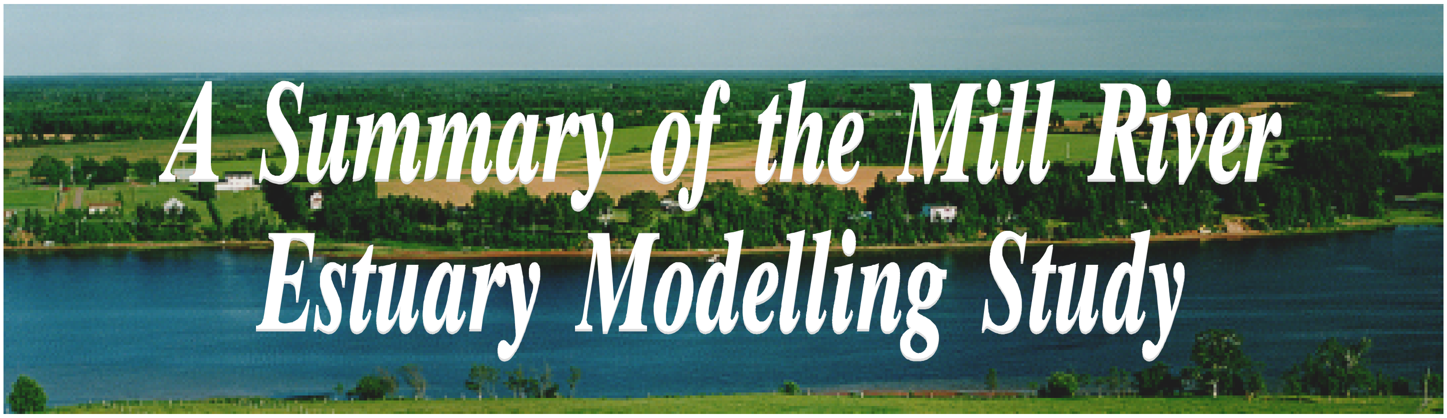
A Summary of the Mill River Estuary Modelling Study



The History

Residents of the Mill River area have been concerned about the failing health of the Mill River estuary since the first shellfish closures in the upper river more than 30 years ago. The problems are easily seen. Large floating mats of sea lettuce have become a common sight in some areas of the river during summer months. When these large mats begin to die off, the decay process causes a strong rotten egg smell and bacteria can result in the water turning a milky white or greenish colour. As all of the oxygen in the water is used up, the result can be fish and shellfish kills.

Various views of sea lettuce growth in Mill River.

The Mill River Watershed Roundtable, a partnership of the community and government, was created in 1999 to develop a strategy to address problems in Mill River. As a first step, the Roundtable hired Martec Ltd, an oceanographic consulting firm from Halifax, to carry out a study. The goal was to pinpoint the causes of the problems in Mill River and identify potential corrective measures to improve conditions.

The Study

The study examined the effects of *bridges and causeways*, *sediment inputs*, and *nutrient inputs* on water quality, and how changes could be made to these to improve conditions in the river. It then provided *an optimized strategy*, or particular combination of changes which would provide the most improvement.

The study used computer modelling technology, which is currently the best way to predict how physical changes in tidal flushing, nutrient reduction, land management and other measures, can interact to produce a change in any given body of water. Three separate but interconnected models were used:

- *The watershed model* was used to show how nutrient and silt loads would be affected if changes were made to land-use practices.
- *The hydrodynamic model* was used to predict if widening the openings of bridges; creating openings in causeways; or dredging of channels, shallow areas, or the Goose Harbour entrance to Cascumpec Bay, would create improvements in tidal flushing.
- *The water quality model* was used to predict if improvements in water quality were possible by making changes in tidal flushing or nutrient loading from wastewater treatment or land use.

The Results

Effect of Bridges and Causeways

The model demonstrated only a slight difference between tides in Cascumpec Bay and Mill River; but a great difference between tides in Mill River and the bay, and a point outside of the bay (off Alberton). This indicates that tidal flow and circulation patterns within Mill River are controlled by the entrance of Cascumpec Bay and not by the Cascumpec Bridge.

The model also demonstrated that creating larger openings at the Cascumpec, Long Creek and Meggison's Creek bridges, and creating openings at the Fox Island and Pitt Island causeways, would produce no improvement in flushing or water quality in Mill River or Hill's River.

Effect of Dredging and Reducing Siltation

The study demonstrated that dredging would not produce significant changes in water quality in Mill River.

- Dredging Goose Harbour would result in only a slight change in tides in Mill River and no improvement in water quality in the river.
- Dredging of selected in-filled areas of Mill River would produce a marginal improvement in water quality but there would still be sea lettuce growth.
- Dredging a four-metre channel from Cascumpec Bridge though to the upper river area would produce no significant improvement in water quality.
- Dredging of shallow upper river areas would not have a great impact on water quality as continuing large inputs of nitrogen would cause continued sea lettuce and algae growth.

Effect of Reducing Nutrients

Sewage Treatment Plant

An additional level of treatment at the Mill River Sewage Treatment Plant could result in an 82 per cent reduction in phosphorus entering the river from that source. This reduction in phosphorus was predicted to result in a slight decrease in algae growth in the river.

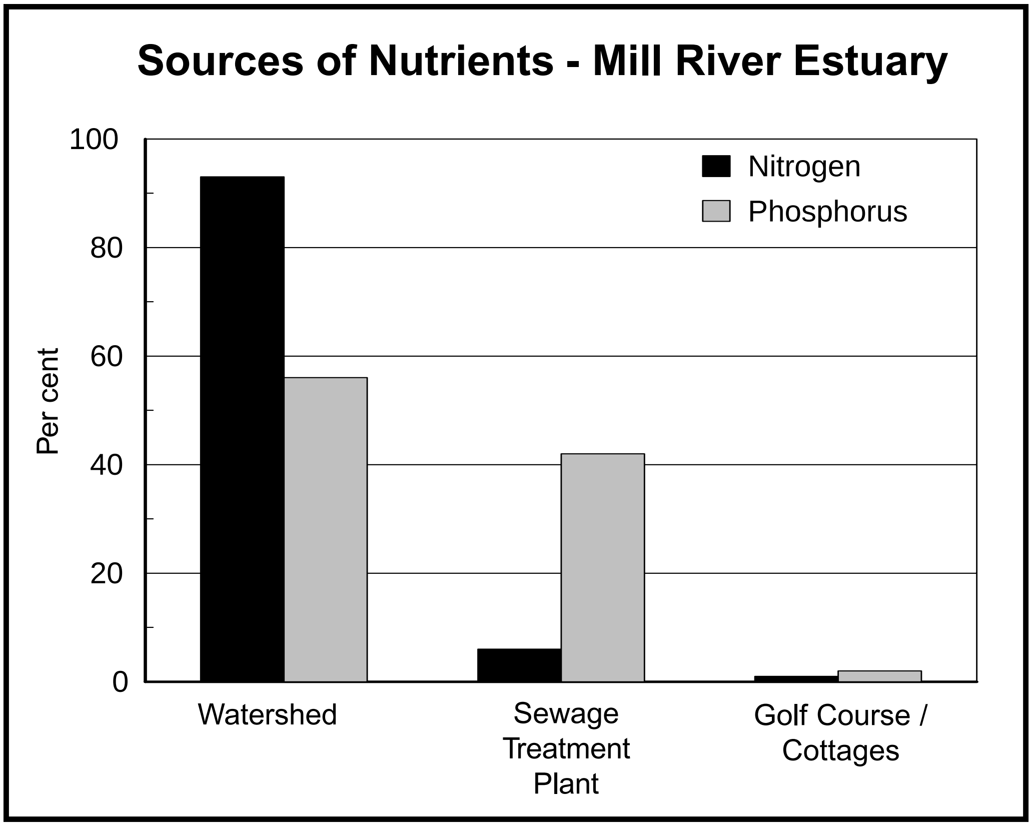
Agricultural Practices

The water quality model showed that reducing nutrients entering the river from farmland throughout the watershed, would greatly decrease algae and sea lettuce growth in the river. In order to reduce nutrient inputs, various combinations of soil conservation and altered fertilizer applications methods were run in the watershed model. The model results varied depending on what combination of measures was used. Man-made settling ponds and artificial wetlands predicted an additional reduction in nutrients when used in conjunction with reduced fertilizer application and additional soil conservation.

Dredging

Nutrient rich sediments in the upper river could act as a source of phosphorus for the estuary for some time. The model demonstrated that a large amount of material would have to be removed to reduce this phosphorus source. The cost of this dredging would not offset the benefits.

The upper estuary and Mill River resort



Source: Adapted from Figure 18.5 and from text values in Addendum 1, Mill River Watershed Modelling Study.

The watershed model demonstrated that most of the nitrogen entering the Mill River estuary (93 per cent) comes from the watershed while the phosphorus comes from both the watershed (56 per cent) and the sewage treatment plant (43 per cent).

Identifying An Optimum Strategy

Six strategies were considered:

1 Nutrient reduction on farmland combined with tertiary treatment at the treatment plant.
2 Nutrient reduction and use of settling ponds and artificial wetlands on farmland combined with tertiary treatment at the treatment plant.
3 Dredging a four-metre deep channel through the upper estuary.
4 Dredging a four-metre deep channel through the upper estuary combined with Strategy 1 above.
5 Enlargement of opening at Cascumpec Bridge.
6 Reduction of nutrients from cottages and the golf course.

To determine the best solution to the problems in Mill River, each strategy was examined using the models. The options were then ranked according to the percentage of improvement achieved.

Strategies 1, 2, 4, and 6 all predicted reduced growth of algae in the river. However, **Option 2 produced the greatest improvement and was ranked highest.** Option 5, the opening of Cascumpec Bridge, was the lowest ranked option as no improvement in algae growth would be produced.

Conclusions

It was concluded that the best strategy to improve Mill River is to reduce nutrient inputs by targeting both agricultural runoff and the sewage treatment plant effluent. The study has shown that 75 per cent reduction of nutrients in agricultural runoff would produce a positive change in conditions in the river. To get this reduction, best management practices such as soil conservation and nutrient management would have to be used in conjunction with man-made settling ponds or artificial wetlands.

By upgrading the existing sewage treatment facility to tertiary treatment, the levels of phosphorus entering the river from that source can be reduced by 82 per cent.

Making physical changes to bridges and causeways in the Mill River would not improve conditions. Dredging in-filled areas in the upper estuary would not reduce growth of sea lettuce as nutrient loading to the river is currently great enough that sea lettuce would grow in water deeper than one to three metres.

The complete Mill River Estuary Modelling Study can be found online at:
www.gov.pe.ca/go/millriverstudy
For further information, contact:
Mill River Watershed Improvement Committee
(c/o Al Peters, 606 Fortune Cove Road
RR 3 O'Leary, PE C0B 1V0) ***or***
Departmentof Environment, Energy and Forestry
Water Management Division
(902) 368-5044 or toll-free 1-866-368-5044