

**I. Project Title:** Gunnison River Temperature Model

**II. Principal Investigators:**

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**III. Project Summary:**

Studies have postulated that changes in hydrology and water temperature releases from the Aspinall unit could benefit the Colorado Pikeminnow. It is believed that by increasing the release temperature from the Aspinall Unit, the Gunnison River will increase growth potential of Colorado Pikeminnow below the Aspinall Unit at Delta, Colorado (Osmundson, 1999). Temperature models can be used to determine the feasibility of achieving the desired river temperature warming at Delta, CO, through a combination of flow and release levels. The goal is to address the following issues:

1. Confirm results from Phase I indicating that a temperature control device at Blue Mesa Dam would result in warmer release temperatures from Crystal Dam.
2. Determine whether an increase in release temperatures from Crystal Dam would result in a significant increase in stream temperatures in the area around Delta, Colorado.
3. Determine how much warmer the release waters would need to be to meet the targets identified in Osmundson's 1999 report.
4. Determine how wet/normal/dry year inflows to the Aspinall Unit impact reservoir stratification and releases, and how these variations would impact the use of a TCD.
5. Determine time when temperature targets can be met in a wet/normal/dry year.

6. Determine impact of TCD on reservoir heat budget.
7. Determine the most feasible TCD options to achieve temperature targets.
8. Determine reservoir and release temperature response to flow recommendation.

Hydrosphere Resource Consultants (Hydrosphere) and Bureau of Reclamation (Reclamation) are joining effort to accomplish these tasks. Hydrosphere is to perform the following tasks: Application and calibration of the Aspinall reservoir models using CE-QUAL-W2, and development and calibration of the Gunnison River model. Reclamation will review model input data, the calibration process, and the scenario analysis.

**IV. Study Schedule:**

March 2002 to December 2003

**V. Relationship to RIPRAP:**

Gunnison River Action Plan, Task #107

**VI. Accomplishments of 2002 Tasks and Deliverables, Discussion of Initial Finding and Shortcomings:**

Temperature models for Blue Mesa, Morrow Point, and Crystal Reservoirs were developed using the Corps of Engineer's CE-QUAL-W2 model (version 3.1). All three reservoir models were simulated and calibrated.

Hydrosphere was also tasked with the development of an empirical (statistical) model of mean daily water temperatures in the reaches between Crystal Dam and the town of Delta. The critical months for the analysis, based on Doug Osmundson's 1999 report, are late May/early June through October. These are the months during which river temperatures are most greatly reduced (i.e., cooler water) by the Aspinall reservoirs. The approach to developing this model has been to use a multivariate, stepwise regression, using air temperature, Crystal releases, Crystal release temperature, North Fork flows, and Uncompahgre river flows as the independent variables. Several variations on this theme have been conducted, including the use of hourly and daily average and maximum data sets. Aggregating the daily average data by month has produced reasonably good results in the "shoulder" months of interest, i.e., May, June, and October. However, the July through September results are less encouraging. The primary issue appears to be that once the reservoirs have stratified, there is almost no variation in release temperatures for these months. Because the historical data reflect very little variation in release temperatures for these months, the statistical model is unable to discern a relationship between release temperatures and river temperatures at Delta. Therefore, an alternative approach is required to meet the project's objectives.

A different modeling approach using QUAL2K has been selected to simulate the Gunnison River. This 1-D model is an enhanced version of QUAL2E and simulates diurnal variations in stream temperature for a steady flow condition. QUAL2K application for the Gunnison River had been calibrated using combinations of meteorological data and flows for the period May through October. The scenario analyses are currently being completed.

**VII. Recommendation:**

None

**VIII. Project Status:**

The project is on track and ongoing.

**IX. FY 2003 Budget Status:**

**Bureau of Reclamation:**

Funds provided \$20,480

Funds expended \$ 5,898

Difference: \$ 14,581

**Hydrosphere (Based on the entire project, not Fiscal Year):**

Funds provided \$82,770

Funds expended \$67,760

Difference: \$15,010

**X. Status of Data Submissions:**

Not applicable.

**XI. Signed:**

Amy Cutler

November 10, 2003

Principle Investigator

Date

Jean Marie Boyer

November 10, 2003

Principle Investigator

Date