

MODELING A MISSISSIPPI RIVER DIVERSION INTO A LOUISIANA WETLAND

A Thesis

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ABSTRACT

Wetland loss has significant impacts. Numerous loss mechanisms have been hypothesized, and a greater number of solutions have been proposed. One proposed solution is to divert river water into a degraded area with the intent of increasing sedimentation, introducing nutrients, and/or decreasing salinity within the wetland. However, wetland hydraulics and hydrology are complex processes and any hydrologic modification may result in unintended consequences. Predicting these consequences can be problematic due to the complexity and difficulty associated with proper modeling of the hydraulics and topography. The primary objective of this study is to evaluate the suitability of established one- and two-dimensional (1-D and 2-D) models for investigating flow diversions in a wetland environment. This study focused on a Mississippi River diversion through Hope Canal into Maurepas Swamp, Louisiana. The 1-D models used to investigate canal flow were HEC RAS 3.0 for hydraulics and QUAL2E for nutrients. These provided data and boundary conditions for the 2-D RMA2 (hydraulics) and RMA4 (constituent transport) models that were used to evaluate the 2-D modeled area. The secondary objective of this study is to use these models to evaluate the effects of a river diversion through the existing canal into the freshwater swamp. Results showed that the existing canal can convey 300 ft³/sec (8.5 m³/sec) and the total nitrogen content within this channel decreased by less than 3 percent. At this flow rate, the existing hydrological features in the swamp limit the impact of the diversion to the southeastern quadrant of the model area. The remaining area of the swamp is still dominated by the pre-existing hydrological inputs. According to the nutrient transport model (RMA4), nitrogen will not get assimilated in the modeled area. In terms of

applicability, the HEC RAS 3.0 and QUAL2E are sufficient tools to investigate diversions with no overbank flow. The RMA2 model is a good investigative tool for wetland flows due to its ability to account for some of the unique hydrodynamic aspects of wetland flow. The RMA4 program models nutrients only superficially, thus, it is sufficient as a screening tool but not robust enough to investigate wetland nitrogen processes.