



— BUREAU OF —
RECLAMATION

CVP Water Temperature Modeling Platform Project

Final Independent Peer Review

September 12-14, 2023



Photo credit: John Hannon, Reclamation

Welcome and Introductions





Photo credit: John Hannon, Reclamation

WTMP Team Opening Remarks



WTMP Team

- Reclamation staff:
 - Bay Delta Office
 - Central Valley Operations Office
 - Denver Technical Services Center
- Contracted services:
 - Watercourse, RMA, Stantec, Sunzi Consulting, and Eyasco
- Modeling Technical Committee (MTC):
 - Interested Agencies, Stakeholders, and Individuals





Photo credit: John Hannon, Reclamation

WTMP Project Overview

Randi Field, Hydrologic Engineer

Reclamation, Central Valley Operations Office



Vision for WTMP Project (Part I)

Goal: Deliver quality products to support Reclamation's mission – predict water temperature to support CVP operations

- Modernize CVP systemwide water temperature modeling and analytics
- Develop to current professional standards
- Consistency: Real-time, seasonal, and long-term planning
- Design for flexibility
- Address uncertainty
- Leverage technological advancements
- Build expertise
- Independent review



Vision for the WTMP Project (II)

- **Tool:** The WTMP project is the technical tool development effort to build the model and supporting mechanisms for water temperature management analysis:
 - Real-Time and Seasonal Temperature Management Plans
 - Long-Term Planning Studies
 - Fishery habitat conditions
- **Use:** The long-term operation (LTO) teams establish how to apply tools and analysis for water temperature management

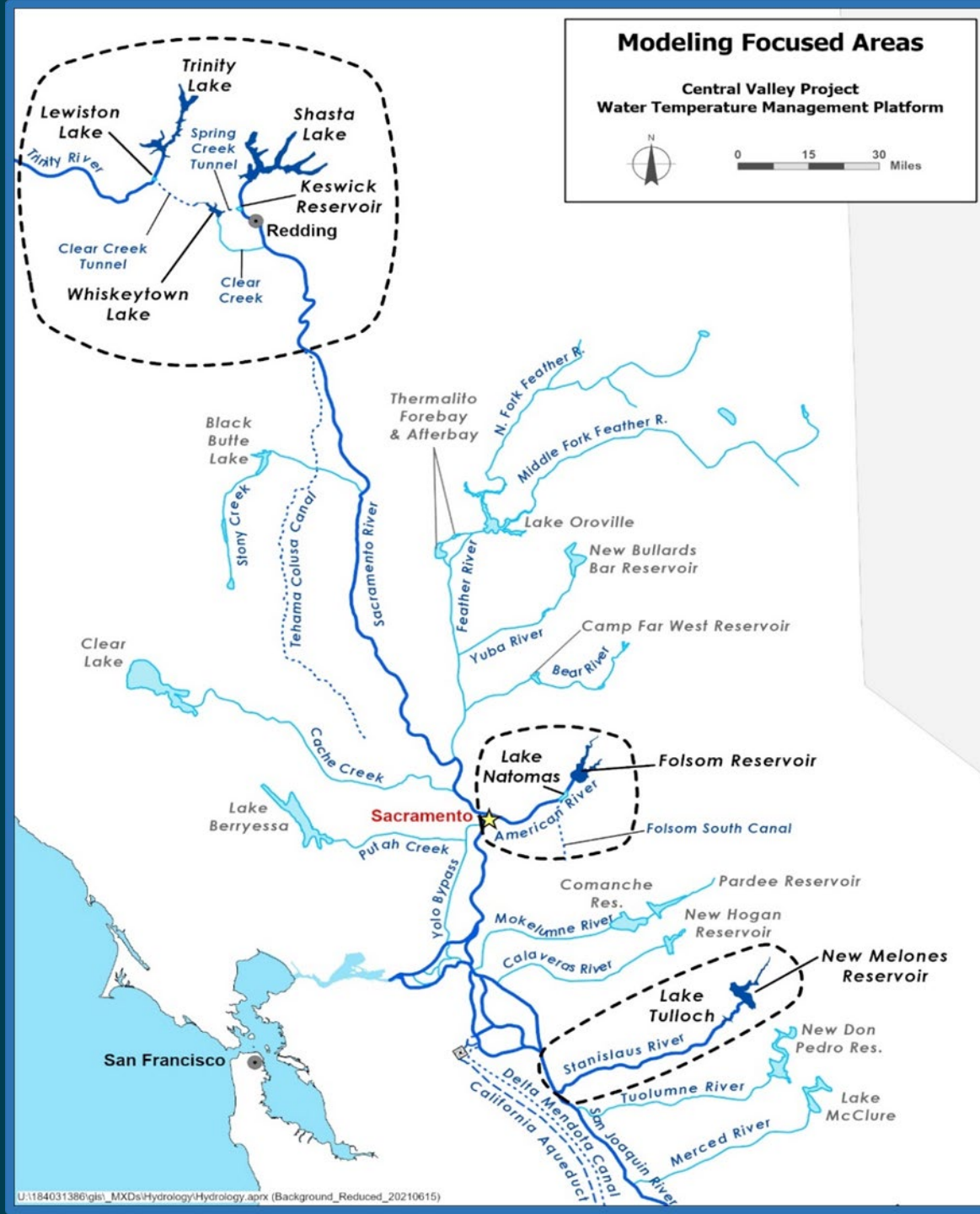


Vision for the WTMP Project (III)

- Outcome: A living modeling platform to support long-term CVP operations by addressing water temperature modeling needs and challenges.
- Major products:
 - Documentation package
 - Water Temperature Modeling Platform
 - Implemented models/model framework
 - Data Management System
 - MTC collaboration and feedback (quarterly meeting communication and participation in document review)
 - Independent scientific peer review feedback (mid-term and final)



WTMP Model Domain



Mid-Term and Final Peer Review Purpose (Part I)

- The Mid-Term Peer Review findings and recommendations were designed to focus on:
 - Model development: Shasta/Keswick
 - Offer insight on providing important guidance to the interim WTMP products
 - Influence remaining model development and preparing work products for the Final Peer Review



Mid-Term and Final Peer Review Purpose (II)

- The Final Peer Review is designed to focus on:
 - Development of remaining basins (i.e., Trinity/Whiskeytown/American/Stanslaus)
 - Development of unique system features (i.e., thermal curtains, temperature shutters, and submerged dam)
 - Evaluation of uncertainty
 - Ability to apply models for the intended uses (i.e., Forecast and Long-Term Planning modes)



Expected Outcomes of Peer Review

- Recommendations and feedback considering anticipated WTMP application in Spring 2024
- Confirm the strengths of the project
- Highlight immediate areas that need additional consideration prior to use
- Identify and prioritize future work



Topics covered in the Mid-Term Peer Review

- WTMP Mid-Term Peer Review: July 19-20, 2022
 - CVP Overview
 - Temperature Management/Selective Withdrawal
 - Needs of the WTMP Project
 - Phase 1 Model Development (documents updated):
 - WTMP Webpage Home
 - Model Framework Selection
 - Model Selection
 - Data Management
 - Data Development
 - Model Development



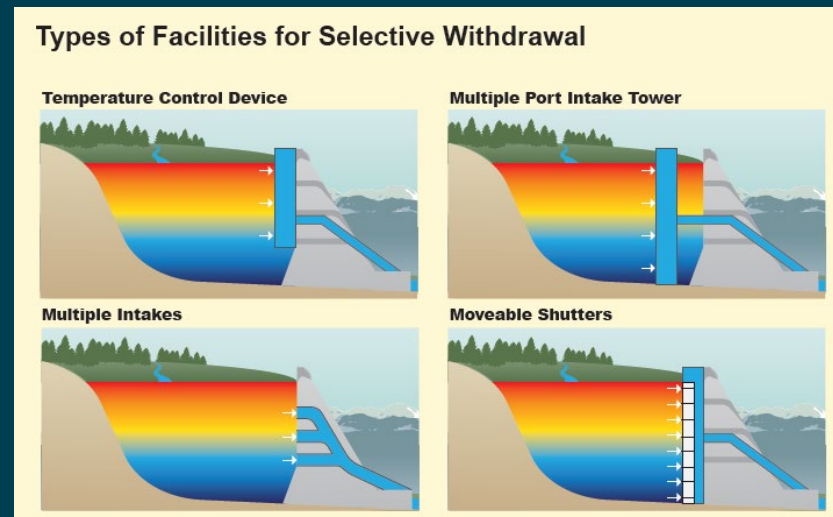
Responses to Mid-Term Peer Review Comments

- Peer Review comments were highly effective and provided significant guidance to model development process
- Within-scope comments and suggestions were directly incorporated into the work products
- Some suggestions were outside the scope of the WTMP project
- Some questions and comments addressed work products intended for the Final Peer Review
- Further details are highlighted in the [Mid-Term Peer Review Response Presentation](#)



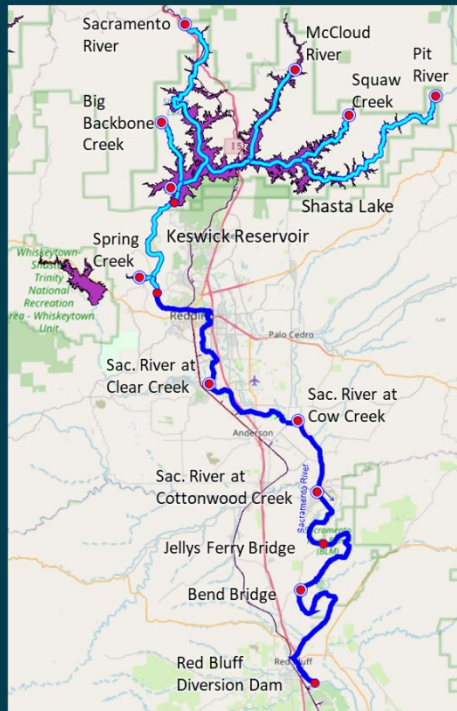
Key Response to Mid-Term Peer Review

- Conceptual suggestions (e.g., high level overview of facility features and dynamic characteristics) are covered in [Water Temperature Management in Reservoir-River Systems through Selective Withdrawal](#) documentation, with specific examples on the Sacramento and American River systems.

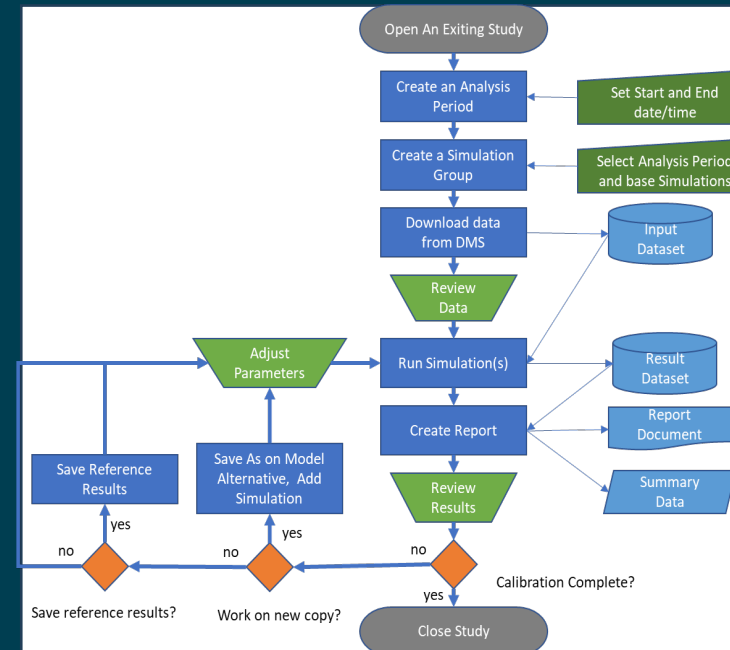


Key Response: Modeling Design – High Level Overview (Introductory and Visualization)

- Documentation contains enhanced maps/diagrams/model elements/control points



- Documentation has been enhanced based on the Panel feedback: overviews, model features, events, and processes.



Key Response to Model Adequacy: Extreme Hydrologic/Storage Conditions

- Tables detailing historical water year types, reservoir release, and storage conditions have been enhanced in the Data Development documentation.
- Consideration of the full range of model applications was an important project objective.
- The WTMP team does not see any consistent or obvious calibration bias for different year types to suggest a need for multiple models.



Key Response to Model Testing: Validation

- The term “validation” and its definition, consistent with [CWEMF Protocols for Water and Environmental Modeling](#) (2021) and is retained in the WTMP documentation as we find balance between the stakeholder and academic/professional communities. We appreciate the more recent nomenclature of “testing” or “evaluation”.



Key Response to Model Testing: Calibration

- The calibration section documentation was significantly enhanced based on Panel feedback.
- A manual model calibration was performed and further consideration of automated routines will be explored.



Enhancements following the Mid-Term Peer Review (Part I)

- Technical Memorandums:
 - MTC review comments and updates
 - Peer review Panel comments and updates
 - New Material
 - Model development: Trinity/Whiskeytown/American/Stanslaus basins
 - Calibration, validation, and sensitivity analysis for all models
 - Model implementation modes: forecasting and long-term planning
 - Estimation of uncertainty sources/protocols
 - Automatic Reporting/Appendices



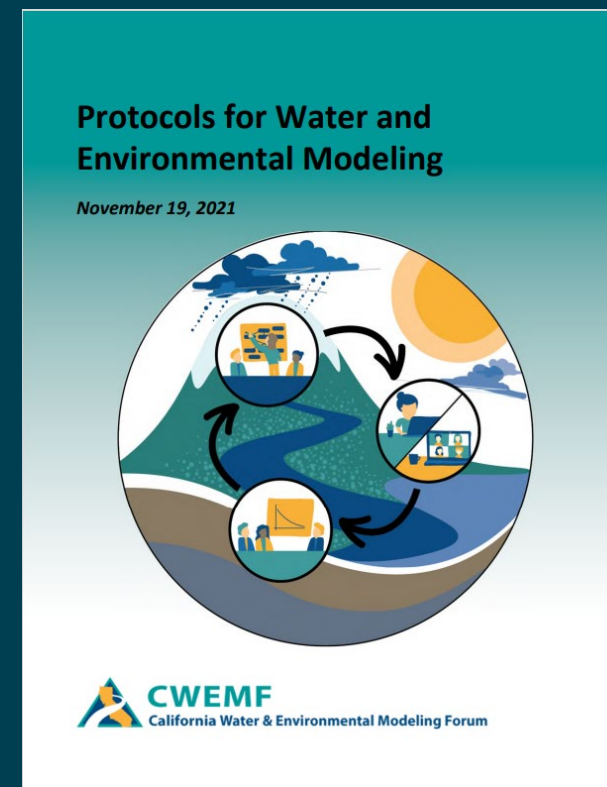
Enhancements following the Mid-Term Peer Review (II)

- Data Management feature refinements
 - Meta data
 - Templates
 - Procedures
- Framework development
 - HEC-WAT interface for specific workflows



Structured Model Development Approach

- CWEMF Protocols for Water and Environmental Modeling benefits:
 - Improved performance and reliability
 - Better documentation
 - Better access
 - Improve understanding and reproduction
 - Increased confidence and credibility



Source: CWEMF

Comparing Development Approach

CWEMF Guidance	WTMP
Preliminary Analyses	Model and Framework Selections
Framing the Modeling Study	Model Configuration, Testing, and Uncertainty
Application of the Model	Model Implementation
Communicating and Documenting Results	Technical Memoranda and Appendices
Encouraging Collaboration in the Modeling Community	Modeling Technical Committee and Peer Review

Phase I Activities

Task	Objective
Task 1. Project Workplan	Develop workplan and schedule for the overall modeling project with emphasis on Phase I – Task 1 through Task 10
Task 2. Stakeholder Involvement and Outreach	Outreach activities
Task 3. Develop Reclamation's Institutional Knowledge	Technology transfer
Task 4. Data Management	Develop data management plan for Phases I and II of project
Task 5. Model Framework Design and Refinement.	Develop a system-wide model framework for use throughout project area
Task 6. Model Selection/Design	Select models for each of the elements of the framework
Task 7. Data Development	Identify necessary input data to models and obtain necessary data
Task 8. Model Development	Develop and revised or refined models
Task 9. Calibration, Validation, and Sensitivity	Calibrate and validate models
Task 10. Documentation Phase I	Documentation of Phase I model development

Phase II Activities

Task	Objective
Task 11: Phase II Workplan	Develop a detailed workplan and schedule for Phase II – Task 11 through Task 17
Task 12: Implementation	Determine schedule for downstream/in-river simulation, real time/seasonal, and planning applications
Task 13: Estimation of Uncertainty – Sources	Develop and communicate sources of uncertainty in estimates of water temperature downstream of regulating reservoirs.
Task 14: Estimation of Uncertainty – Protocols	Develop and communicate protocols for estimating uncertainty bounds in estimates of water temperature downstream of regulating reservoirs. Task 14 will be combined with Task 13
Task 15. Output Communication	Develop output communication/visualization tools and data presentation approaches
Task 16: Documentation – Phase II	Documentation of Phase II activities
Task 17. Peer Review	Provide support for peer review of model components and overall framework.

WTMP Unique Features

WTMP Items	Highlights of Unique Features
Key Code Modifications	Enhanced modeling considerations for unique facility components
Model Domain	Consistent with operations which influence downstream water temperature
Model Framework	Addresses multi-model simulations/different spatial-temporal scales + uncertainty
Data Management System	Improve flexibility for data access and quality of data
Communications/Transparency	Quarterly Modeling Technical Committee Meetings/Web access - GitHub/RISE (planned)



Brief Summary of Accomplishments

- **Accomplishments:**
 - **Guided by CWEMF modeling protocol**
 - Developing/testing and documenting to professional standards
 - Transparent
 - **Met Reclamation's critical decision making requirements**
 - Independent scientific peer review
 - **Addressed Modeling needs:**
 - Real-time/seasonal and long-term planning modes/computation time
 - Unique project features
 - Data organization/management/and quality control
 - Thorough representation of features influencing operations
 - Performance evaluations and testing
 - Model recommendations identified for future improvement



Brief Summary of Assessments

- **Assessments:**
 - Documentation – comprehensive
 - Transparency – structured approach
 - Tools – efficient and flexible
 - Performance – objectively analyzed, unexpected performance investigated, and overall determined acceptable for application
 - Limitations – identified



Presentation Layout (Part I)

- Day 1:

- Brief review Framework Selection, Model Selection, Data Management, and Data Development
- Model Development
- Unique features:
 - Lewiston and Whiskeytown thermal curtains
 - Folsom Temperature Shutters
 - Submerged Old Melones Dam
- Model calibration, validation, and sensitivity methods and performance



Presentation Layout (II)

- Day 2:

- Model calibration, validation, and sensitivity methods and performance
- Model implementation modes: forecast and long-term planning
- Estimating uncertainty: sources and evaluation protocols
- Model limitations and recommendations
- Summary and future work





Photo credit: John Hannon, Reclamation

Morning Break

