

3-D Modeling Assessment of the Lake Powell Temperature Control Device

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Situation

The purpose of the 3-D modeling is to provide a tool to assess differences between backwater and main stem water temperatures caused by operating the proposed Temperature Control Device (TCD) at Glen Canyon Dam.

Approach

A three-dimensional (3-D) hydrodynamic and water quality model, GEMSS® (Generalized Environmental Modeling System for Surfacewaters) was used to study the flow patterns and water temperatures at backwater regions in a short reach of the Colorado River. The model domain covers 5 km beginning at River Mile 65 (measured from Lees Ferry and below the confluence of the Little Colorado River).

The model was calibrated at two different locations using observed logger data at the Salt Mines backwater region within the study area. The calibration shows that GEMSS® generates reliable water temperatures if appropriate meteorological data are used. Three scenarios with high, low, and observed flows were simulated to study the impact of the Temperature Control Device (TCD) proposed for the Glen Canyon Dam. The high flow scenario has very high flow rates that are almost double that of the other scenarios. The input water temperatures at for low flow scenario are higher than those for the other scenarios, with up to a 6°C difference. The water temperatures used with the high flow scenario are slightly lower than those for the observed flow scenario. The model results for these three scenarios were compared, analyzed and reported.

Results

The results show higher backwater temperatures, hence improved habitat, at lower flows. However, stratification is more pronounced at higher flows, with the difference between surface and bottom temperatures in the backwater about 2°C with the low flow scenario and about 4°C with the high flow scenario.

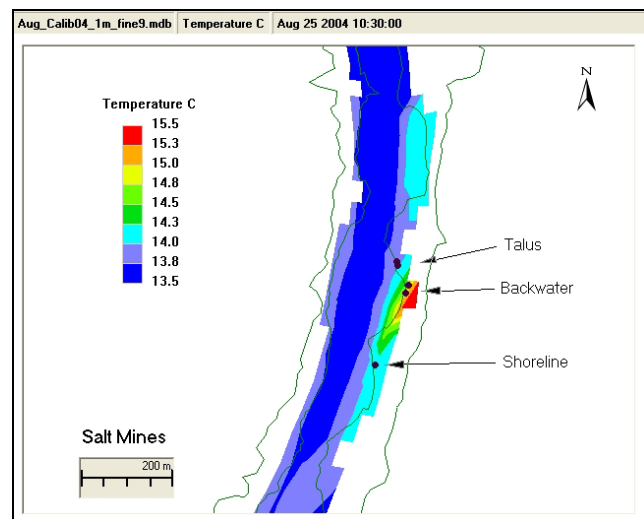


Figure 1 Example of the surface water temperature contours in summer