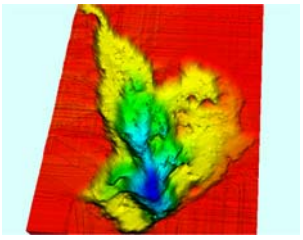
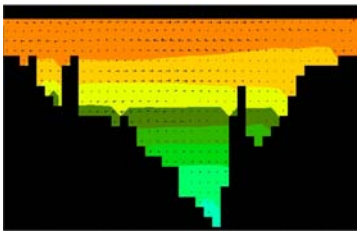
Flow Patterns and Fecal Coliform Transport Modeling

Camp Dresser & McKee, Inc., Lake Auburn, Maine





Situation

The Auburn Water District (AWD) and the City of Lewiston Water Division (LWD) required estimates of circulation patterns, travel times, and pathways for hypothetical coliform loads, including those from resident bird populations, in Lake Auburn for typical and extreme wind and flow conditions. These estimates allowed an assessment of the need for advanced water treatment processes.

Approach

GEMSS® (Generalized Environmental Modeling System for Surfacewaters) was used to study the hydrodynamic patterns in Lake Auburn, Maine for the time period April 2002 to November 2002. The model was calibrated and then used to study the fecal coliform transport within Lake Auburn for stratified and non-stratified time periods in 2002. A total of nine fecal coliform source locations (three tributary sources, three sediment sources and three Bird Island sources) were included in the simulations.

The water supply plant managed by Auburn Water District (AWD) and the City of Lewiston Water Division (LWD) is located on the south shore of Lake Auburn. The AWD/LWD intake coliform concentrations under high inflow, high outflow and runoff event conditions were examined with the 3-D modeling study.

Results

The model results show a good calibration for water balance and water temperatures. GEMSS® 3-D visualization capabilities allowed circulation patterns resulting from due to surface wind stress, varying depths, and the presence or absence of stratification to be studied.

An analysis of the simulations shows that the fecal coliform concentrations at the intake during the summer stratified time period are much smaller than the concentrations during the fall non-stratified time period. Among all the coliform source locations, the sources near the Townsend Brook yield higher concentrations at the intake. This result may be due to the short distance between the source location and the intake location, and the driving force from the Townsend Brook inflows.

The model results indicate that high inflows combined with high tributary concentrations sources yielded high in-lake coliform concentrations. The sediment sources yielded much higher intake coliform concentrations in the non-stratified time period than in the stratified time period.

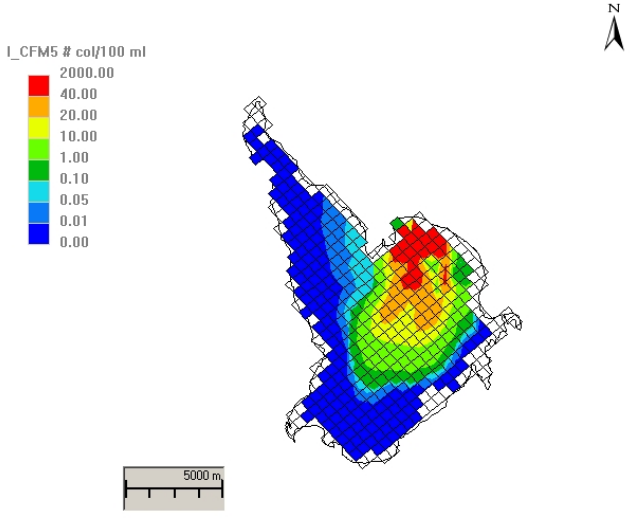


Figure 1 Plume of sediment coliform source at the intake layer near Townsend Brook