

## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

#### **Modeling Results**

Without modifications, Hope Canal can convey 300 ft<sup>3</sup>/sec (8.5 m<sup>3</sup>/sec) from Airline Highway (US 61) to the I-10 bridge at bank full capacity and with minimal scour. Higher flow rates would result in overbank flow. At 300 ft<sup>3</sup>/sec (8.5 m<sup>3</sup>/sec), velocities would create a depositional environment. Within Hope Canal, total nitrogen concentrations would be reduced from 1.40 mg/L to 1.36 mg/L, basically an insignificant change. Results from RMA2 show that the influx of 300 ft<sup>3</sup>/sec (8.5 m<sup>3</sup>/sec) at the Hope Canal I-10 bridge would most significantly impact the southeastern quadrant of the modeled area. Due to breaks in the north-south railroad bed, some impact would also be felt in a portion of the northwestern section of the modeled area. Otherwise, the dominating factors are precipitation and tidal exchange, with precipitation having the most significant effect. Under these conditions, any nitrogen introduced into the swamp via this flow would move through the southeastern quadrant of the study area and out of the modeled area. It must be noted, though, RMA4 models nitrogen as a first order decay and does not take into account the nitrogen cycle or the processes that occur in marsh sediments during the marsh porosity flow.

#### **Model Utility**

For the 1-D modeling environments, HEC-RAS 3.0 and QUAL2E have sufficient capabilities to investigate various diversion scenarios while the flow is contained within the channel banks. Once overbank flow occurs, the environment becomes a 2-D flow environment and the utility (or application) of these models become questionable.

In the 2-D environment, RMA2 has the capability to take into account the microtopography and roughness characteristics that can be problematic in wetland hydrodynamics. RMA4, though, is not suitable for detailed nutrient modeling. Nitrogen evolution in a biological system is a complex interdependent process of the various elemental species (i.e., nitrogen, ammonia, nitrate, and nitrite) present. RMA4 only has the capability to model a first order decay rate independent from other modeled constituents. Thus, RMA4 would be best used as a screening model.

### **Recommendations for Future Work**

To examine diversion impacts on the entire Maurepas ecosystem, model boundaries need to be extended to encompass the whole swamp. Note, however, that this will result in increased computational requirements due to a significantly larger mesh. A higher resolution digital elevation model is also necessary to confirm the nuances of the microtopography in the area. This increased resolution is especially critical since the fine distinctions in topography can have significant impacts on water flow.

Model parameters such as marsh porosity and roughness coefficients can be refined through fieldwork and laboratory studies. A denser gauge system should also be placed out in the swamp to provide calibration data. Results from this study indicate that the optimal locations for stage gauges are away from boundary conditions and in the vicinity (but not in) the existing drainage channels.

For detailed nutrient modeling, a more sophisticated model is needed. RMA4, in this environment, does not adequately replicate nutrient evolution within the swamp.

As for Maurepas Swamp, any diversion scheme would have to be closely scrutinized not only in terms of hydraulic effects but also in terms of the biological

impacts. Critical questions to ask would be how any proposed flow diversions would affect seed dispersal dynamics and the life cycles of native plant species. Excessive flooding may result in the conversion of swamp to open water due to ecosystem disruptions.

Other techniques are available to help maintain this ecosystem. One is to remove or degrade structures that no longer serve their design purpose. In the model runs, the abandoned railroad embankments had a significant impact on flow patterns within the modeled area. Breaching these structures will assist in restoring water circulation to the pre-existing patterns.