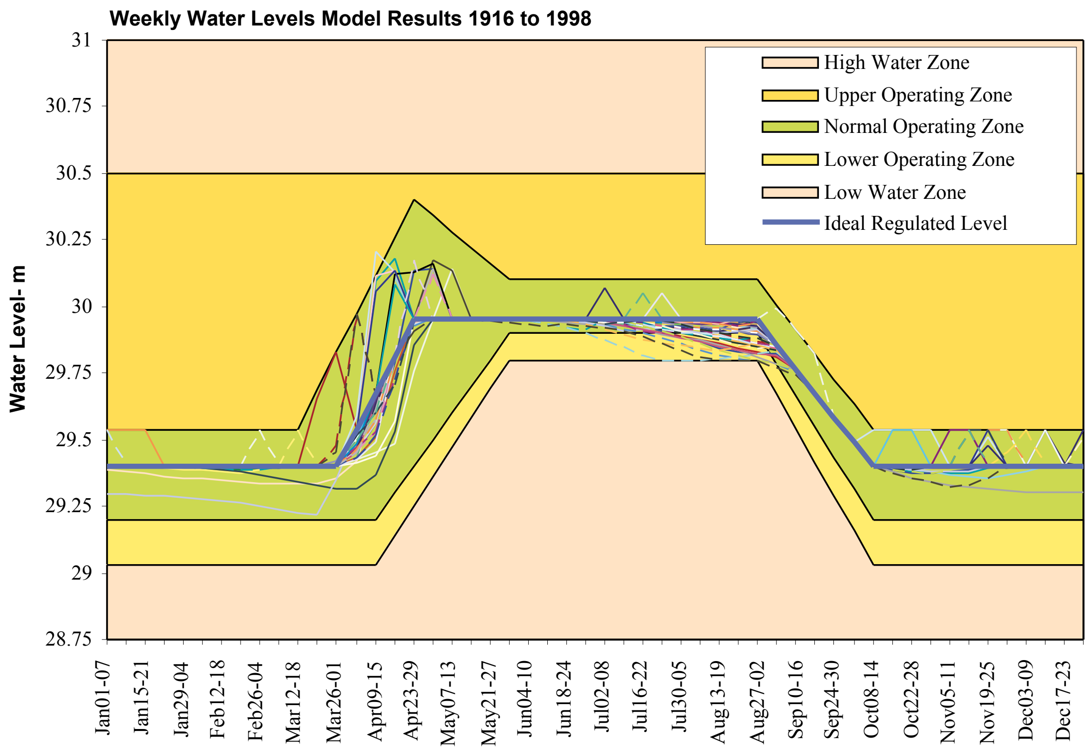
12.6 Summary

The recommended Water Control Operating Plan for the Magnetawan River fulfills the mandate of this study as it provides an improved operating procedure for the river system while observing the needs of the water users. This Plan also reaches beyond that objective in that it addresses the objectives of several other management plans. For example, the two MNR District Land Use Guidelines that pertain to the study area (Parry

Sound and Bracebridge) include a number of policies that relate to the management of water levels. Some of the policies that are promoted include recognizing the need to regulate water levels to achieve minimum fluctuations; recognizing the implications of water level fluctuations on fish and wildlife resources; recommending that emergency measures for flooding be instituted; and improving the monitoring of water levels on lakes and rivers. The Magnetawan River Water Control Operating Plan addresses many of these policies. Indirectly, several of the Official Plans of communities within the watershed are also addressed with the recommended water control plan.

Notwithstanding the fulfillment of the objectives mentioned above, other objectives of this study could not be met within the context of this water management plan. Achieving the increased minimum flow objectives below several of the controlled dam/lakes and the Magnetawan River downstream of Ahmic Lake will maintain and enhance ecological conditions and improve stagnant water conditions during periods of low flow. However, the minor flow increases are not likely to translate into significantly higher water levels through these reaches, including Poverty Bay since the natural river morphology and steeper gradient limit the water level rise under low flow conditions. Likewise, it is unlikely that the increased minimum flows in the Magnetawan River below Ahmic Lake will translate into measurable flow or water level increases to the South Magnetawan River and Harris Lake since the Trout Lake flow split allows for very little flow to spill into the South Magnetawan River during low flow conditions. The large water level fluctuations that occur along the middle and lower reaches of the Magnetawan River will persist since they are related to the natural, seasonal variation in river flows and the relatively confined river channel. Some minor reduction to the frequency of water level fluctuations during low flow periods in these downstream reaches may occur as a consequence of implementing the minimum flow objectives during dry periods.

Implementation of the Magnetawan River Water Control Operating Plan will help ensure that the future operational management of the dams within the Magnetawan River watershed continues in a safe, responsible manner that recognizes a balanced sharing of the resource.



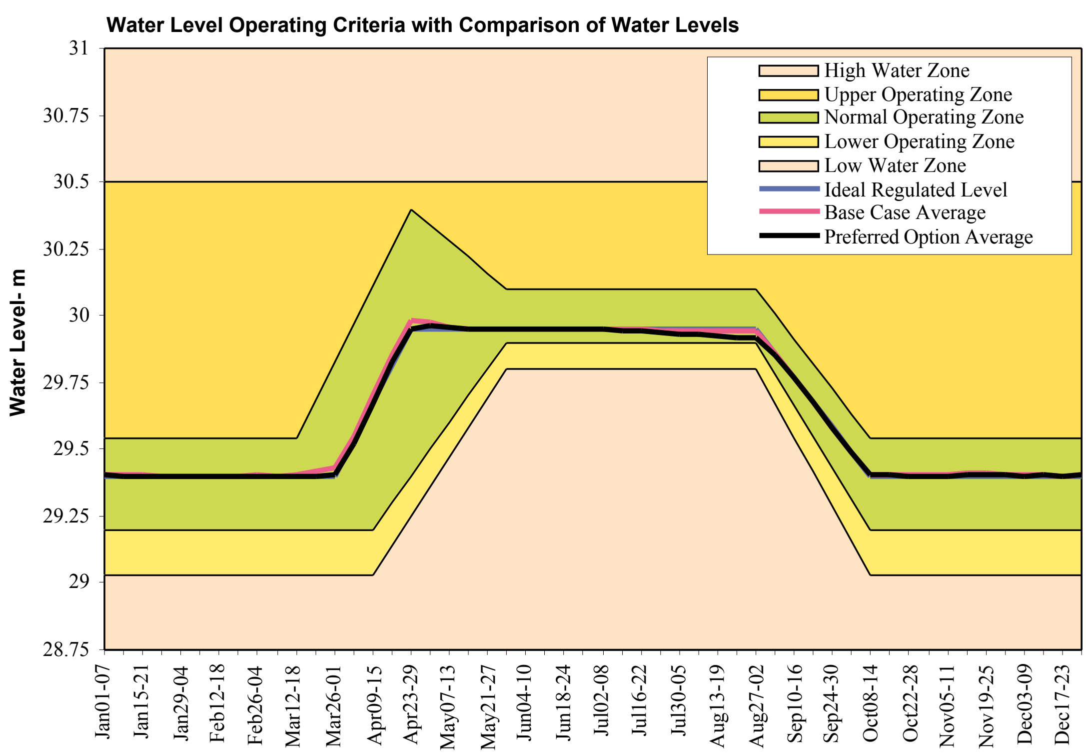
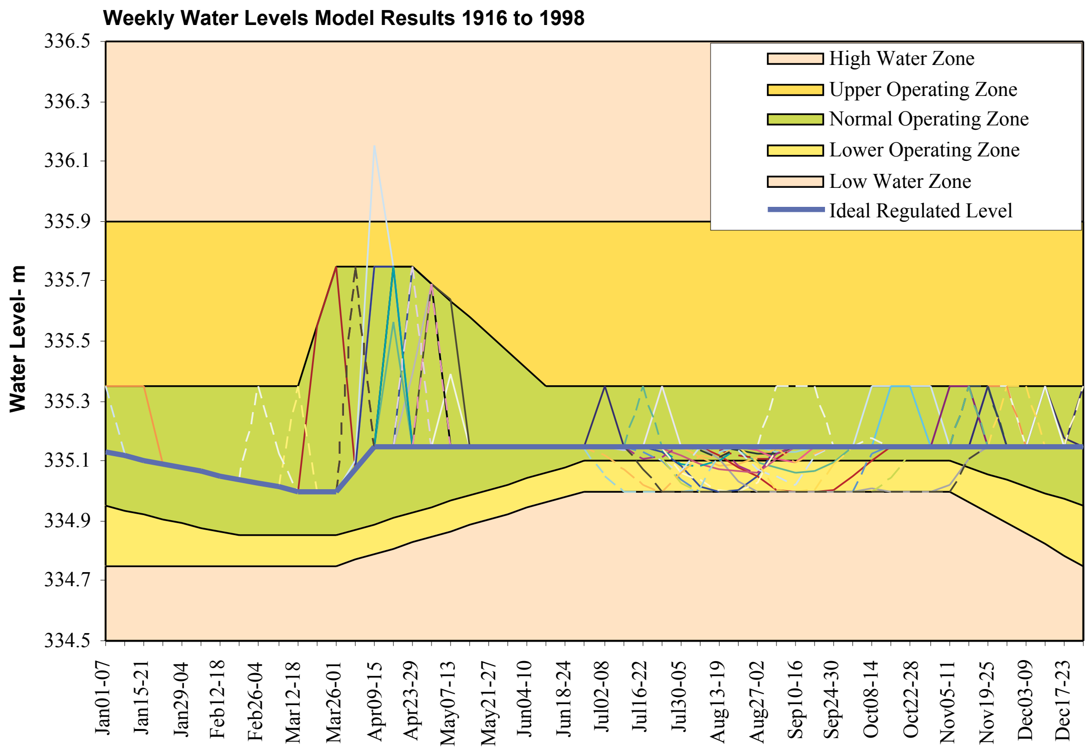


Figure 12.1
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Pevensey Dam (Loon Lake)

ACRES International



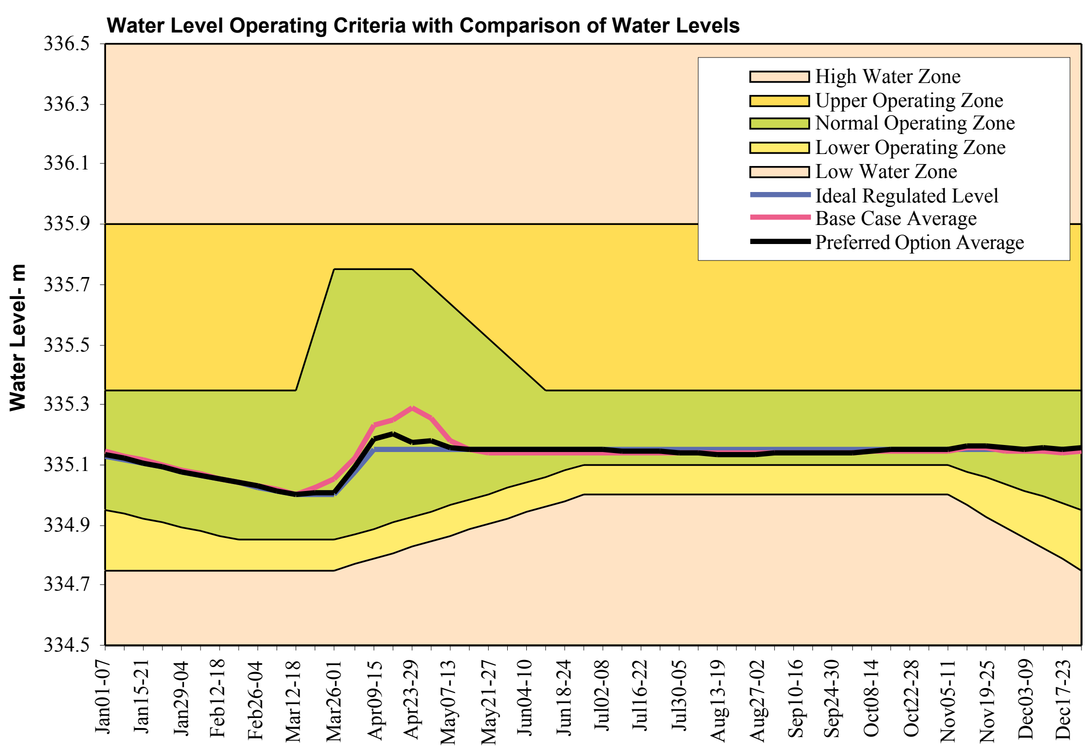
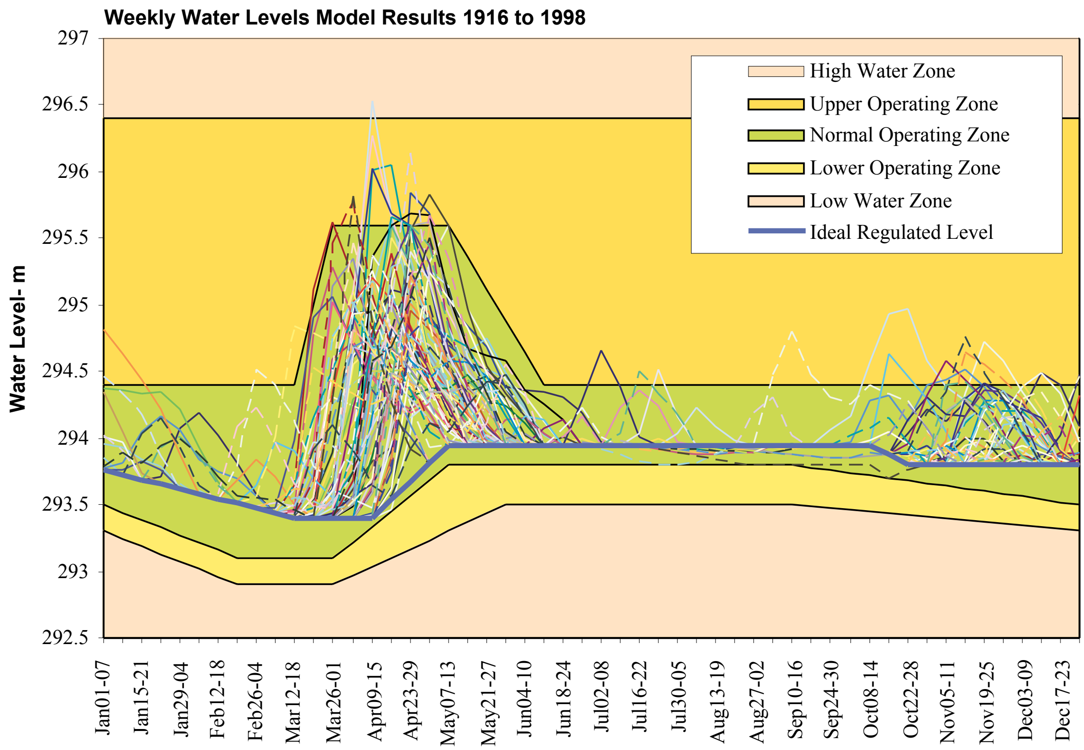


Figure 12.2
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Ayres Dam (Perry Lake)

ACRES International



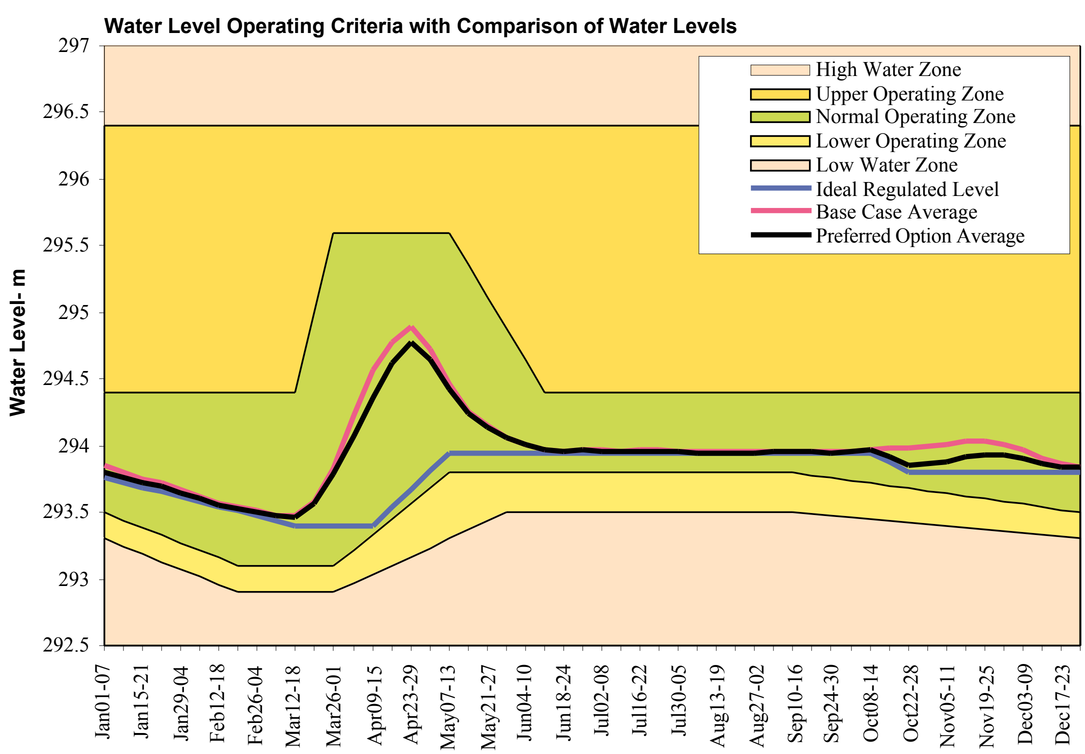
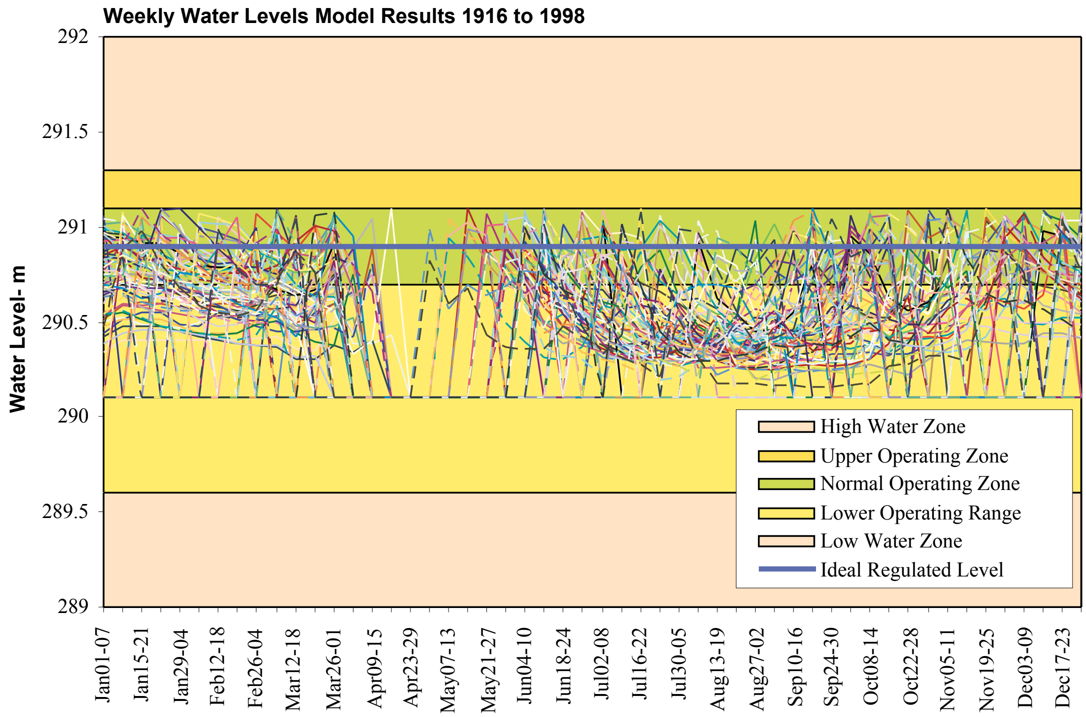


Figure 12.3
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Watts Dam (Doe Lake)

ACRES International



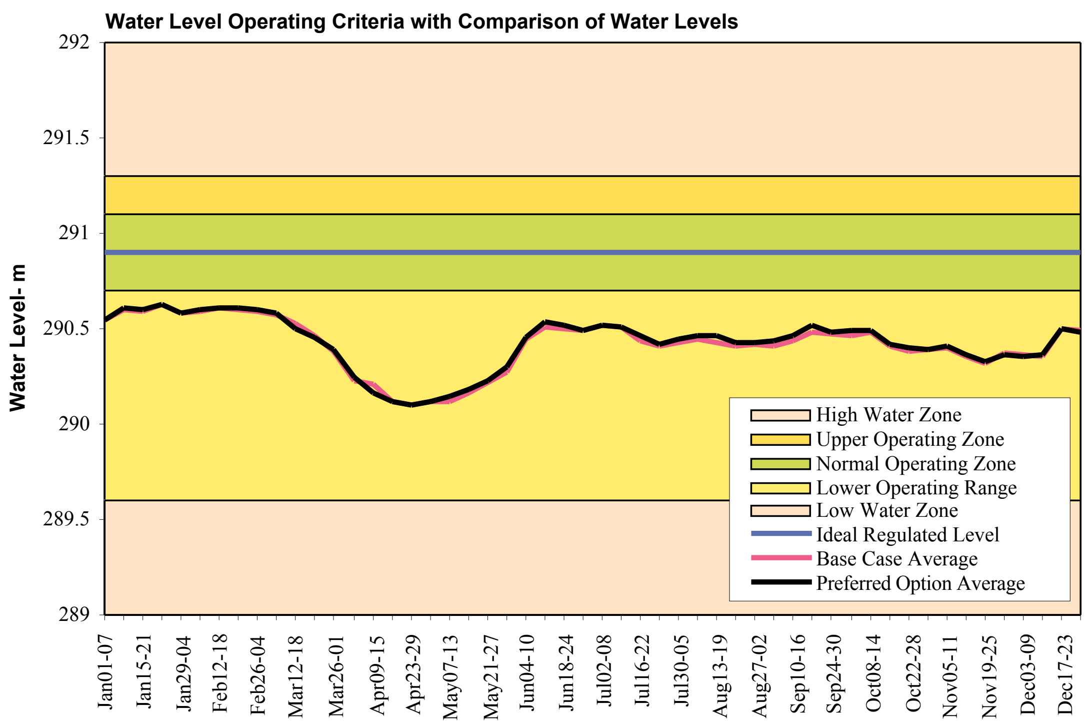
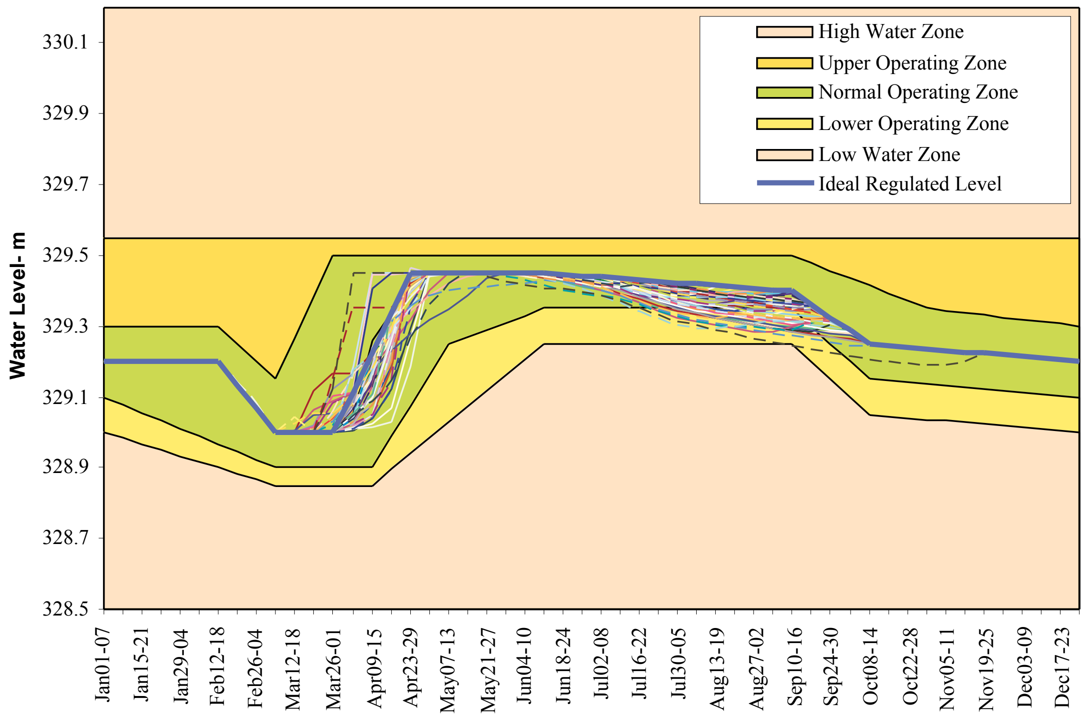


Figure 12.4
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Burk's Falls Dam

Weekly Water Levels Model Results 1916 to 1998



Water Level Operating Criteria with Comparison of Water Levels

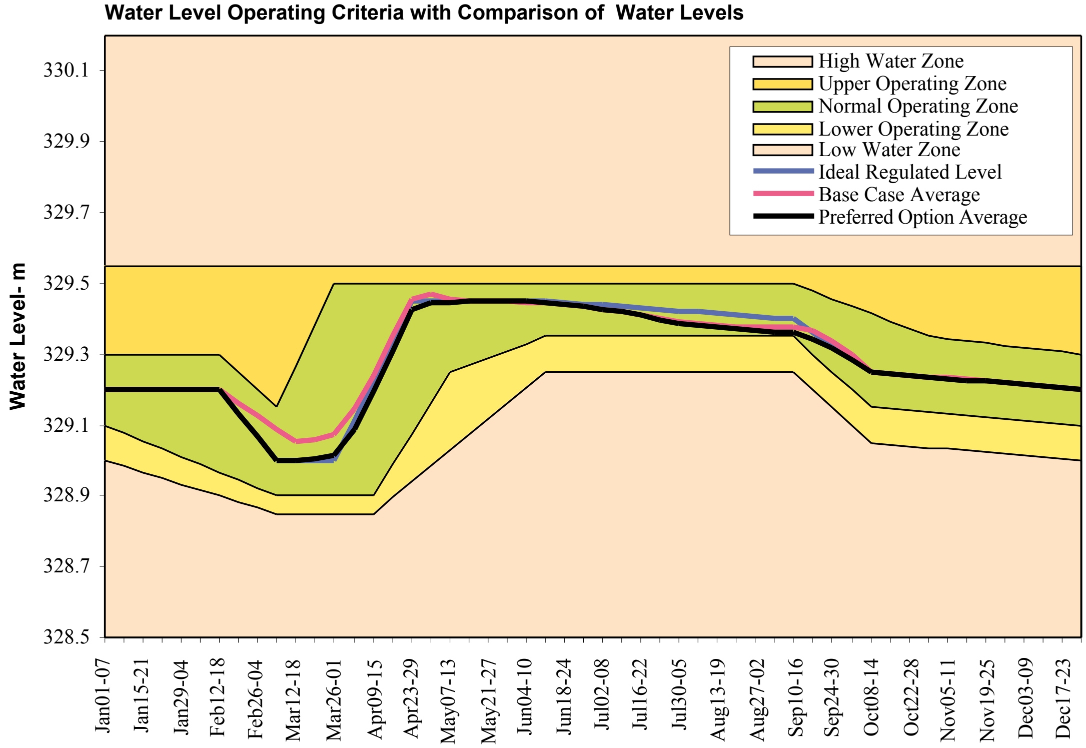
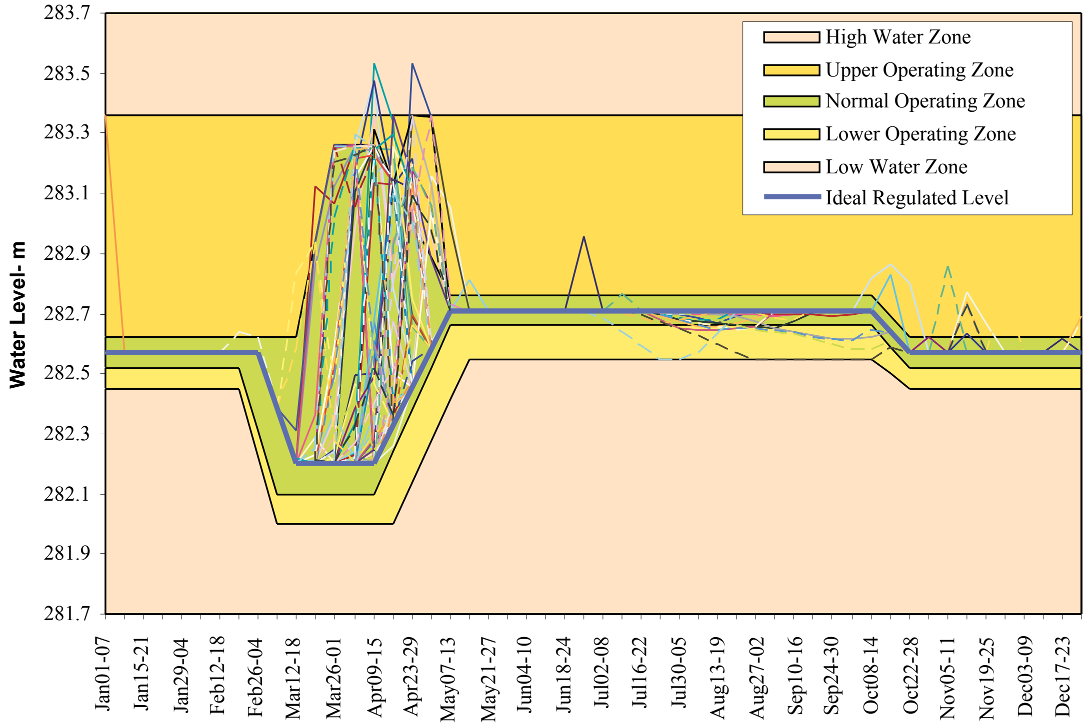


Figure 12.5
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Bernard Lake Dam

ACRES International

Weekly Water Levels Model Results 1916 to 1998



Water Level Operating Criteria with Comparison of Water Levels

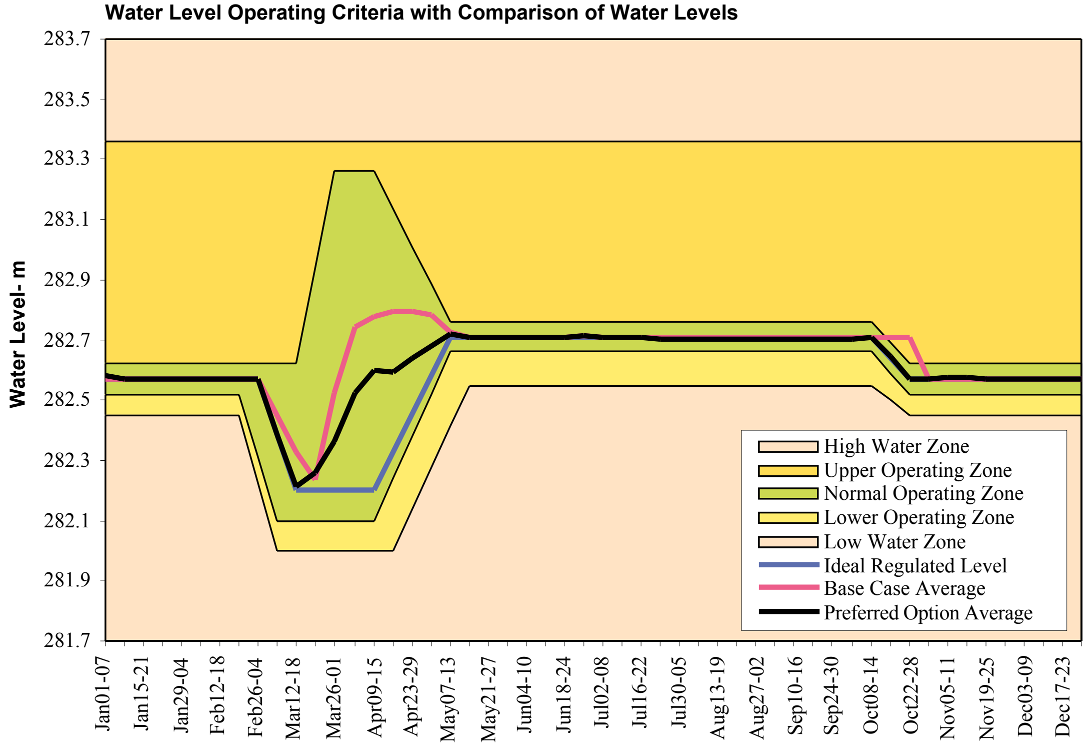
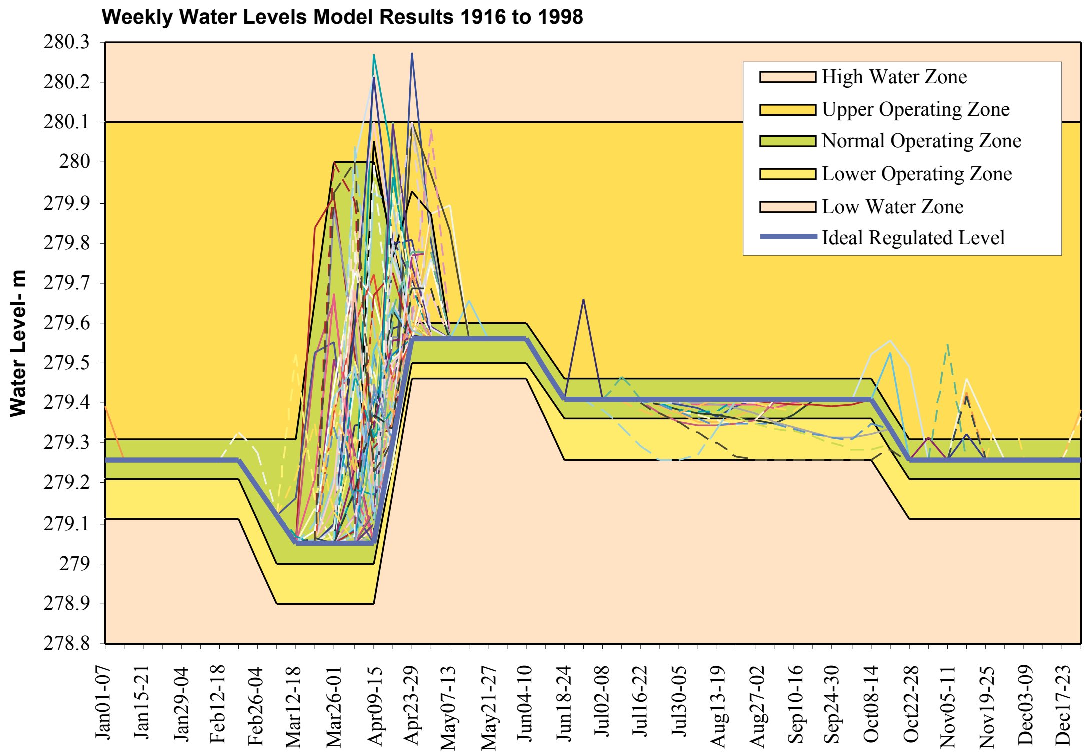


Figure 12.6
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Magnetawan Dams (Cecebe Lake)

ACRES International



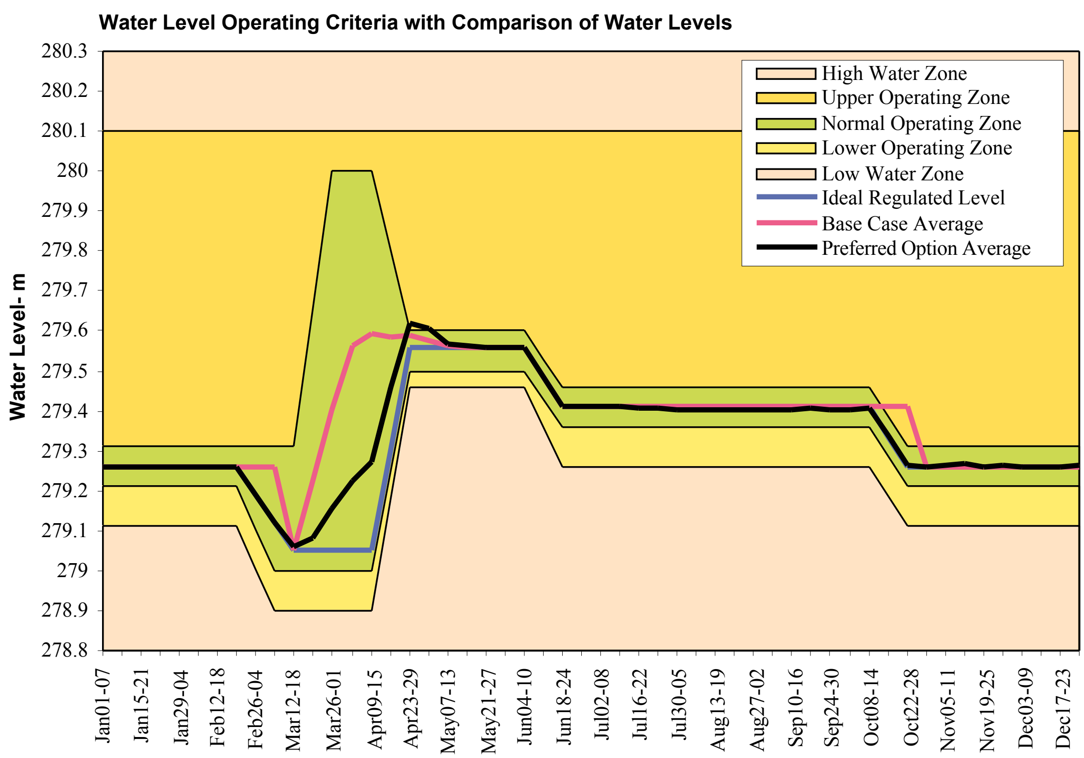
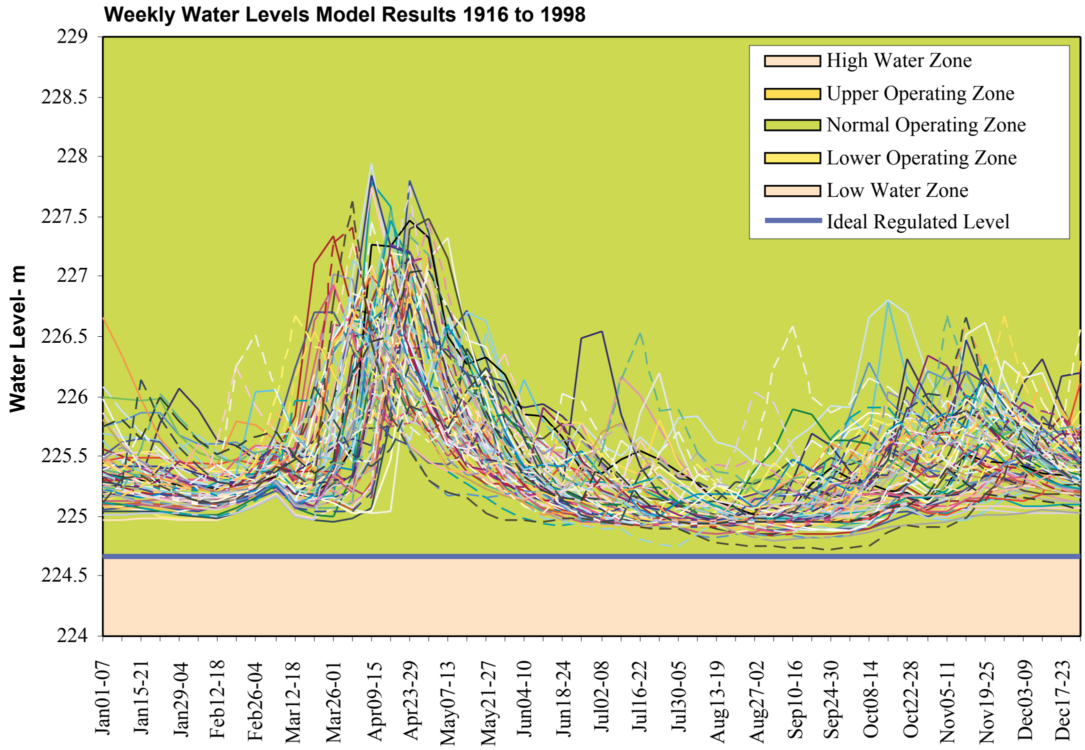


Figure 12.7
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Feighens and Knoepfli Dams (Ahmic Lake)

ACRES International



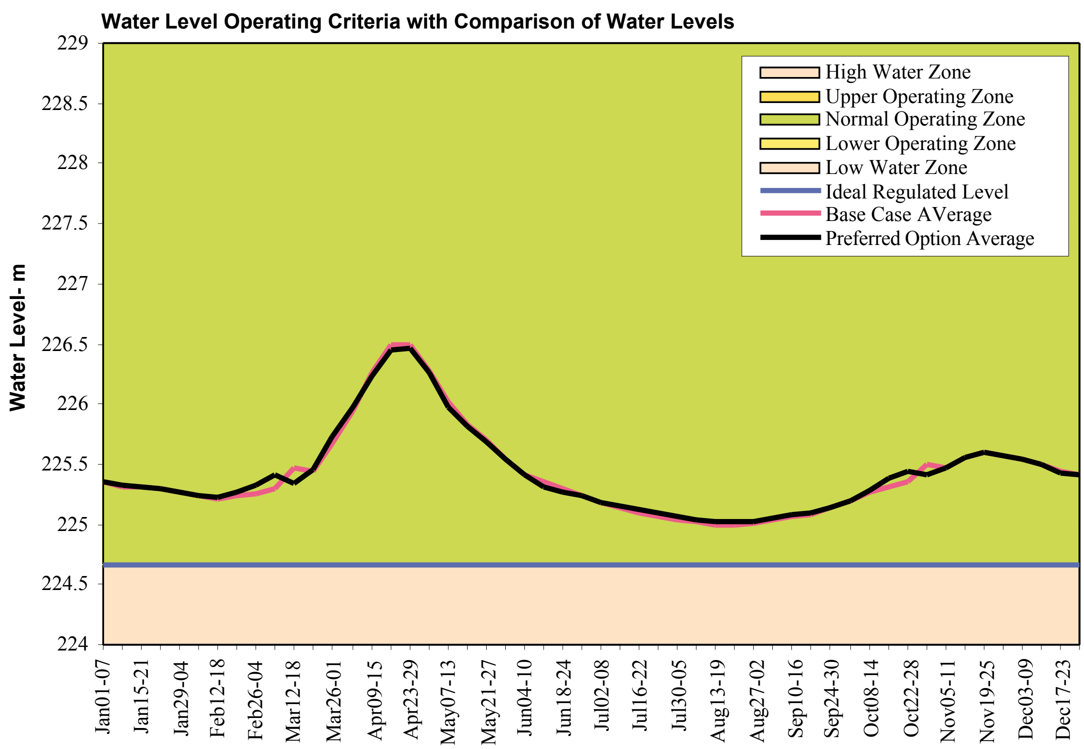
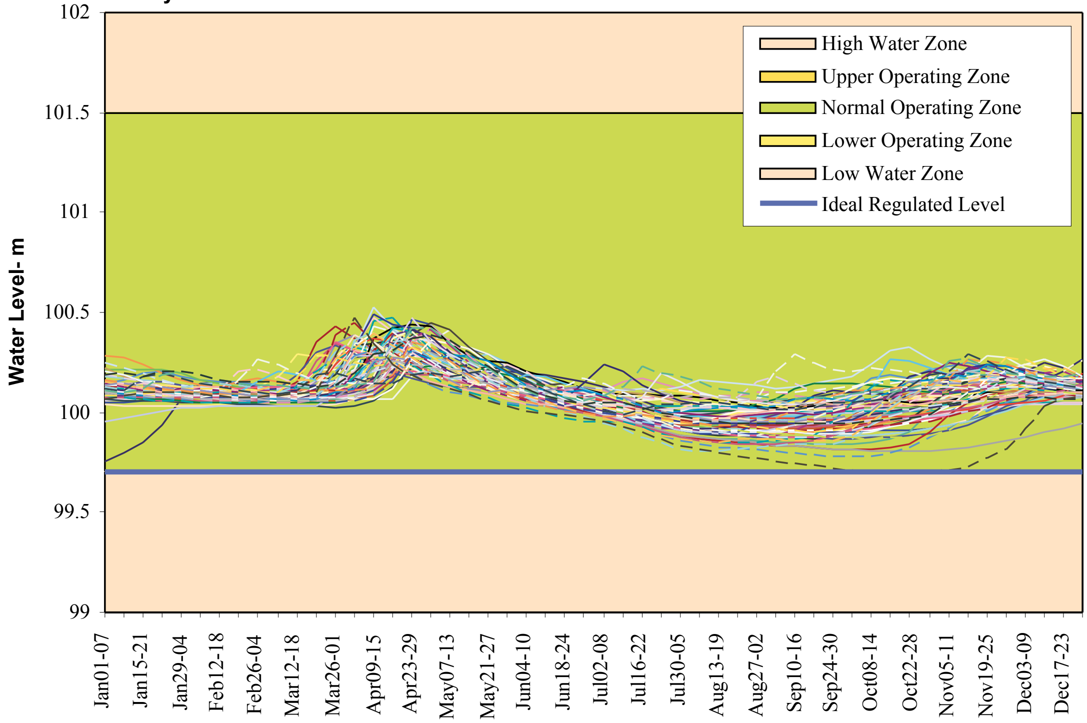


Figure 12.8
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Wahwashkesh Lake Dam

ACRES International

Weekly Water Levels Model Results 1916 to 1998



Water Level Operating Criteria with Comparison of Water Levels

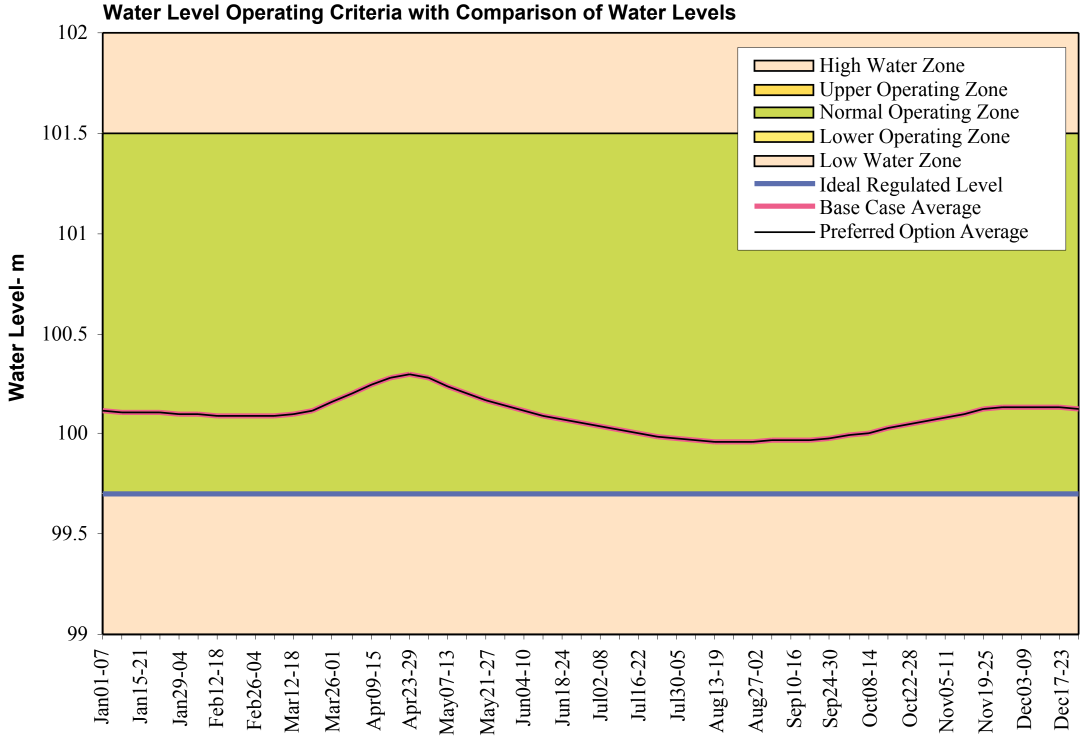
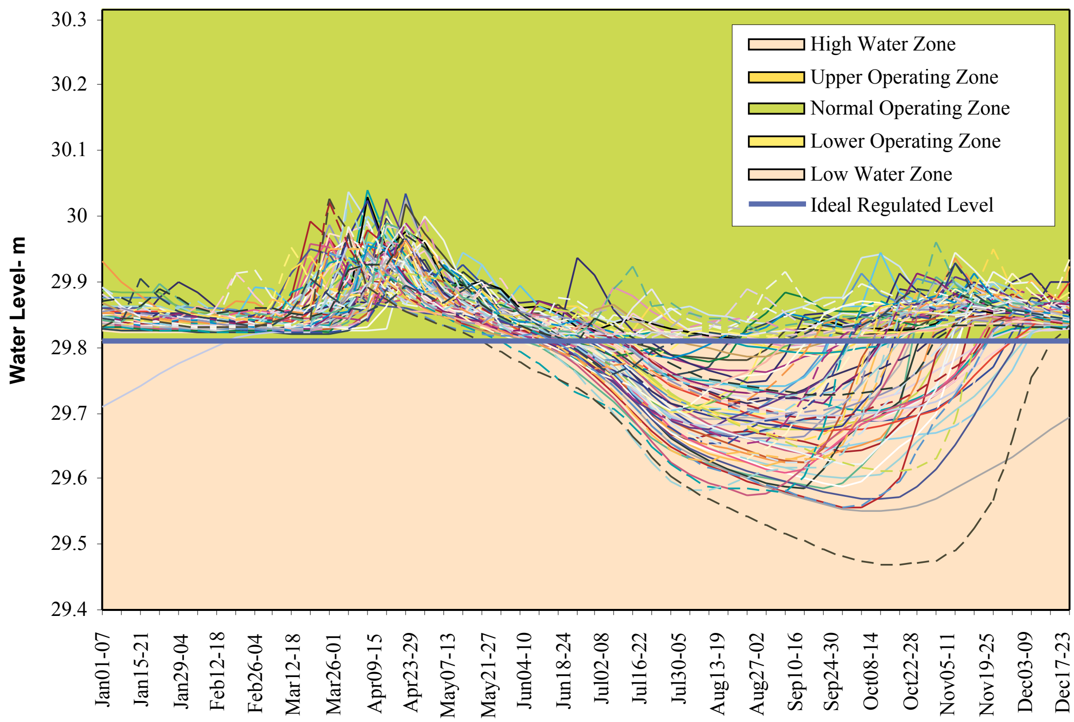


Figure 12.9
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Kasegaba Lake Dam

ACRES International

Weekly Water Levels Model Results 1916 to 1998



Water Level Operating Criteria with Comparison of Water Levels

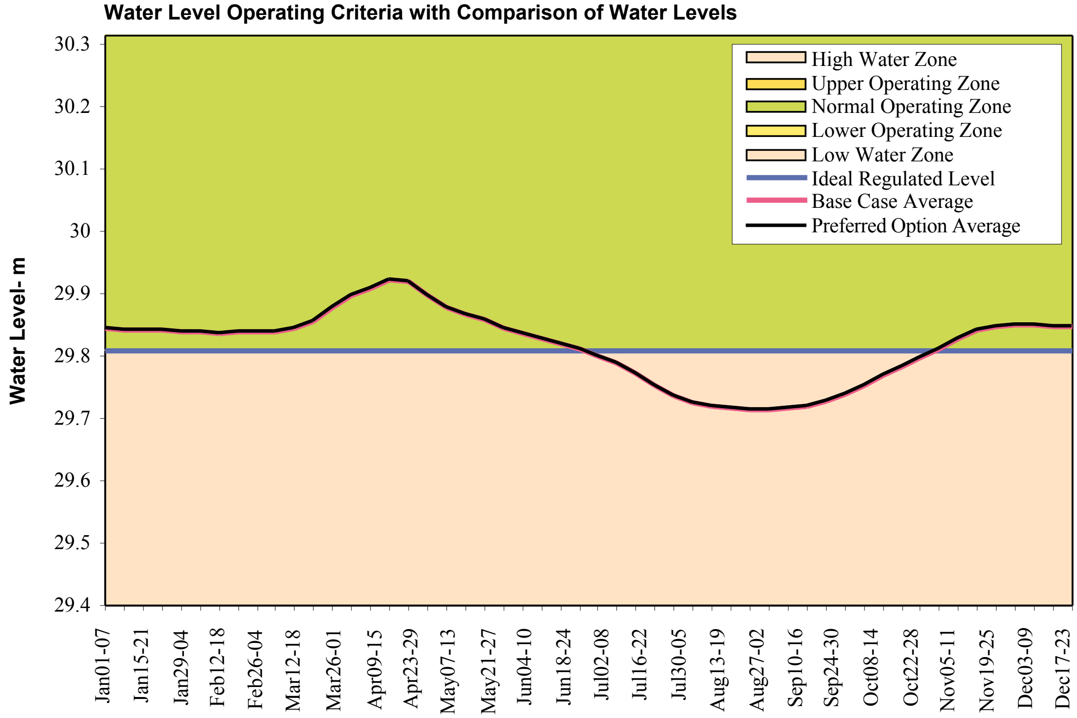
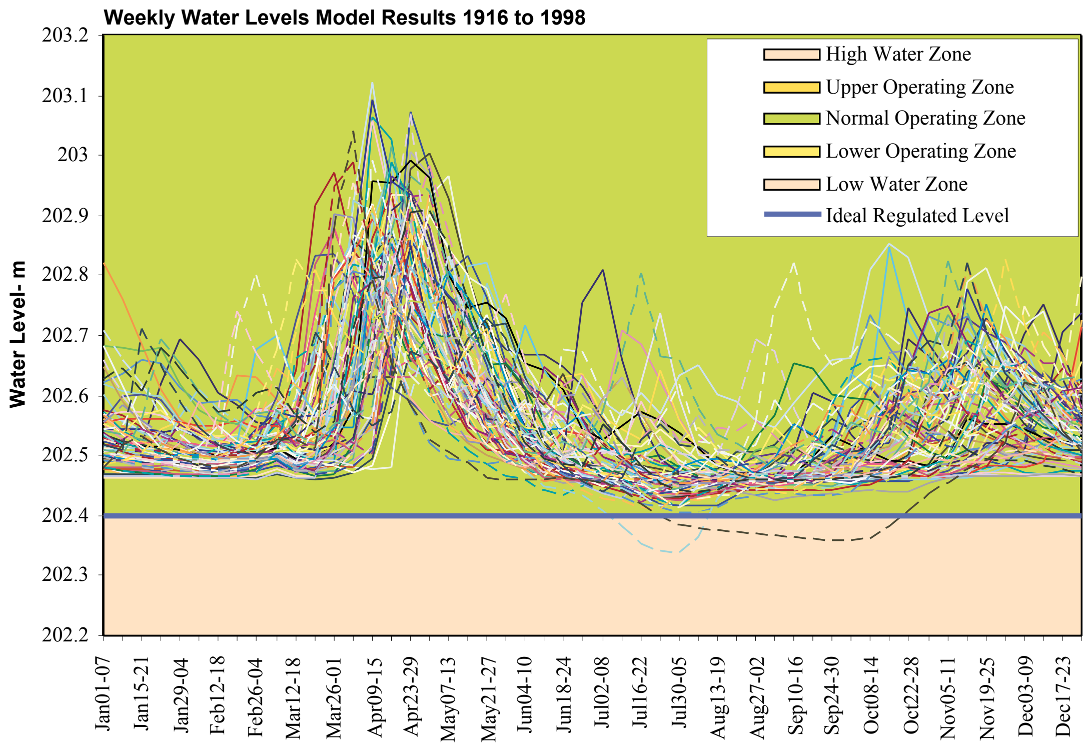


Figure 12.10
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Gooseneck Lake Dam

ACRES International



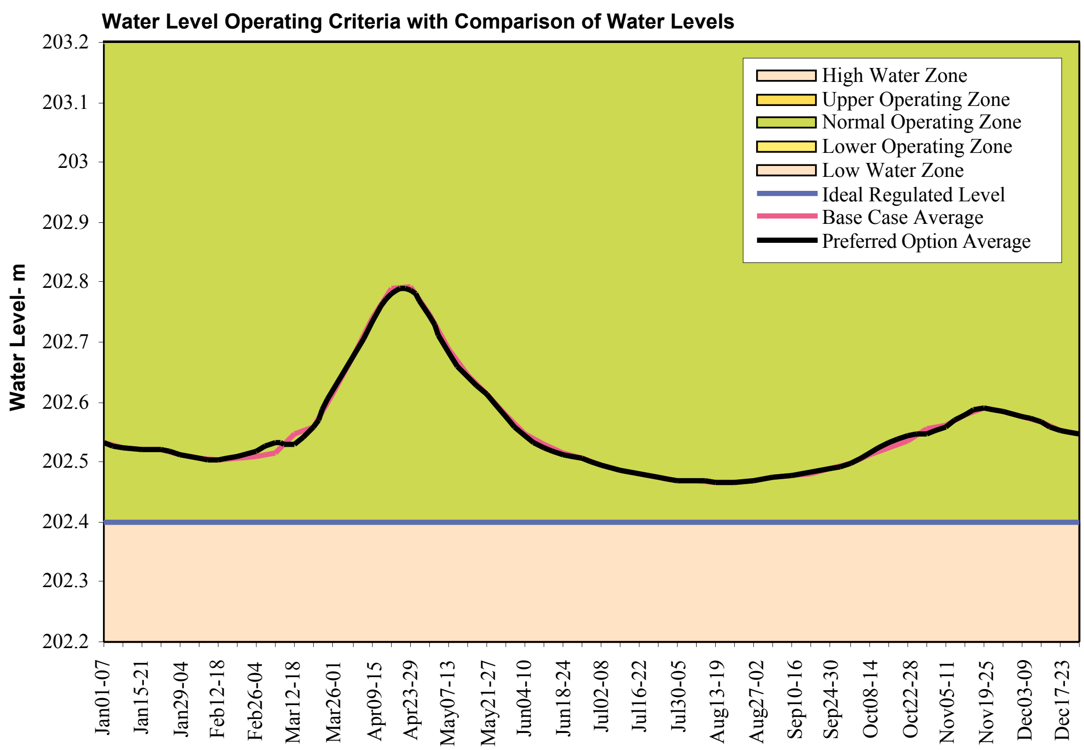


Figure 12.11
Ministry of Natural Resources
Magnetawan River Water Control Operating Plan
Preferred Option for Harris Lake and American Trail Dams

ACRES International

13 WATER CONTROL OPERATING PLAN IMPLEMENTATION FRAMEWORK

13 WATER CONTROL OPERATING PLAN IMPLEMENTATION FRAMEWORK

13.1 Public, First Nation and Agency Review

The recommended Magnetawan River Water Control Operating Plan will be subject to a final phase of public, First Nation and agency consultation, prior to approval of the plan by MNR.

Implementation of the preferred plan will result in relatively minor water levels and flow changes through the Magnetawan River system. Consequently, it is unlikely that the plan will require a consideration by DFO under the Canadian Environmental Assessment Act. DFO has however been provided with a copy of the plan for their review.

When the final plan is approved following public consultation, copies of the plan will be available for public inspection at the local MNR offices.

13.2 Monitoring Program

A monitoring program is recommended to coincide with the implementation of the Magnetawan River Water Control Operating Plan. The proposed changes made to the operating regimes of the control dams on the Magnetawan River are not expected to result in any negative effects on the lakes and riverine ecosystem. Therefore the initial objectives for monitoring would be directed at conducting baseline monitoring to fill identified data gaps. This information would be used to build on the existing knowledge of the natural and social environment of the river system and serve as a basis of comparison against which future changes can be measured. Monitoring activities associated with assessing the effectiveness of the plan’s implementation and to determine what changes, if any, are occurring with the proposed dam operations would be best determined in conjunction with MNR’s other resource management initiatives such as fisheries management, water control and flood forecasting.

The components of the recommended monitoring program are

- baseline monitoring
- effects monitoring
- compliance monitoring.

The monitoring program will be initiated with baseline monitoring. The purpose of baseline monitoring is to (i) establish a set of conditions that measure pertinent attributes that may be affected as the management plan is implemented and (ii) use that set of conditions against which change can be measured that may result from implementation. The existing baseline information will be analyzed, and from this analysis the effects monitoring program will be developed. Concurrently, compliance monitoring will be conducted although on a less rigorous level. Each year, decisions on the monitoring program for the next season will be made based on

- building on existing knowledge of the natural and social environment of the river system
- gaining an understanding of which monitoring projects are most effective
- assessing the availability of financial and human resources to conduct the monitoring studies.

It is anticipated that the baseline data will provide the necessary background information to assess the effects of any future operational changes to the existing baseline water management strategy. Monitoring activities will be conducted by MNR or their designate, but overall coordination will be conducted by MNR. Monitoring results may be summarized on an annual basis, in report format. Results will also be available for public review. The reporting requirements and other aspects of the monitoring program are addressed in the following sections.

13.2.1 Baseline Monitoring

Aquatic Ecology

During the water management planning process, background information was collected for the aquatic ecology of the Magnetawan River system. Abundant information is available to the extent that there is a good understanding of the existing aquatic ecology within the system. Nevertheless, several data gaps were identified through the background information collection exercise. Given the incremental changes that will occur to flows and levels following implementation of the water control plan, the proposed baseline monitoring strategy is to fill the data gaps and provide information that will update and re-assess the status of the ecosystem.

The South Magnetawan River is the primary area identified with information gaps, specifically relating to spawning areas of walleye and other resident fish species. An aquatic ecology baseline monitoring program is recommended for this area to provide information on

- walleye spawning areas
- fish population information (creel and netting surveys)
- water levels
- survey of bank conditions and erosion-prone areas.

Socioeconomic

The socioeconomic environment has been well documented in Section 3 of this report. The information therein will serve as the basis for the socioeconomic portion of the monitoring program and will focus on the attributes that were used for assessment of the alternative strategies. These attributes are flood management, tourism/recreation and small hydro potential. An initial assessment of the shoreline infrastructure in the form of a boat reconnaissance of docks and boathouses was conducted in May 2002 for Ahmic, Cecebe and Doe Lakes. This information is summarized in Appendix G5 and was conducted to determine the potential for impacts to shoreline structures as a result of changes in water levels on these lakes. Although no significant water level changes are proposed for the other controlled lakes on the system, it is recommended that a shoreline structure reconnaissance be conducted for Bernard Lake, Perry and Hassard Lakes, and the Magnetawan River reach from Watts dam to approximately 2 km upstream of Little Doe Lake using the same approach established in Appendix G5. As part of the reconnaissance, areas susceptible to erosion should also be documented.

Water Levels and Flows

At each of the control dams, Acres International recommends that automatic water level gauges be installed to record continuous readings. This data would provide the necessary information to determine inflows throughout the basin for future updating and fill in missing data to verify that the recommended minimum flow releases are achievable. In addition, a streamflow gauge is required on the Magnetawan River below Poverty Bay (Ahmic Lake). This would allow confirmation of the discharges from the Ahmic Lake dams and provide additional data for updating the water management plan in the future. Other locations, such as main tributaries to the Magnetawan River, and below the other dams would provide additional data that could be used in the future but is not a necessity since the calculated discharges from the dams based on recorded water levels would provide adequate data. MNR will have to undertake a cost-benefit analysis of this Acres recommendation to install data loggers.

Rainfall and Snowfall

Rain gauges and snow course stations are required within the basin to provide the necessary data for implementation of flood forecasting. Since preparation of the draft Magnetawan River Water Management Pan (A&A, 2002), the MNR has installed an automatic tipping bucket rainfall gauge at Doe Lake near Katrine and has established a snow course station near Bernard Lake. Data collected at these stations will help provide needed watershed-specific baseline data to further verify the computer model and provide critical hydrometric information for flood forecasting. In addition to the Doe Lake rainfall gauge, consideration should be given to installing 2 to 3 other rain gauges spaced throughout the watershed above Wahwashkesh Lake. This data would provide insight into the spatial and temporary effects of rainfall distribution across the watershed as well as to further model verification data and forecasting ability for summer rainfall flood events. Consideration should be given to the installation of at least one snow course station located in the southern area of the watershed associated with the sub-basin for Cecebe Lake. The data from this station combined with data from nearby stations would provide necessary information for prediction of spring freshets.

The proposed baseline monitoring program will be implemented upon finalization of the water management plan. It is expected that the specific details of the monitoring program will be developed by MNR based on their assessment of resources and integration with initiatives for environmental monitoring such as fisheries management. This process will likely occur over the year following finalization and approval of the Water Management Plan. This timing will be necessary to accommodate the seasonality of the fishery, such as spring walleye spawning, summer recreational use, etc.

13.2.2 Effects Monitoring

The effects monitoring program will evaluate the degree to which implementation of the Magnetawan River Water Control Operating Plan has achieved the planning objectives and what, if any, impacts have resulted. This portion of the monitoring plan will be conducted to gain the essential information to adapt operations and conditions to better fulfill the objectives of the plan.

The effects portion of the aquatic ecology monitoring program will follow the format of the baseline information study. The baseline information gathering exercise may not have included field surveys, therefore some of the effects monitoring program will be an update of some of the existing data. Much of the information is collected by the MNR on an ongoing basis in various parts of the watershed. These include programs such as Fall Walleye Index Netting (FWIN), Spring Littoral Index Netting (SLIN) and spawning surveys. These programs will be incorporated into the effects monitoring program and the results will be compared with data from earlier years to determine the effectiveness of the plan.

Effects monitoring for baseline information that was collected in the field will be a continuation of that program.

The effectiveness of the Magnetawan River Water Control Operating Plan in achieving social objectives will also be monitored on an ongoing basis. These effects will be assessed according to the attributes and criteria that were used in the assessment of alternatives. Thus, flood management, tourism/recreation uses and small hydro potential will be monitored. Some of the components of the socioeconomic effects monitoring may include

- ongoing records of daily, weekly or monthly water levels recorded at each of the control dams
- review of continuous flow records obtained from the WSC stations within the watershed
- visual observations and spot measurements of water levels and flows during normal operations, drought and flood events at critical reach locations along the river
- collection and review of file records of comments or complaints registered with MNR regarding water levels, flows and/or ecological concerns.

Each year that effects monitoring is conducted, the data will be analyzed and compared with the baseline conditions. The recommended water management strategy will then be reviewed to determine if modification is necessary. In the event of a modification, additional monitoring may be required as well as an amendment to the original plan. MNR or their designate will be responsible for conducting the effects monitoring and summarizing the results in the form of a report. It is expected that effects monitoring reports will be prepared on an annual basis for the duration of the program.

13.2.3 Compliance Monitoring

The cornerstone of compliance is the principle that dam operators are accountable for operating the facilities according to the water management plan. Compliance monitoring is not expected to be an issue with the Magnetawan River Water Control Operating Plan, as MNR presently owns, maintains and operates the dams, and they will be responsible for implementation of the water control plan.

13.3 Plan Amendment, Review and Renewal

13.3.1 Plan Amendment

Consistent with other resource management plans and practices of the MNR, this plan will be subject to review and renewal by MNR approximately every 10 years. Under certain circumstances however, amendments may be required to the Magnetawan River Water Control Operating Plan prior to the plan review and renewal. These amendments would likely arise as a result of new scientific research and studies being conducted or other information becoming available as specified in the plan or through other data gathering exercises.

If these amendments are minor in nature and are consistent with the water control plan's objectives including matters of public interest and safety, then MNR may amend the plan without public consultation, after a very thorough review of the amendment. Copies of these minor amendments will be maintained in the local MNR offices.

If the proposed amendment is more significant in nature, such as a change in operating regime at one or more of the structures or of significant public interest, then it will be deemed to be a major amendment by MNR and shall be subject to public consultation. This public consultation may include further Environmental Registry posting, public meetings, First Nation dialogue, or the involvement of a public advisory body.

13.3.2 Plan Review and Renewal

The Magnetawan River Water Control Operating Plan will be subject to review and renewal, approximately 10 years from the date of its approval. Given the moderate complexity of the plan, but the absence of significant issues, the review process should be initiated approximately 1 year prior to the end of its term. The plan review process will mirror the steps involved in the plan preparation, with new data and information considered during the review as a basis for continuing with the status quo or recommending changes (MNR, 2002), as well as any legislative or policy requirements of MNR at that time.

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Web Sites

Government Agencies

Environment Canada www.ec.gc.ca
Indian and Northern Affairs Canada http://www.ainc-inac.gc.ca/index_e.html
Ontario Ministry of Environment http://www.ene.gov.on.ca/
Ontario Ministry of Municipal Affairs and Housing http://www.mah.gov.on.ca/english.asp
Ontario Ministry of Natural Resources http://www.mnr.gov.on.ca/
Ontario Ministry of Northern Mines and Development – Mining Claims http://mndm.gov.on.ca/claims/clm_mdva.htm
Ontario Parks http://www.ontarioparks.com/
Statistics Canada – Profile of Canadian Communities http://ww2.statcan.ca/english/profil/PlaceSearchForm1.cfm

Towns

Township of Armour http://www.hips.com/armour/
Burk's Falls, Armour, Ryerson Community Access Program http://www.kirk-white.com/barcap/index.htm
Municipality of Magnetawan http://magnetawan.on.ca/
Town of Kearney http://www.townofkearney.com/
Magnetawan Ontario, Canada http://www.onlink.net/~village/magnet.htm
Village of Sundridge http://www.geocities.com/TheTropics/Cabana/9986/

Businesses

Almaguin 2000 Development Agency http://www3.sympatico.ca/almaguin.2000/
Canadian Wilderness Trips http://www.cndwildernesstrips.com/b3.html
Killarney Mountain Lodge and Outfitters http://www.killarneyoutfitters.com/
Magnetawan Area Business Association http://www.onlink.net/~village/service.htm
Northern Wilderness Outfitters http://www.northernwilderness.com/
Ontario Out of Doors Magazine Article Ahmic Lake http://www.woodlandechoes.on.ca/oodmag.htm
Ravens Watch Dog Sled Tours http://www.traveltomuskoka.com/ravenswatch/
Stage 2 Nordic http://www.stage2nordic.on.ca/index.html
White Squall Paddling Centre http://www.zeuter.com/~squall/

Associations

Algonquin Eco-Watch http://www.algonquin-eco-watch.com/
Almaguin Fishing Improvement Association http://www.onlink.net/~village/afia.htm
Discover Routes Trails Organization http://www.discoveryroutes.org/
Federation of Ontario Cottagers Associations http://www.foca.on.ca/index.htm
Fishing Georgian Bay http://www.georgianbay.com/
Magnetawan Trails http://www.discoveryroutes.org/magnetawan.html
Old Nipissing Road http://www.onlink.net/~woodland/trail.htm
Ontario Federation of All Terrain Vehicle Clubs http://www.psatv.upandrunning.com/
Ontario's Near North http://www.ontariosnearnorth.on.ca/index.html
Parry Sound Snowmobile Clubs http://www.parrysoundsnowmobile.on.ca/
Northern Ontario Tourist Outfitters Association http://www.noto.net/
Sierra Legal Defense Fund http://www.sierralegal.org

Resorts

Almaguin Parklands Campground http://www.onlink.net/~stefang/
Caswell Resort Hotel http://caswellresort.com/
Doeview Cottages and B&B http://doeview-cottages.com/
Fern Glen Inn B&B http://www.bbcanada.com/1959.html
Granite Ridge Wilderness Campground http://www.graniteridge.com/index.html
Lighthouse Landing Cabins and Camping http://www.execulink.com/~lighthousecamp/
Quiet Bay Motel and Restaurant http://www.onlink.net/~quietbay/quiet2.htm
Resorts Ontario http://www.resorts-ontario.com/search.cfm
Roundstone Inn Motel http://www.roundstoneinn.on.ca/
Shady Nook Cottage Court http://www.shadynook.on.ca/
Silver Sands Family Resort http://www.vianet.ca/pages/silverss/
Woodland Echoes Cottage Resort http://www.woodlandechoes.on.ca/index.htm
Ye Old Cutter Camp http://www.cuttercamp.com/