Exhibit A, Attachment 1

Key Terms and Abbreviations

- Analyses – evaluation of water temperature model application results
- Model – computational/mathematical tool capable of representing a simplified version of reality, including physical features, processes, and responses of a system
- Model Application – use of calibrated/validated model accomplished by supplying initial conditions and forecasts/forcing inputs to generate future water temperature predictions at specific locations
- Model Framework – a computational/mathematical tool (or set) used to connect/link models together (including consistency across boundary conditions, initial conditions and alignment of input/output parameters) and leverage technology to efficiently carry out repetitive actions
- MTC – Modeling Technical Committee is composed of water temperature management community members including agencies, stakeholders, and interested parties who desire to participate and provide constructive feedback in the WTMP work effort
- Model Representation – assumptions and characteristics developed within the model environment to describe physical features or processes of a system
- River Reach – section of the riverine environment of particular interest from a water temperature management perspective
- WTMP – Water Temperature Modeling Platform represents the entire modeling develop effort including model and framework selection, data collection, data management, model implementation, calibration, validation, application, testing, uncertainty, and documentation.

Charge to the Water Temperature Model Platform Peer Review Panel

Objective

The intent of the review is to constructively inform Reclamation with recommendations to improve the process of developing and implementing water temperature modeling tools and a framework for the CVP with respect to development objectives and intended use discussed below:

Reclamation is developing specialized models and a framework which are envisioned to meet operational goals and achieve environmental objectives on short-term, seasonal, and long-term timeframes. These models and framework(s) assist Reclamation’s staff in

quantitative evaluations that yield water temperature projections, given hydrology and meteorology conditions, operations, and available infrastructure capacity and constraints as inputs.

This modeling effort is designed to develop a set of tools that simulate water temperatures for a range of environmental conditions (e.g., expected ranges of dry to wet hydrology, cool to warm meteorology, and operational patterns of reservoir releases) for use: (1) in real-time operations for short periods (i.e., approximately three to five days); (2) seasonally, to develop downstream river compliance location and temperature target plans (e.g., up to six months in advance for the period May through November); and (3) to evaluate longer term comparative planning studies (i.e., near one-hundred year runs). The general model development objectives are to:

- **Build confidence and trust** by providing robust documentation and hosting quarterly MTC meetings to engage the community on a regular basis for feedback and input,
- **Estimate future spatial and temporal water temperature** at specific locations in reservoirs and downstream reaches and anticipate biological model needs (model application and selection criteria are specifically described in the Technical Memorandum on Model Selection considering appropriate spatial and temporal scales for use with biological models such as temperature-dependent mortality),
- **Incorporate unique features of the CVP** (e.g., thermal curtains, selective withdrawal devices, and submerged dams),
- **Establish compatibility and efficiency capabilities** by leveraging model framework technology,
- **Incorporate uncertainty** of input parameters to better understand the magnitude and range of possible future outcomes, and
- **Ensure quality and confidence of model performance** by calibrating to within 2 degrees Celsius of historical temperatures on a daily average across the historical time frame for 95% of days in the historical records for operational applications and employ continuous testing strategies.

The envisioned application of tools includes using uncertain forecast information, the best available representation of the watershed, facility features, and CVP operational constraints to estimate future water temperatures in reservoirs and downstream river reaches. These estimated future water temperatures allow Reclamation's staff to effectively communicate to partner agencies and stakeholders' feasible future operational alternatives given limitations of the model and describe uncertainty. Reclamation needs representative temperature models that perform well and have quantified uncertainty that support operational decision making.

Peer Reviews

Two peer reviews are planned with the specific purposes of assessing model development and model application. The mid-term review will focus on model development and the final review on model application. PRP will develop findings and recommendations as well as provide important guidance for the on-going temperature model development effort to improve tools for managing water temperature.

Mid-Term Review

The mid-term review is intended to constructively evaluate the development of the Shasta-Keswick-Sacramento River temperature models. This review includes: (1) model selection, (2) data development, (3) model structure, (4) testing, and treatment of selective withdrawal components, and (5) documentation. The Independent Review Panel's findings and recommendations will influence the remaining development areas: Trinity River, Clear Creek, American River, and Stanislaus River systems.

Final Review

The final review will include the representation of system features within the temperature models, including the unique physical components of Lewiston and Whiskeytown Lakes temperature curtains, Folsom Dam temperature shutters, and submerged Old Melones Dam. This review will constructively evaluate the application of the models for the intended uses, including abilities to utilize real-time/seasonal tools in a forecast mode and to incorporate and address uncertainty. The Independent Review Panel's findings and recommendations will influence the final phase of the temperature model application effort.

Peer Review Materials

Materials consistent with the focus of each peer review will be provided to the Peer Review Panel. Each review will include a panel charge to focus panel members on project purpose and need, model development, and model application.

Mid-Term Review

Mid-term review will focus on model development of the Shasta-Keswick-Sacramento River system and include the following topics:

- Background (2019 Updated Proposed Action/2019 Biological Opinion)
- Project design/concept (TM: Project Workplan)
- Data management (TM: Data Management Plan; TM: Data Development)
- Framework and Model selection (TM: Model Framework Selection; TM: Model Selection)
- Model representation, specific system infrastructure, and key assumptions (e.g., Shasta Temperature Control Device representation) (Model Development and Calibration/Validation Report)
- Model calibration/validation and sensitivity (Model Development and Calibration/Validation Report)
- Documentation (Model Development and Calibration/Validation Report)

Final Review

The final review will contain two components: (1) Model Development, and (2) Application. The focus will be on Model Application but will also include Model Development approach consistent with the Mid-term review for the Trinity River, Clear Creek, American River, and Stanislaus River systems.

Model Development Component (Trinity River, Clear Creek, American River, and Stanislaus River systems)

- Data Management
- Model Framework Design and Refinement
- Data Development
- Model Development
- Calibration, Validation and Sensitivity
- Documentation

The Model Development Component review is anticipated to be less intensive than the Mid-term review, and generally limited to review of the approach and confirming that the Mid-term review findings and recommendations have been addressed in all CVP reservoirs and stream reaches.

The Application Component of the Final review assesses model application to address model implementation for: (1) short-term forecasting, seasonal forecasting and planning, and long-term planning, (2) associated identification, characterization, and estimation of uncertainty, and (3) using models to explore the implications of this uncertainty on simulated water temperatures. These models will reside in a modeling framework to improve model application efficiency, provide a means to assess different spatial and temporal resolution for certain model representations (e.g., reservoirs), automate analysis tasks (e.g., ensemble analysis), assess uncertainty, and output reporting. Methods of communicating uncertainty in model inputs and key outputs to operators, stakeholders, and managers will also be a subject of review.

Application Component

- Implementation
- Estimation of Uncertainty – Sources
- Estimation of Uncertainty – Protocols
- Output Communication
- Documentation

Summary of Charge

An Independent Peer Review Panel is requested to convene and review the water temperature modeling effort at two stages in the model development process. The Mid-term review focuses on model selection, construction, calibration, and validation for the Shasta-Keswick-Sacramento River system. Findings and recommendations from the Mid-term review are intended to improve and refine the remaining regions of CVP water temperature model development (i.e., Trinity, Clear Creek, American, and Stanislaus).

The Final review addresses model application and use of temperature models within a modeling framework, incorporation of uncertainty in modeling analyses, implementation of the unique/temperature management features of the CVP, and the remaining regions of model development (Trinity River, Clear Creek, American River, and Stanislaus River system). For both Mid-term and Final reviews, Reclamation is requesting constructive feedback that can improve the modeling capabilities for predicting water temperatures in short-time frames for real-time operations, seasonally for development of temperature management plans, and longer-term for planning studies.

Specific questions are identified below to guide the PRP for the Mid-term and Final review. The PRP is encouraged to review each question carefully and clarify, refine, or otherwise modify questions as appropriate. Reclamation requests the PRP identify both modeling elements that are appropriately represented and consistent with the project objectives, as well as critical input and associated direction and recommendations to improve the model development and application. The terms ‘adequate’, ‘appropriate’, ‘sufficient’, and ‘suitable’ should be defined in the context of the project development objectives listed on page A-2 (as they relate to operations and temperature management objectives) and intended use.

Mid-Term Review:

1. Does the modeling design (e.g., model selection, framework) include the necessary processes and resolution (spatial and temporal) to represent the short-term and long-term temperature dynamics expected in the reservoir and river environments throughout the CVP project area?
2. Are the models adequate for describing water temperature during extreme hydrologic/storage conditions (e.g., droughts/low storage)?
3. Are unique features (i.e., selective withdrawal devices, thermal curtains, and submerged structures) adequately represented?
4. Are available data sufficient for the development of the selected models and intended uses?
   a. Where data gaps have been identified, are the assumptions and methodologies used to address them suitable?
5. Are testing methods (calibration and validation) adequate to demonstrate confidence in model performance for the historic period?
6. Does the modeling documentation include adequate information, assumptions, and detail to allow for transparency and replication of model results?

Final Review:

For the Final review, the Mid-term questions will be used to assess the development of the Trinity River system (Trinity Lake, Lewiston Lake, and Trinity River), Clear Creek system (Whiskeytown Lake and Clear Creek), American River system, and Stanislaus River system models:

7. For the Trinity River, Clear Creek, American River and Stanislaus River systems: a summary of items 1-6, above, regarding model development, calibration/validation, documentation, etc.

Additional PRP questions with respect to model application are:

8. Are the model framework linkages adequate between models?
9. Are the models, in forecast mode, adequate for the intended real-time and seasonal planning purposes (i.e., forecast period ranges from 3- to 5-days to six months into the future), based on performance measures, uncertainty, and the fidelity with which the models represent physical processes?
10. Is the proposed plan to manage the range of expected variability (e.g., hydrology and meteorology) from future climate projections adequate?
11. Are the metrics and methodology for describing and incorporating uncertainty in input data adequate and is model uncertainty described and quantified appropriately?
12. Are the modeling processes and approaches associated with model application appropriately documented?
13. What should be included in the models in the future to improve their accuracy, resolution, or other features?

Schedule
Mid-Term Review: July 2022
Final Review: Fall 2023