

**PLACER COUNTY WATER AGENCY**  
**Middle Fork American River Hydroelectric Project Relicensing**  
***Draft Temperature Model Review***

A brief review of applicable river and reservoir flow and temperature models is summarized in Table 1 (a much more comprehensive review is available). The review was primarily put together by Dr. Mike Deas. There are a few critical attributes that were used to assess the following models for the proposed project. For rivers the primary attributes included:

- longitudinal temperature gradients are of primary importance
- a model must be able to replicate variable flow conditions on a short time step (e.g., one-hour) to assess potential implications of hydropower operations, i.e., robust hydrodynamics
- sub-daily temperatures are desirable to identify not only mean daily conditions, but maximum daily temperatures
- topographic and riparian shade may both be important factors in water temperature response

For reservoirs the primary attributes include the ability to assess the existing reservoir outlets and sub-daily simulation time steps. Both models identified have these attributes.

Further, only open source codes that are actively supported by the model developer or sponsor were included. Neither this list, nor the criteria identified above are considered comprehensive, rather this information is intended to provide general background information on potential models and the feasibility of applying a numerical model to the Middle Fork American River, including the Rubicon River, French Meadows Reservoir, and Hell Hole Reservoir.

Because a model does not have a particular attribute may not be a fatal flaw: certain processes can be added to the model (e.g., topographic or riparian shading). Nonetheless, the river models which present the most promise include RMA, the Tennessee Valley Authority models, CE-QUAL-W2, and Heat Source. It should be noted that the CE-QUAL-W2 model is primarily a reservoir model, and velocities in steeper river reaches often preclude its use. Both CE-QUAL-W2 and CE-QUAL-R1 would be potential reservoir models; however, additional information would be reviewed prior to final selection. CE-QUAL-W2 requires more detailed reservoir bathymetry than CE-QUAL-R1.

In summary, there are models available for application with little or no modification for the proposed project. Further, the identified models (as well as others in Table 1) have been used in various regulatory settings (e.g., Total Maximum Daily Load (TMDL) studies, and FERC relicensing), and have undergone peer review as a result of these processes. Final model selection usually occurs early in the project after definition of the project objective has been developed.

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