BUREAU OF RECLAMATION

CVP Water Temperature Modeling Platform

Modeling Technical Committee (MTC) Meeting #3

January 6, 2022; 1:00 p.m. – 4:00 p.m.

Welcome!!

- We are looking forward to a productive meeting, please consider –
- Remote meeting. Remote collaboration meetings can be challenging and frustrating, especially with larger groups – please be patient and flexible. If you are having technical difficulties, please chat with Sarah Hamilton.
- Chat Panel will be used for participants to provide comments and queue up questions. Use Raise Hand functions in Q&A session.
- Agenda includes presentation and Q&A sessions.
- Handouts were distributed this morning.

Feedbacks on meeting logistic and suggestions: Yung-Hsin Sun, PhD, PE @ yung-hsin.sun@stantec.com

MTC #3: Objectives

- Establish common understanding of project status and upcoming topics of MTC discussion
- Provide opportunities for input on interim products and collaboration
- Provide opportunities for input on engagement and process

MTC #3: Agenda

1:00 p.m.	Meeting Logistics and Welcome Remark
1:10 p.m.	Introduction Topic: Sacramento/Trinity River Water Temperature Model
2:10 p.m.	Break (5 min)
2:15 p.m.	Discussion Topics: • Linkage and consistency between the system model and detailed models • Common Model Preparation and Considerations
3:10 p.m.	Break (5 min)
3:20 p.m.	Closure Discussion: Modeling Framework and Model Selection TMs
3:40 p.m.	Feedback: Improve MTC engagement and functions for collaborative WTMP development
3:50 p.m.	Next Steps
4:00 p.m.	Adjourn

Note that the Agenda contains the links to register future MTC meetings for convenience.

Agenda Topics for the 2022 MTC meetings (Subject to Change)

Topic	7/1/2021	10/7/2021	1/6/2022	4/7/2022	7/7/2022	10/6/2022	2023
MTC Orientation	1/2/3	-	**-**	-	-	-	-
Project Purposes, Goals, Anticipated Outcomes	1/2/3	3	**-**	-	-	-	-
Modeling Framework Selection	1	2	**3**	-	-	-	-
Water Temperature Model Selection	1	2	**3**	-	-	-	-
Consistency between System Model and Detailed Models	-	1	**2**	3	-	-	-
Common Model Preparation and Considerations	-	1	**2/3**	-	-	-	-
Sacramento/Trinity River Water Temperature Model	-	-	**1**	2	2/3	3	-
American River Water Temperature Model	-	-	**-**	1	2	2/3	-
Stanislaus River Water Temperature Model	-	-	**-**	-	1	2	-
Modeling Framework Implementation	1	-	**2**	-	-	3	-
Phase II Activities	-	-	**-**	-	TBD	TBD	TBD
Peer Review Outcomes	-	-	**-**	-	1/2/3	-	TBD

Key: 1 – Introductory Presentation; 2 – Comments and Discussion; 3 – Closure Discussion; TBD – To be determined

The agenda topics and schedule are also available in the handout.

Welcome Remark

Randi Field, Hydrologic Engineer, CVO

Welcome Back, MTC Members

- Community-based collaborative WTMP development
  - Thank you for your feedback
  - Thank you for sharing your data
  - Remember to register for all future meetings

Request to Members

- Request your continued support and collaboration, leveraging your technical expertise:
  - Consistent engagement in quarterly MTC meetings
  - Project product review
  - Constructive input and comments
  - Potential future user group on water temperature modeling
  - Envision opportunities for your use in the future and further collaboration

MTC Meetings (Past, Present, and Future)

- We have set the stage and covered the basics in the past two meetings
- We are getting into the detail of river system model development starting with the Sacramento/Trinity system discussion in this meeting
- We anticipate that we may have needs for basin-specific or topic-specific subgroup discussions if members are interested in more in-depth collaboration and discussion (more later in the meeting)

Vision for WTMP Project

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

- Modernize Systemwide Water Temperature Modeling and Analytics
- Develop to Professional Standards and Foster Transparency
- Consistent Use: Real-time, Seasonal, and Long-term Planning
- Accommodate Continued Technological Advancements

Communication Channels

- Website: https://www.usbr.gov/mp/bdo/cvp-wtmp.html
  - Meeting information/Fact sheets/Deliverables
  - Updates regularly
  - New postings coming soon
- Project contact: mppublicaffairs@usbr.gov
- Interim deliverable comments and other suggestions: RField@usbr.gov

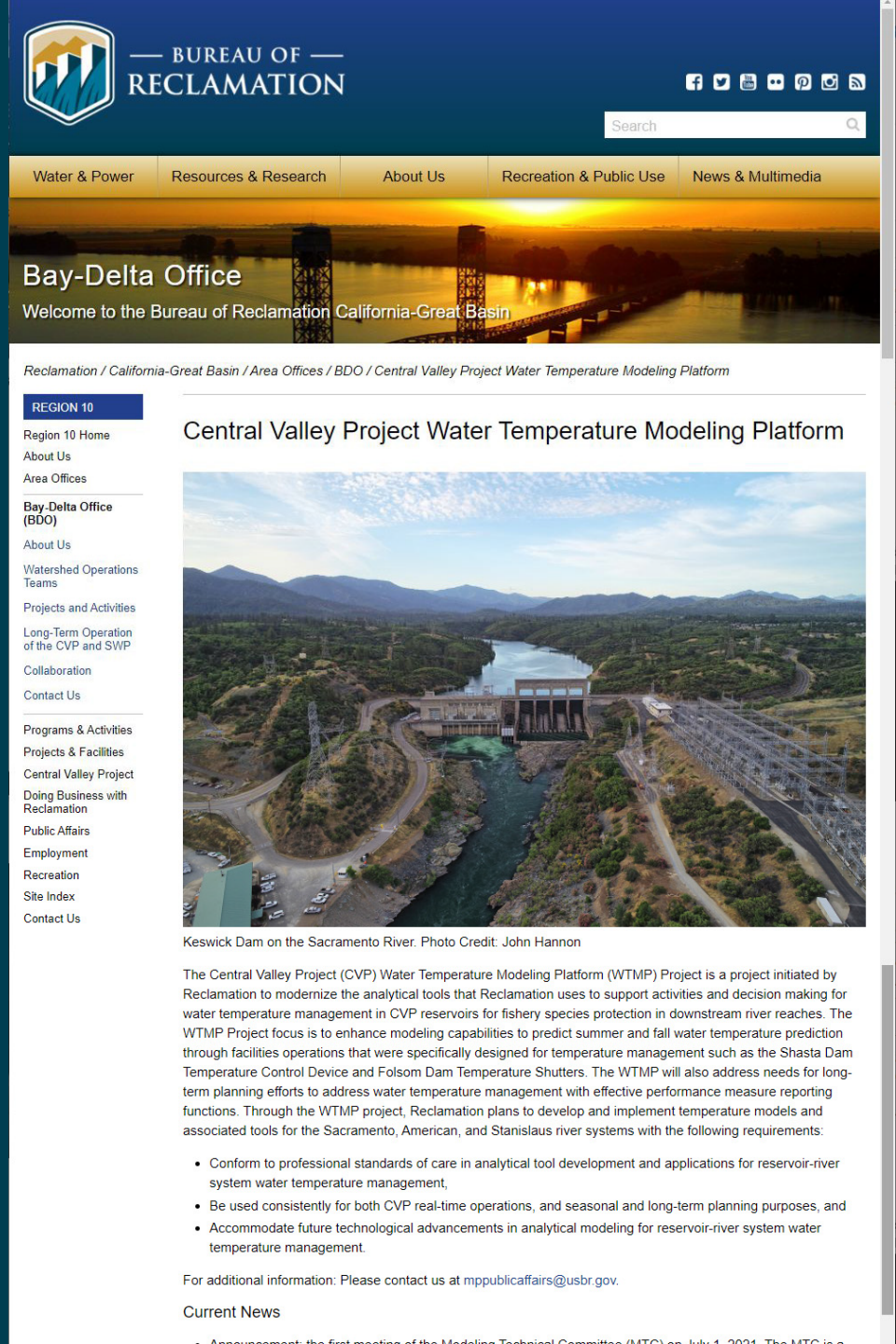


Photo credit: John Hannon, Reclamation

Introductory Topic: Sacramento/Trinity Water Temperature Models

Mike Deas, Ph.D., P.E., Watercourse Engineering, Inc.

Sacramento/Trinity Water Temperature Models

- Modeling is a major topic for this meeting and likely the next three meetings to conclude.
  - MTC 3: Introduction
    - Introduce the system and model development approach
    - Receive early input on model development approach and underlying data
  - MTC 4: Model initial setup and calibration*
  - MTC 5: Model calibration/validation*
  - MTC 6: Model sensitivity and documentation*

*The details for future MTC meetings will be adjusted according to the model development progress.

Sacramento/Trinity System

- WTMP Model Representations
- Details covered today
  - System overview
  - Temperature control tools
  - WTMP model representations
  - WTMP model data requirements
- MTC Input
  - Did we miss any important features?
  - Did we overlook any critical model data?

Shasta/Trinity System – WTMP Model Representations

- Reservoir Attributes
  - Vertical temperature gradient
  - Longitudinal gradient (e.g., afterbays)
  - Cold water pool representation through time
  - Reservoir operations/release temperatures
  - Management actions
- Reservoir Models
  - HEC-ResSim (1-D vertical)
  - CE-QUAL-W2 (2-D vertical and longitudinal)

Shasta/Trinity System – WTMP Model Representations (cont.)

- Key River Attributes
  - Longitudinal temperature gradient
  - Inflows (e.g., tributaries) and outflows (e.g., diversions)
  - In-river reporting locations
  - Management actions
- River model
  - HEC-ResSim (1-D longitudinal)

Major Strategy for Developing Sacramento/ Trinity System Model

Sacramento River System

- Extend the Shasta-Keswick water temperature CE-QUAL-W2 model completed in 2021
  - Extend simulation period to include 2020 and 2021
  - Extend modeling to include
    - HEC-ResSim for Shasta Lake and Keswick Reservoir
    - HEC-ResSim for Sacramento River
  - Review/Refine as needed

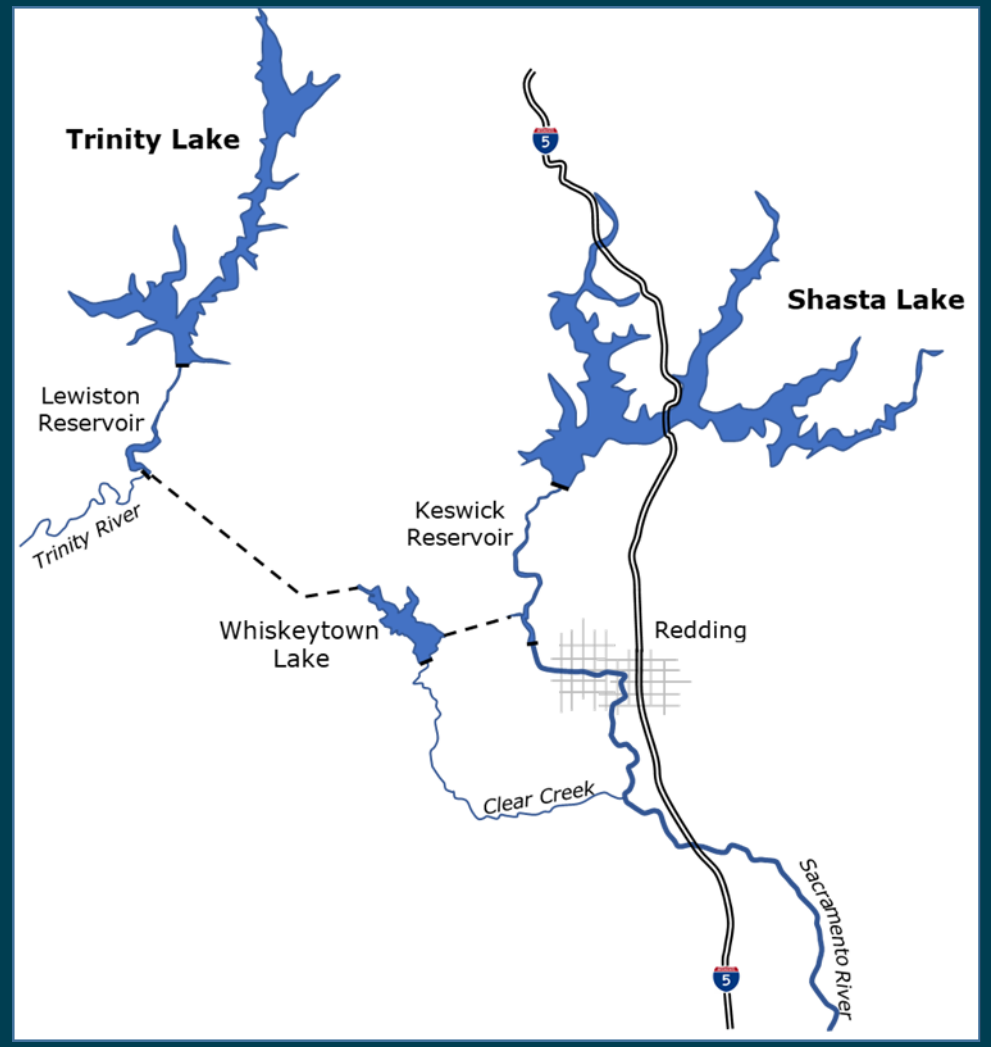
Major Strategy for Developing Sacramento/ Trinity System Model (cont.)

Trinity River and Clear Creek Systems

- Apply HEC-ResSim and CE-QUAL-W2
  - Trinity Lake, Lewiston Lake
  - Whiskeytown Lake
- Apply HEC-ResSim
  - Trinity River
  - Clear Creek
- HEC-ResSim will be applied as a system model
- Model development data period: 2000 to 2021

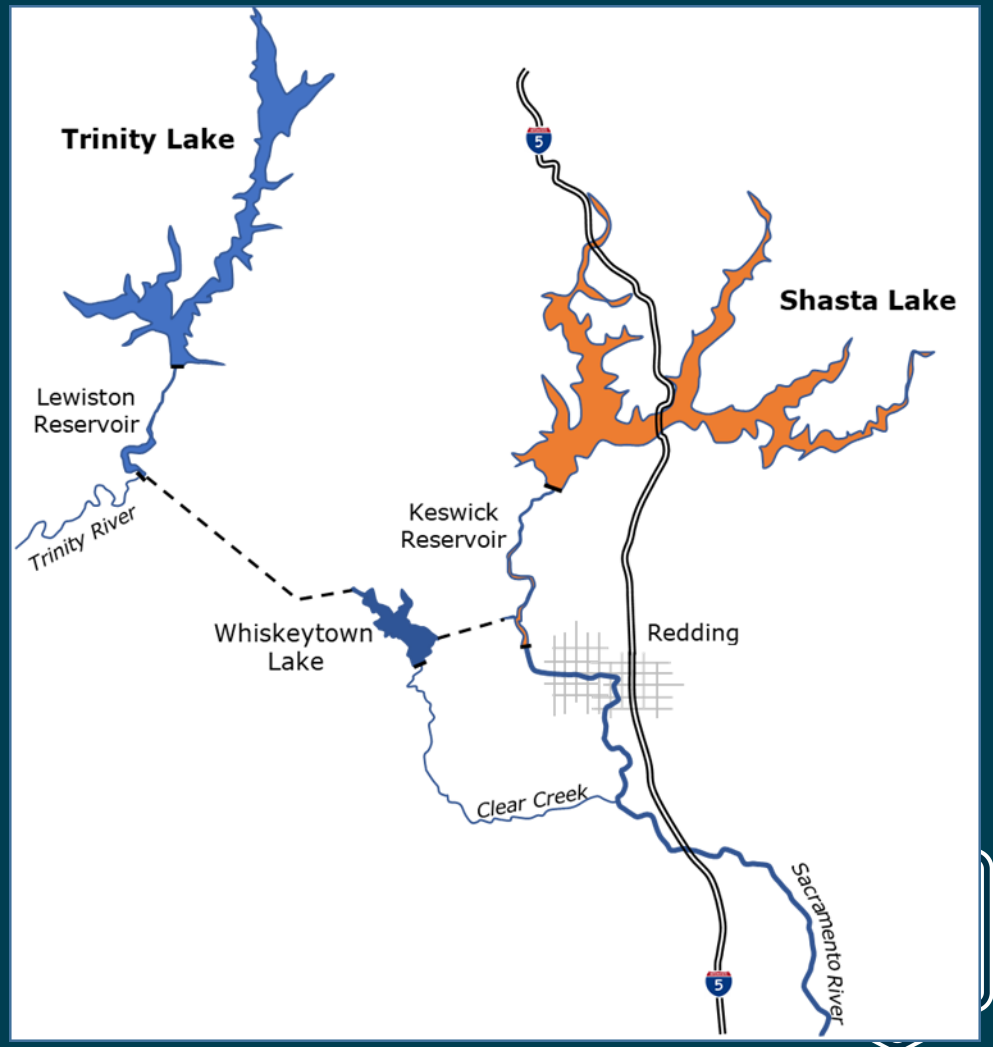
Sacramento/Trinity System – Overview

- Sacramento River Basin
  - Shasta Lake
  - Keswick Reservoir
  - Whiskeytown Lake
  - Spring Creek Tunnel
  - Clear Creek
  - Sacramento River
- Trinity River Basin
  - Trinity Lake
  - Lewiston Lake
  - Clear Creek Tunnel
  - Trinity River



Sacramento/Trinity System – Overview
Sacramento River Basin

- Sacramento River Basin
  - Shasta Lake
    - Full pool elevation: 1,067 feet
    - Maximum storage: 4.552 million acre-feet (MAF)
    - Surface area at maximum storage: 30,000 acres
    - Temperature Control Device (TCD)
  - Keswick Reservoir
    - Full pool elevation: 601.6 feet
    - Maximum storage: 23,800 acre-feet (AF)
    - Surface area at maximum storage: 640 acres
  - Sacramento River
    - Keswick Dam to Bend Bridge

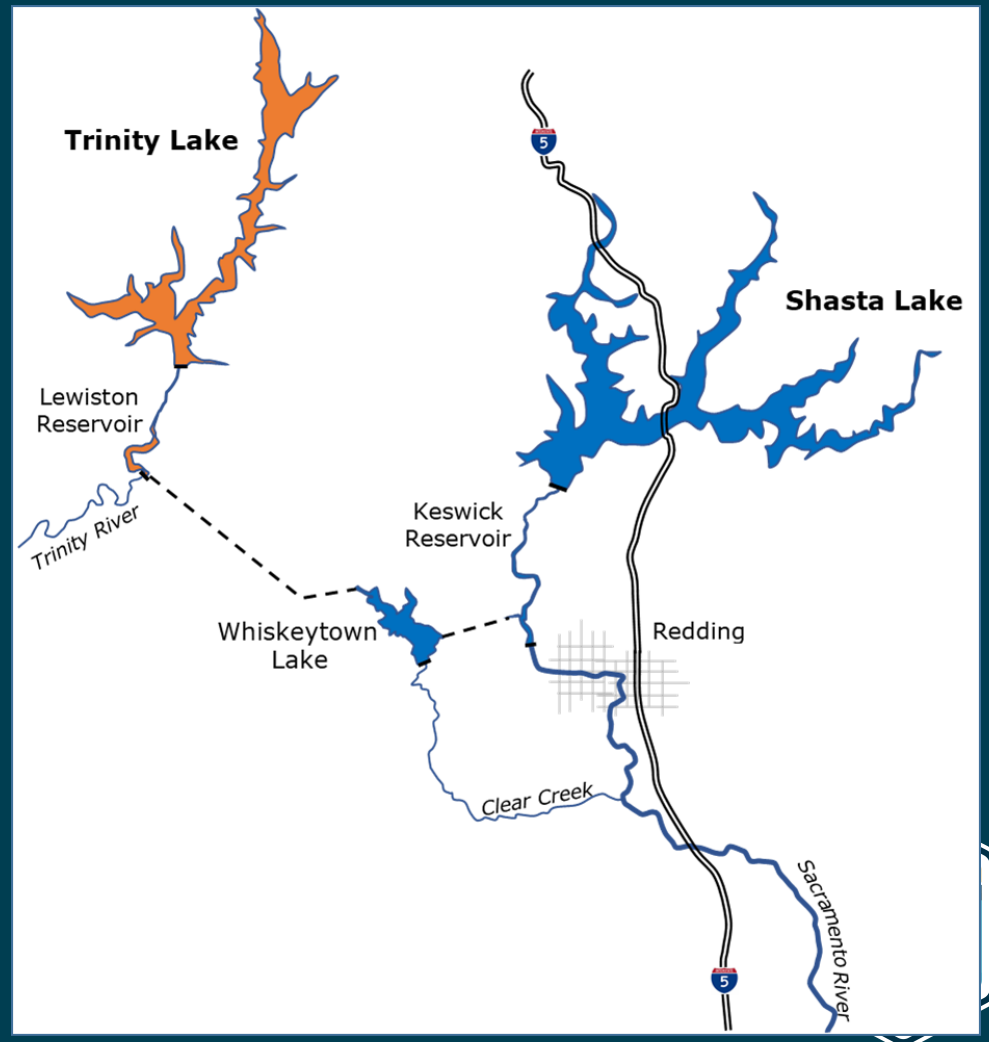


Sacramento/Trinity System – Overview
Sacramento River Basin (cont.)

- Sacramento River Basin
  - Whiskeytown Lake
    - Full pool elevation: 2,370 feet
    - Maximum storage: 2.447 TAF
    - Surface area at maximum storage: 17,222 acres
    - Temperature control curtains
  - Clear Creek
    - Whiskeytown Dam to Sacramento River (18 miles)
  - Spring Creek Tunnel

Sacramento/Trinity System – Overview
Trinity River Basin

- Trinity River Basin
  - Trinity Lake
    - Full pool elevation: 2,370 feet
    - Maximum storage: 2.447 MAF
    - Surface area at maximum storage: 17,222 acres
  - Lewiston Lake
    - Full pool elevation: 1,903 feet
    - Maximum storage: 14,660 AF
    - Surface area at maximum storage: 750 acres
    - Temperature control curtain
    - Fish Hatchery
  - Trinity River
    - Lewiston Dam to North Fork Trinity River
  - Clear Creek Tunnel

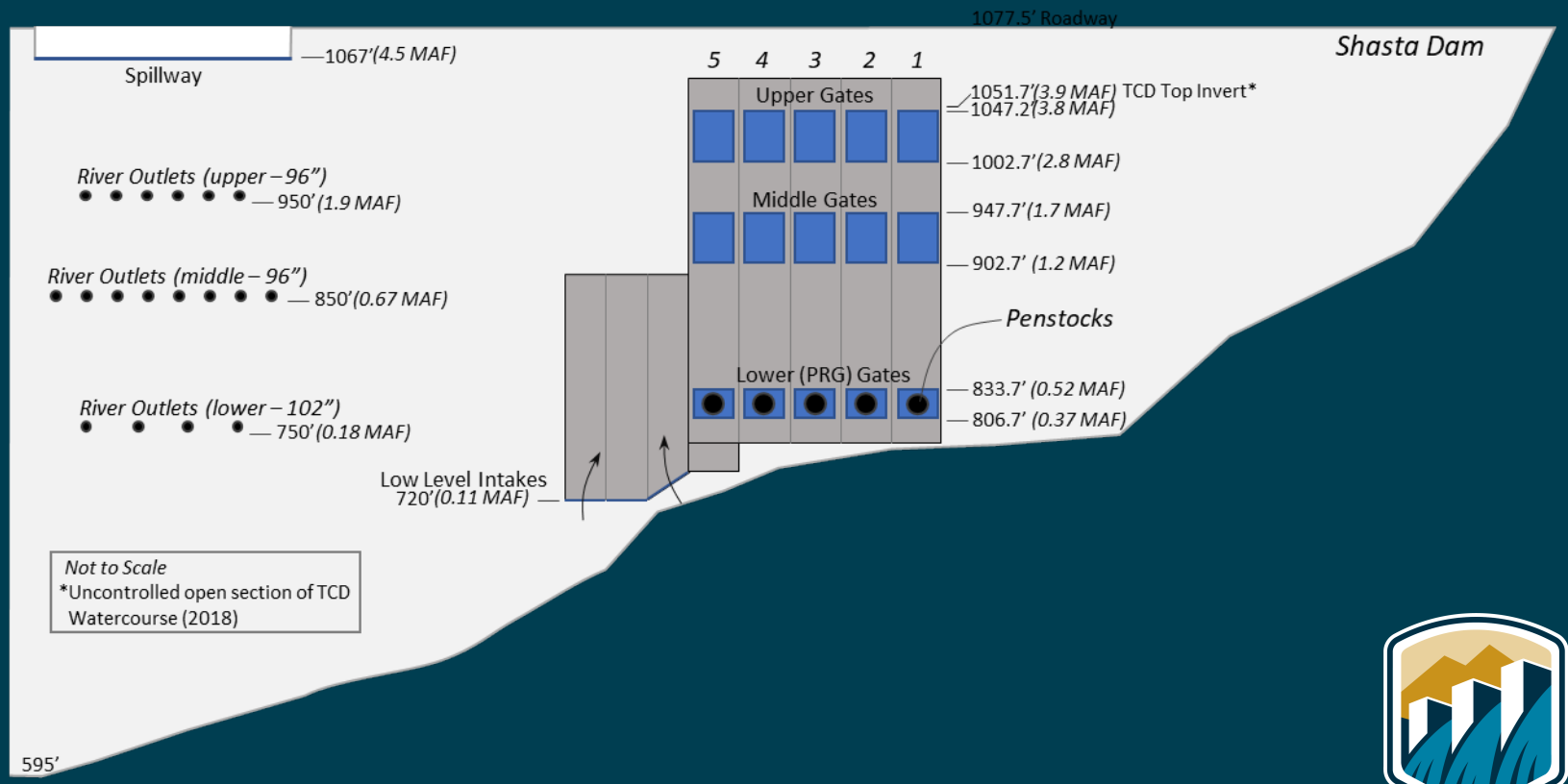


Sacramento/Trinity System – Temperature Management Tools

- Active temperature management
  - Shasta Dam Temperature Control Device facilitated selective withdrawal
- Passive temperature management
  - Temperature Control Curtains
    - Lewiston Lake Curtain
    - Whiskeytown Lake Curtains

Sacramento/Trinity System – Temperature Management Tools – Shasta TCD

- Shasta Dam Temperature Control Device
  - Selective withdrawal
  - Key features
    - Gate size
    - Hydraulic constraints
    - Side gate
    - Leakage
  - Model representation

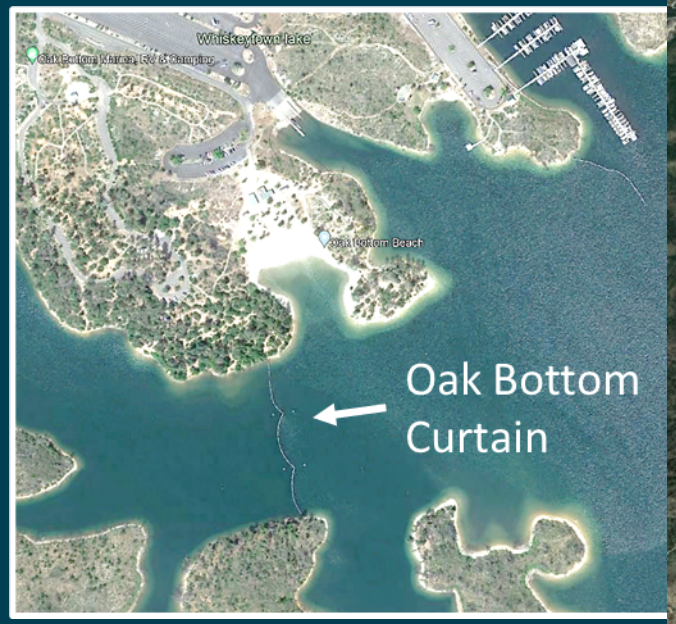


Sacramento/ Trinity System – Temperature Management Tools

- Lewiston Lake Temperature Control Curtain

Sacramento/Trinity System – Temperature Management Tools (cont.)

- Lewistown Lake Curtains



WTMP Modeling Data Requirements

- Reservoir and River Model Data/Information
  - Geometry
  - Hydrology
  - Temperature
  - Meteorology

Geometry: Sacramento River

- Shasta Lake
  - Bathymetry/Stage-Area-Volume (S-A-V)
  - TCD
  - Dam infrastructure (outlets, spillway)
- Keswick Reservoir
  - Bathymetry/S-A-V
  - Spring Creek Powerhouse
  - Dam infrastructure (outlets, spillway)
- Sacramento River
  - Bathymetry (x-y-z yields planform, gradient, and cross section)*
  - Diversions/return flows (incl. ACID diversion dam operation)
  - Tributary confluences
- Bathymetry incomplete from approximately Clear Creek to Bend Bridge

Geometry: Clear Creek

- Whiskeytown Lake
  - Bathymetry/S-A-V
  - Dam infrastructure (outlets, spillway)
  - Spring Creek tunnel facilities
  - Carr Powerhouse
  - Temperature control curtains
- Clear Creek
  - Bathymetry
  - Planform and gradient
  - Cross section

Geometry: Trinity River

- Trinity Lake
  - Bathymetry/S-A-V
  - Dam infrastructure (outlets, spillway)
- Lewiston Lake
  - Bathymetry/S-A-V
  - Dam infrastructure (including fish hatchery)
  - Clear Creek Tunnel intake
- Trinity River
  - Bathymetry (x-y-z yields planform, gradient, and cross section)
  - Diversions/return flows
  - Tributary confluences

Hydrology – Sacramento River

- Shasta Lake
  - Inflow
    - Sacramento, McCloud, and Pit rivers
    - Squaw Creek
    - Accretion/depletion
  - Outflow
    - Shasta Dam (spill, river outlets, TCD)
  - Stage
- Keswick Reservoir
  - Inflow
    - Shasta Dam release
    - Spring Creek Powerhouse
    - Spring Creek debris dam
    - Accretion/depletion
- Keswick Reservoir (cont.)
  - Outflow
    - Keswick Dam (spill, river gates)
  - Stage
- Sacramento River
  - Inflow
    - Return flows
    - Tributary inflows
    - Accretion/depletion
  - Outflow
    - Diversion
  - Flow/stage*

* Initial condition, boundary condition, and/or calibration

Hydrology – Clear Creek

- Whiskeytown Lake
  - Inflow
    - Clear Creek
    - Carr Powerhouse
    - Accretion/depletion
  - Outflow
    - Whiskeytown Dam (spill, river outlets)
    - Spring Creek Tunnel
  - Stage*
- Clear Creek
  - Inflow
    - Release from Whiskeytown Dam
    - Accretion/depletion (Whiskeytown Dam to Igo)
  - Outflow
    - n/a
  - Stage*

* Initial condition, boundary condition, and/or calibration data

Hydrology – Trinity River

- Trinity Lake
  - Inflow
    - Trinity River, East Fork Trinity River, Stuart Fork
    - Accretion/depletion
  - Outflow
    - Trinity Dam (spill, river outlets)
  - Stage
- Lewiston Lake
  - Inflow
    - Trinity Dam release
    - Accretion/depletion
- Lewiston Reservoir (cont.)
  - Outflow
    - Shasta Dam (spill, river gates, hatchery, Clear Creek Tunnel)
  - Stage
- Trinity River
  - Inflow
    - Return flows
    - Tributary inflows
    - Accretion/depletion
  - Outflow
    - Diversion
  - Flow/Stage*

* Initial condition, boundary condition, and/or calibration

Temperature – Sacramento River

- Shasta Lake
  - Inflow Temperature
    - Sacramento, McCloud, and Pit rivers
    - Squaw Creek
    - Accretion/depletion
  - Outflow Temperature*
    - Shasta Dam (tailbay)
  - Vertical Temperature Profiles*
- Keswick Reservoir
  - Inflow Temperature
    - Shasta Dam release
    - Spring Creek Powerhouse
    - Spring Creek debris dam
    - Accretion/depletion
- Keswick Reservoir (cont.)
  - Outflow Temperature*
    - Keswick Dam (tailbay)
  - Vertical Temperature Profiles*
- Sacramento River
  - Inflow Temperature
    - Return flows
    - Tributary inflows
    - Accretion/depletion
  - Stream Temperature *

** Initial condition and/or calibration data

Temperature – Clear Creek

- Whiskeytown Lake
  - Inflow
    - Clear Creek
    - Carr Powerhouse
    - Accretion/depletion
  - Outflow*
    - Whiskeytown Dam (spill, river outlets)
    - Spring Creek Tunnel
  - Vertical Temperature Profiles*
- Clear Creek
  - Inflow
    - Release from Whiskeytown Dam
    - Accretion/depletion (Whiskeytown Dam to Igo)
  - Stream Temperature*

* Initial condition and/or calibration data

Temperature – Trinity River

- Trinity Lake
  - Inflow
    - Trinity River, East Fork Trinity River, Stuart Fork
    - Accretion/depletion
  - Outflow*
    - Trinity Dam (spill, river outlets)
  - Vertical Temperature Profiles*
- Lewiston Lake
  - Inflow
    - Trinity Dam release
    - Accretion/depletion
- Lewiston Reservoir (cont.)
  - Outflow*
    - Shasta Dam (spill, river gates, hatchery, Clear Creek Tunnel)
  - Vertical Temperature Profiles*
- Trinity River
  - Inflow
    - Return flows
    - Tributary inflows
    - Accretion/depletion
  - Stream Temperature*

* Initial condition and/or calibration data

Meteorology

- Sacramento River System
  - Redding Airport
- Clear Creek System
  - Redding Airport
- Trinity River System
  - Trinity Lake and Lewiston Lake: Trinity Camp (A)
  - Trinity River: Trinity Camp (B)

Break

- 5-min Break (2:10 p.m. – 2:15 p.m.)

Photo credit: John Hannon, Reclamation

Discussion Topic: WTMP linkage and consistency between the system model and detailed models

Mike Deas, Ph.D., P.E., Watercourse Engineering, Inc.

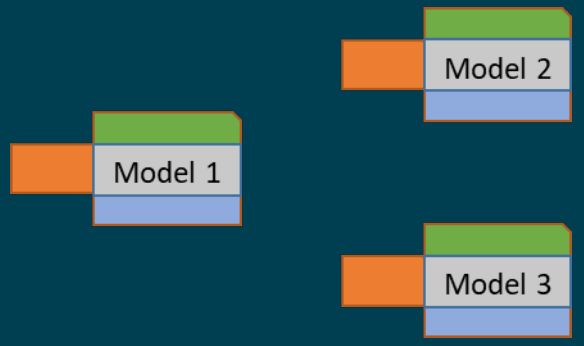
Jeff Schuyler, Eyasco

From the Model Selection TM

- “For the CVP, there is a need for both high resolution, discrete reservoir and/or river element models that can represent more detailed representations, as well as a modeling system that can accommodate system wide operations in a computationally efficient manner.”
- Example Models
  - High-Resolution Reservoir Model: CE-QUAL-W2 model of Shasta Lake
  - System Model: HEC-ResSim

Model Operation and Data Flow

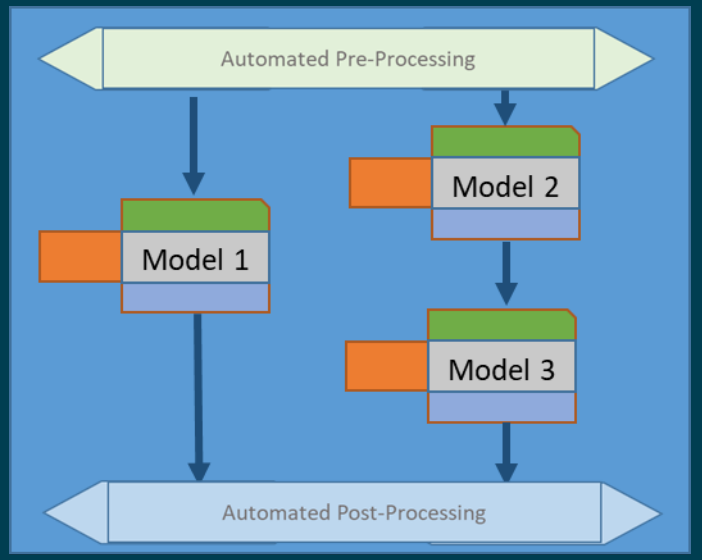
User-Driven



User-driven runs of individual models require domain knowledge plus computer system and data management skills.

Vs

Framework-Driven

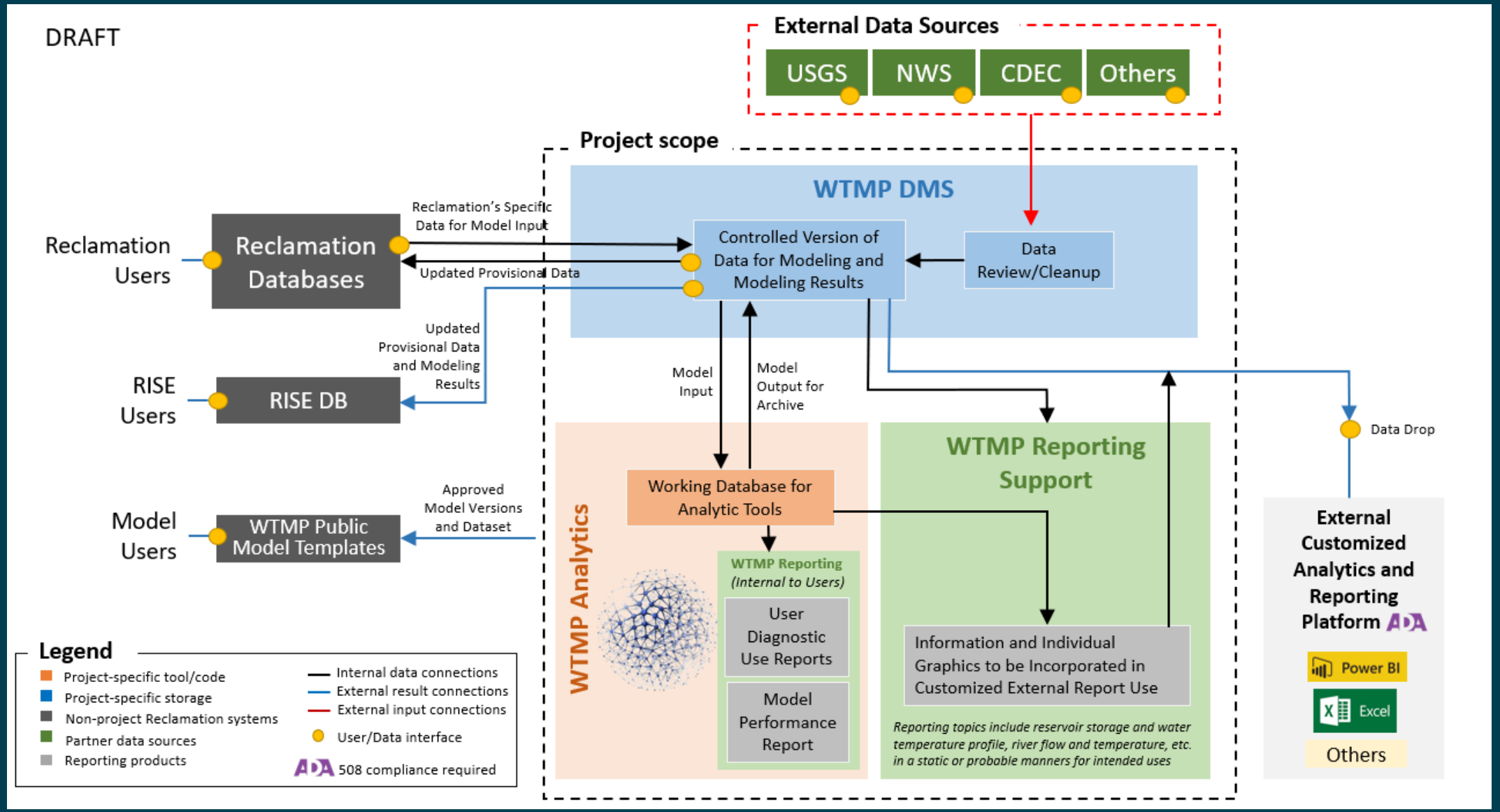


A framework is configured once to support a use case. The sequence of operations and data flows are automated and easily repeated.

Modeling Framework as a Container

- Linkage and consistency
  - Between a system model with many physical features (less resolution) to feature-specific models (more resolution)
  - Between feature-specific models with different resolutions
  - Between operational scenarios
  - etc.
- Open the hood of the WTMP to see how these are done.
- Seek input on the WTMP framework implementation

WTMP Information Flow



Data Management System (DMS)

- Objective
- Data Types
- Data Attributes
- Data Processing
- Metadata
- WTMP Interface
- Other Output

DMS Objectives

- Data acquisition – consolidate time series data from different sources
- Data integrity – track changes made to prepare model-ready data
- Data management – make data easy to interact with

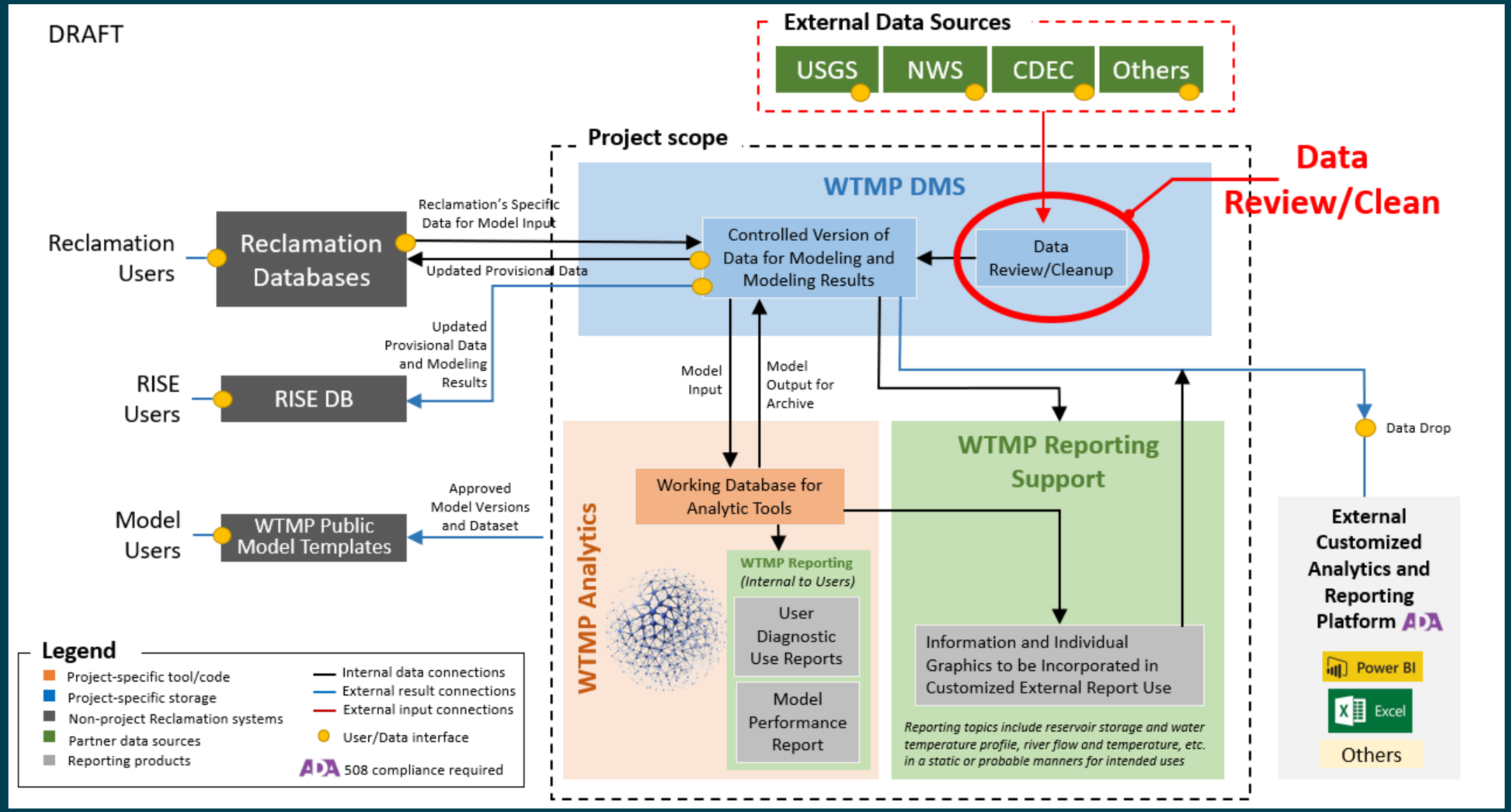
DMS Data Types

- Time Series (most of the data)
  - Flow and Temperature used for boundary conditions and forecasting
  - Temperature Profiles
- Physical
  - Reservoir and river geometry, reservoir intake descriptions, conveyance capacities
- Operational
  - Reservoir operating rules, TCD management protocols, minimum instream flows

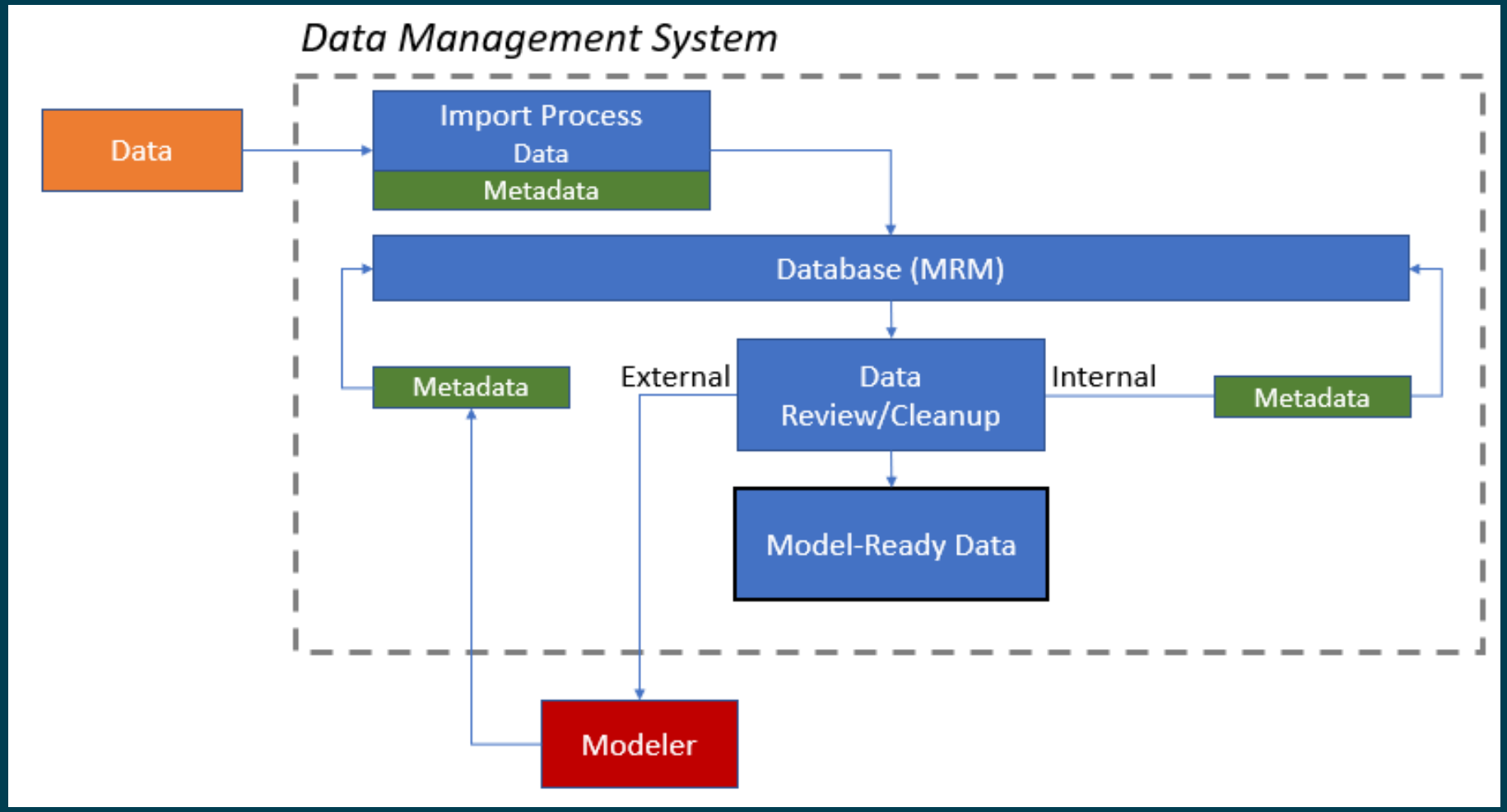
DMS Data Attributes

- Apply rules for organizing time series data
- Automate collection from online sources
- Use import processes and manual entry methods for time series that are unavailable on-line
- Collect and store metadata that tracks the data source, data quality and data revisions
- Provide visualization tools for post-processing source data (QA/QC, gap-filling, etc.)
- Provide a means for on-demand delivery of model ready time series data to the Model Framework
- Keep track the relationship between model input series and model output for rapid comparison and report preparation

Data Processing – Data Review/Clean-up



Data Processing – Data Management System

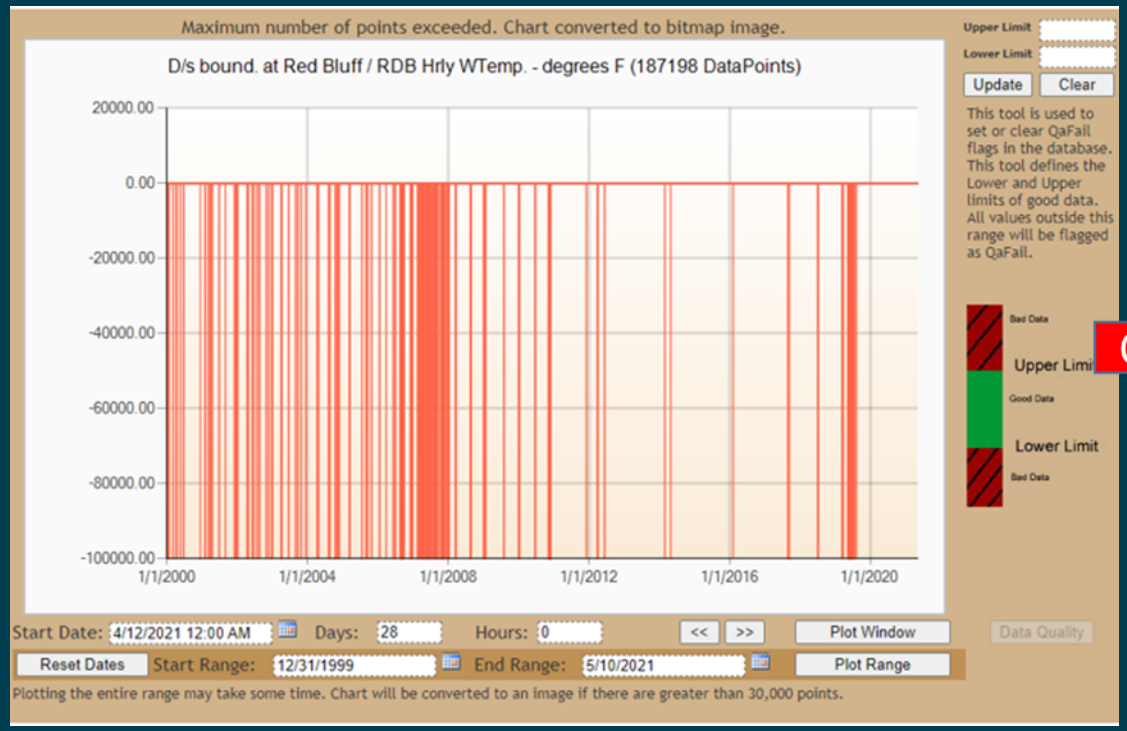


Data Processing

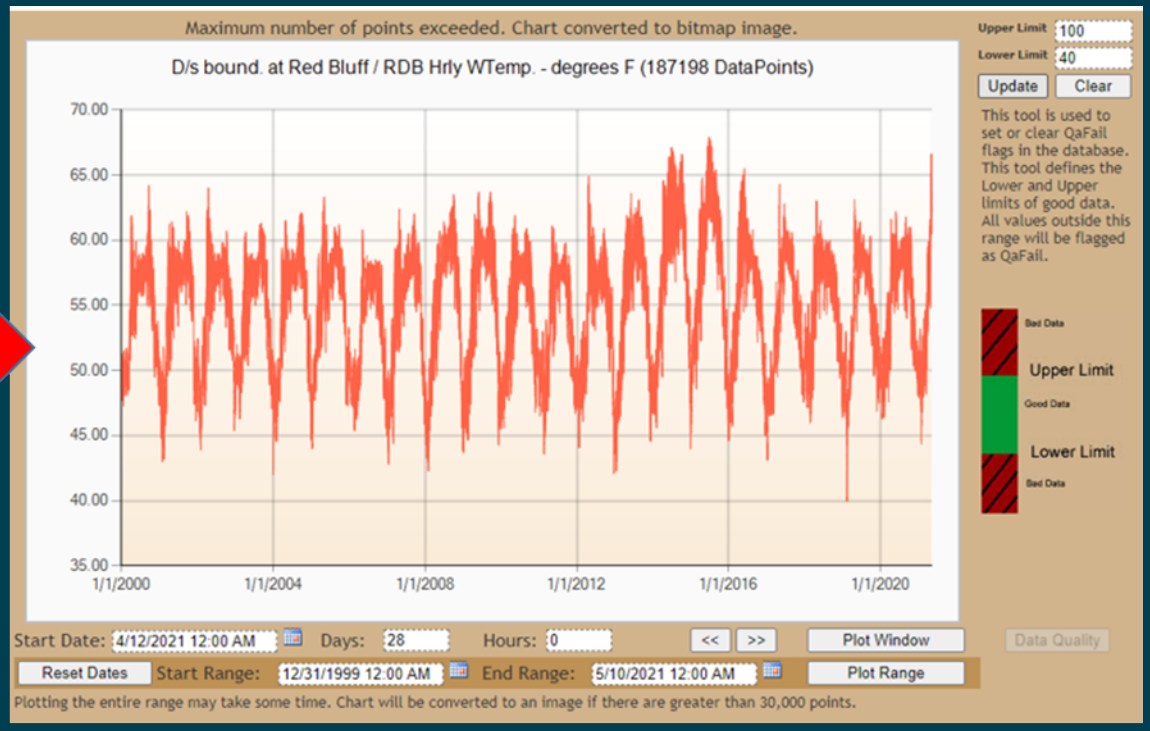
- Filter to allow/not-allow provisional data
- Apply scale factor and offset (e.g., change units)
- Flag data that falls out of acceptable range
- Fill gaps
- Normalize time steps
- Retain raw data

Data Processing – QA/QC

The import process can apply linear thresholds to flag data which is outside normal operating limits in order to improve visualization and speed up the process of producing model ready data.

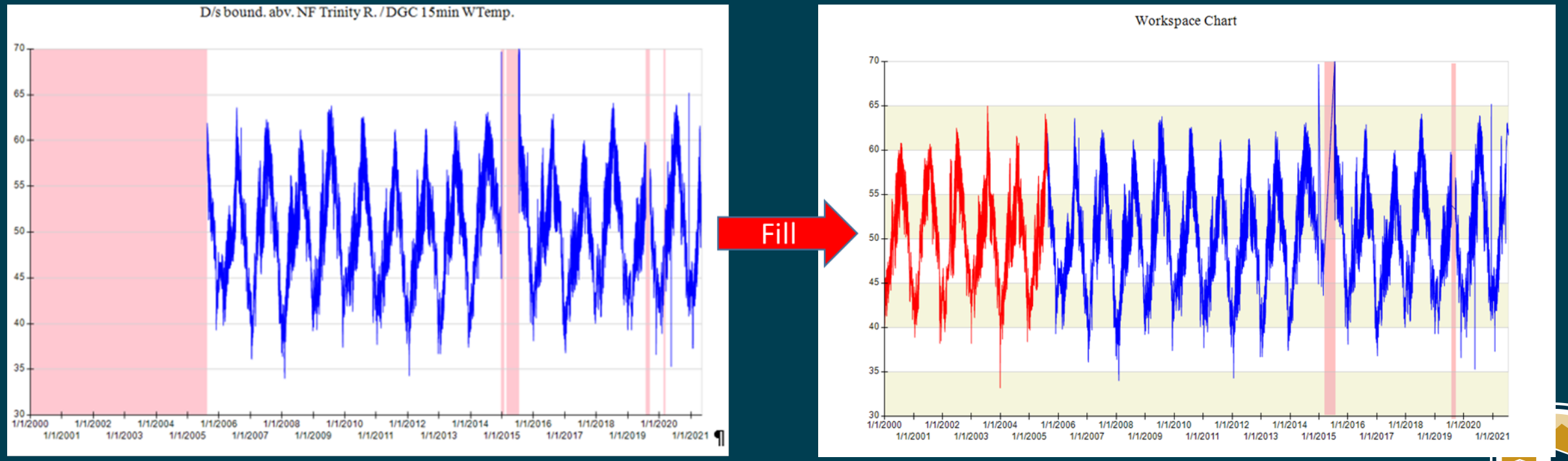


QA/QC



Data Processing – Fill Gaps

Gap filling may be completed inside or outside the DMS depending on size of gap and complexity of model required to adequately represent the physical process.
Minor gap filling (e.g., PDT to PST)
Major gap filling (Modeler)
The DMS includes tools for rapid identification and display of data gaps



Metadata

- Station Metadata (location, owner, data type, etc.)
- Sensor Metadata (sensor type, units)
- Event Metadata (quality, source)
- Event Metadata (modifications)
  - Internal - Flag bad data, unit conversion, time steps, fill small gaps
  - External – Fill large gaps, model results

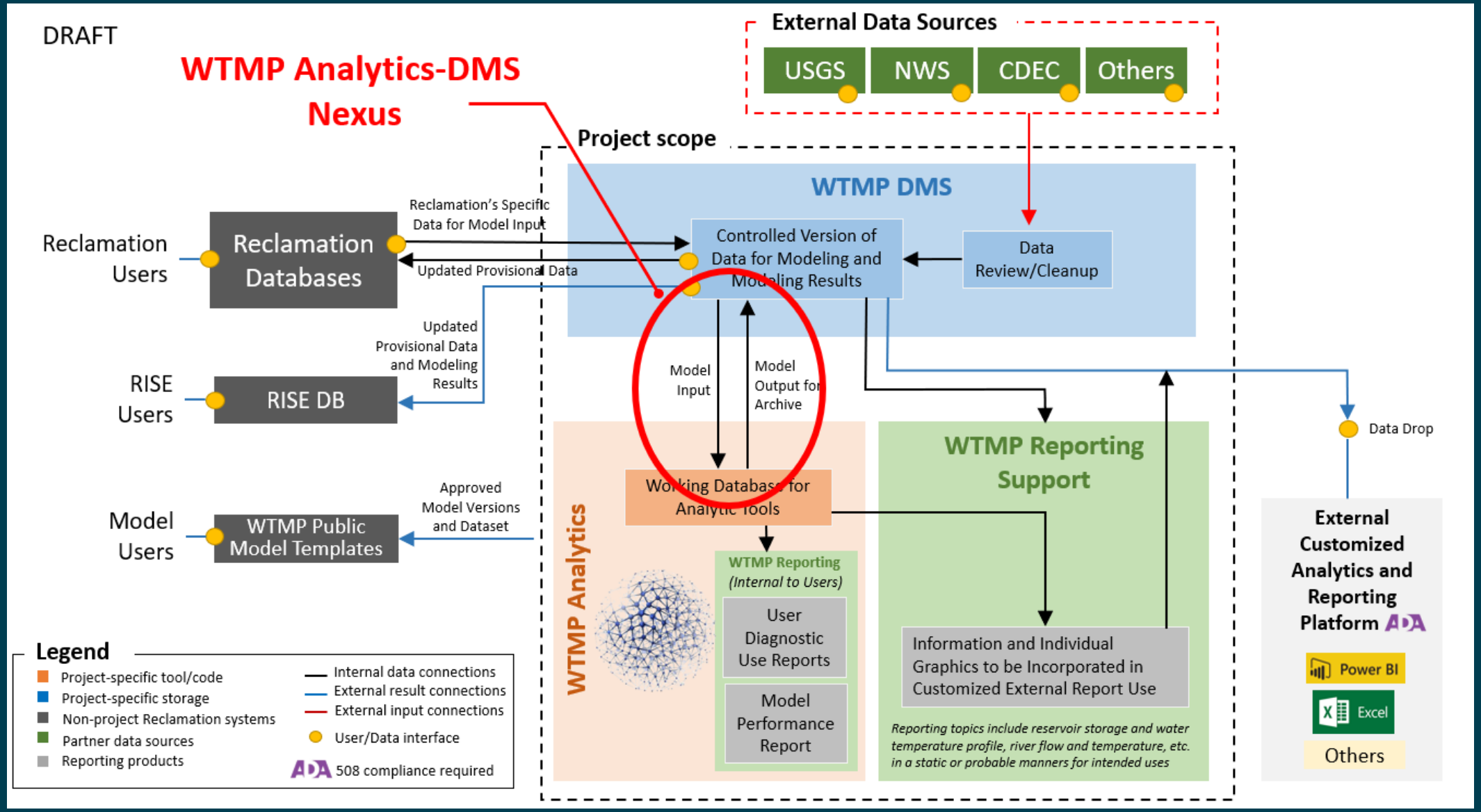
Metadata – Model Ready Data

The goal of data processing is not only to produce "Model Ready Data", but to track changes to and maintain a connection to raw data by using metadata applied at the appropriate place in the DMS.

WTMP Analytics – DMS Nexus

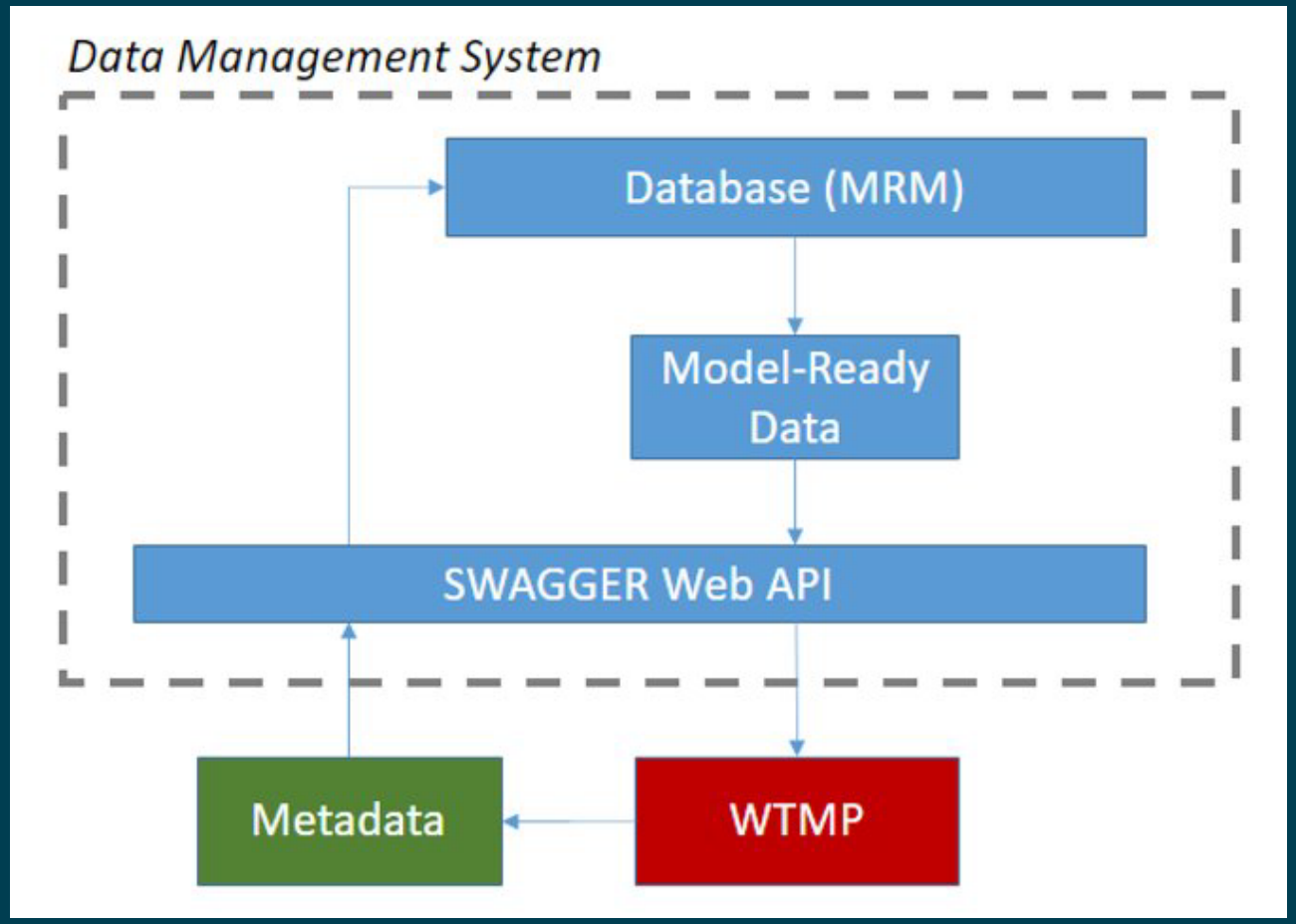
- Model Ready Data includes:
  - Data that can be used directly in the WTMP
  - Metadata
    - Station
    - Measurement
    - Event
    - Revision history
- Model Results
  - Selected model results
  - Metadata

WTMP Analytics – DMS Nexus Diagram



WTMP Analytics – DMS Nexus Flow

- Information Flow



Other Output

- SQL Reporting
- Data Export – Normalized, Pivot
- Data link to RISE
- Data Gateway for PowerBI

Flexibility in Deployment

- Options (TBD, in discussion with Reclamation for security and other administrative considerations)
  - Single server
  - Virtual server(s)
  - Cloud services
- RISE will be the interface for data sharing with external parties

Questions and Feedback

- Is the process for preparing model ready data reasonable and adequate?
- What other metadata in addition to what we have could be useful to broader users once this is completed and shared?

Photo credit: John Hannon, Reclamation

Discussion Topic: Common Model Preparation and Elements

Mike Deas, Ph.D., P.E., Watercourse Engineering, Inc.

Randi Field, Hydrologic Engineer, CVO

Common Model Preparation and Elements

- Two topics for discussion:
  - Physical data for model development – Mike Deas
    - Process and accomplishment for data acquisition
    - Data inventory is near completion – will distribute to MTC members for review and comment
    - A list of good-to-have data requests was distributed with meeting notification – input sought
  - Habitat/data for model application – Randi Field
    - Process and accomplishment for draft information development
    - The draft information was distributed with meeting notification – input sought

Physical Data Acquisition

Outline

- Data Request
- Data Support
- Data Inventory
- Ongoing Activities

Data Request

- Sacramento River
  - Clear Creek water temperature above Sacramento River (currently available at IGO): 2000 to present
- Whiskeytown Lake
  - Temperature of Clear Creek inflow to Whiskeytown Lake: 2000 to present
- Clear Creek
  - Channel geometry in 8-mile reach below Whiskeytown Dam (e.g., surveys)
- Stanislaus River
  - Diversions/return flows downstream of Goodwin Dam: 2000 to present
- Additional data needs as identified

Data Support

- Data support from wide range of agencies and organizations
- Data cover a wide range of data types, locations, frequencies, and often reflect commitment to long-term programs
- Appreciate and acknowledge the time, energy, and resources necessary to collect comprehensive, high-quality data
- Data Inventory will reflect agencies and organizations efforts

Data Inventory

- Purpose
  - Identify available data
    - Boundary conditions (an initial conditions)
    - Calibration/validation
  - Prioritize duplicate data sets
  - Identify missing data
  - Documentation

Data Inventory – Organization

- Organization
  - Station number/abbreviation
  - Station name
  - Data type
    - Flow and stage
    - Water temperature
    - Meteorology
  - Agency (e.g., USBR, USGS, DWR, USFS, etc)
  - Source (e.g., USBR, CDEC, CIMIS, etc.)

Data Inventory – Organization (cont.)

- Organization (cont.)
  - Data frequency
    - Primary (e.g., hourly)
    - Secondary (e.g., daily)
  - Priority
    - Function of (a) Frequency and (b) source
  - Available Period
    - 2000-2021, seasonal, variable frequency (e.g., temperature profiles)
  - Model Use
    - Boundary conditions
    - Initial conditions
    - Calibration/validations

Data Inventory – Example

Sacramento River below Keswick Dam	Abbreviation	Name	Data Type	Agency	Source	Primary Frequency	Secondary Frequency	Priority	Availability	Model Use
Flow	11377100	SACRAMENTO R AB BEND BRIDGE NR RED BLUFF CA	Flow	USGS	USGS	hourly	-	1	2000-present	CV
Stage	11377100	SACRAMENTO R AB BEND BRIDGE NR RED BLUFF CA	Stage	USGS	USGS	hourly	-	1	2007-present	BC/CV
Flow	BND	SACRAMENTO RIVER AT BEND BRIDGE	Flow	USGS/USBR	CDEC	hourly	Daily	2	2000-present	CV
Stage	BND	SACRAMENTO RIVER AT BEND BRIDGE	Stage	USGS/USBR	CDEC	hourly	-	2	2000-present	BC/CV
Flow	KWK	SACRAMENTO RIVER AT KESWICK	Flow	USGS/USBR	CDEC	daily	-	2	2000-present	BC/CV
Stage	KWK	SACRAMENTO RIVER AT KESWICK	Stage	USGS/USBR	CDEC	hourly	-	2	2000-present	BC/CV
Flow	11370500	SACRAMENTO R A KESWICK CA	Flow	USGS	USGS	hourly	-	1	2000-present	BC/CV
Stage	11370500	SACRAMENTO R A KESWICK CA	Stage	USGS	USGS	hourly	-	1	2007-present	BC/CV
Flow	COW	COW CREEK NEAR MILLVILLE	Flow	USGS/DWR	CDEC	hourly	-	2	2000-present	BC
Flow	11374000	COW CREEK NEAR MILLVILLE	Flow	USGS/DWR	USGS	hourly	-	1	2000-present	BC
Flow	IGO	CLEAR CREEK NEAR IGO	Flow	USGS/USBR	CDEC	hourly	-	2	2000-present	CV
Stage	IGO	CLEAR CREEK NEAR IGO	Stage	USGS/USBR	CDEC	hourly	-	2	2000-present	CV
Flow	11372000	CLEAR CREEK NEAR IGO CA	Flow	USGS	USGS	hourly	-	1	2000-present	BC/CV
Stage	11372000	CLEAR CREEK NEAR IGO CA	Stage	USGS	USGS	hourly	-	1	2007-present	BC/CV
Flow	BAT	BATTLE CREEK	Flow	USGS/DWR	CDEC	hourly	-	2	2000-present	BC
Flow	11376550	BATTLE C BL COLEMAN FISH HATCHERY NR COTTONWOOD CA	Flow	USGS	USGS	hourly	-	1	2000-present	BC
Flow	CWA	COTTONWOOD CREEK AUXILIARY GAGE	Flow	USGS	CDEC	hourly	-	2	2000-present	BC
Flow	11376000	COTTONWOOD C NR COTTONWOOD CA	Flow	USGS	USGS	hourly	-	1	2000-present	BC
Temperature	BND	SACRAMENTO RIVER AT BEND BRIDGE	Tw	USGS/USBR	CDEC	hourly	-	-	2000-present	CV
Temperature	AND	SACRAMENTO RIVER AT ANDERSON	Tw	DWR	CDEC	hourly	-	-	2015-present	CV

Ongoing Data Activities

- Developing data inventories (American, Stanislaus)
- Gathering data for the DMS
- Defining metadata for the DMS
- Identifying data gaps and methods to address gaps
- Documentation
- MTC Input
  - Data request (current and ongoing)
  - Data inventory review

Habitat Data

Habitat/Data

- Broad scan to establish the status of understanding for biological importance and data collection needs
  - All life stages and areas
  - The information can be used for WTMP development and broader discussions regarding additional data collection
- For WTMP:
  - To determine the extent of the temperature modeling in river reach downstream of the last CVP facility (e.g., dam) for temperature management purposes and why.

Habitat/Data (cont.)

- Identify by River Reach:
  - Species/Life-stage
  - Importance
  - Status of Data
    - Desired/Available
    - Type
    - Source

Breadth of Table – Expanded

- Original focus: reach cross-sectional/bathymetry data
- Now includes useful information on:
  - Expanded locations
  - Temperature stations
  - Studies and temperature models

Breakout Subgroup Meetings on Habitat/ Data Development

- Reclamation wants to organize subgroup meeting(s) to focus on draft habitat/data tables
  - Goal:
    - Fill in any gaps
    - Expand information as necessary
    - Finalize Tables
  - Poll for interest for participation

Break

- 5-min Break (3:15 p.m. – 3:20 p.m.)

Photo credit: John Hannon, Reclamation

Closure Discussion: Modeling Framework and Model Selection TMs

Mike Deas, Ph.D., P.E., Watercourse Engineering, Inc.

John DeGeorge, Ph.D., P.E., RMA

Modeling Framework and Model Selection TMs

- Purpose:
  - Common understanding on available revised TMs and summary of feedbacks
- Technical Memoranda
  - Water Temperature Modeling Platform: Model Framework Selection and Design (DRAFT)
  - Water Temperature Modeling Platform: Model Selection (DRAFT)

Water Temperature Modeling Platform: Model Framework Selection and Design

- Comment Topic
  - Broad comments concerning artificial intelligence, data-driven machine learning models, or Bayesian modeling frameworks in developing and applying models
    - Note: The WTMP is intended to accommodate different approaches to modeling in general (e.g., model calibration and model application). The intent is to allow users to accommodate the topics such as those noted in the comment. Phase II of the project will assess uncertainty and could accommodate certain aspects related to these comments as well.
  - Calibration over non-stationary periods, including potential implications of climate change. Because the model will be applied over the next several decades this may be applicable.
    - Note: This comment addresses model development, and as such is somewhat independent of framework selection (or model selection) and addresses more directly how models are implemented and applied. Calibration over non-stationary periods is a topic that can be addressed during model development and calibration.

Water Temperature Modeling Platform: Model Selection

- Comment Topic
  - Consider criteria for evaluating a model's capability to adapt to a changing baseline of both hydrology and runoff expectations
    - Note: The selected models, as well as most of the models in the technical memorandum are capable of readily assessing a range of input hydrology (and temperature conditions and meteorology). Modifying inputs may be easier or more difficult for particular models; however, the framework is intended to accommodate different approaches to modeling, model calibration, and model application (including climate change), providing flexibility to accommodate existing and potential future conditions. Phase II of the project will assess uncertainty and could accommodate certain aspects related to these comments.
  - Additional clarity of model selection process.
    - Note: As noted in the TM, model sponsor, website, model documentation, user's guide were considered. Project team had familiarity with nearly all models and model authors.
  - Model documentation for HEC-ResSim: User guide, model documentation, and applications
    - Note: Documentation expected in early 2022. Applications anticipated when final reports are completed.

Water Temperature Modeling Platform: Model Selection (cont.)

- Comment Topic
  - HEC-ResSim: Peer Review (by software developer)
    - Note: HEC validation and peer review exercises typically focus on specific features of the software and include establishing the engineering computation and software requirements and verifying software by testing against known data sets. Technical documentation are published and updated periodically. Updated model documentation forthcoming.
    - Note on Automation: Phase II topic - (i) downstream (automate vs trial and error), (ii) on American River system an a priori system to trade off benefits between two fish species currently exists. Model iterates through multiple options and arrives at a solution given constraints identified. Reclamation wants to preserve this approach on the American River system. Phase II activities will also examine this topic.

Photo credit: John Hannon, Reclamation

Feedback: Improve MTC Engagement and Functions for Collaborative WTMP Development

Yung-Hsin Sun, Ph.D., P.E., Stantec

Randi Field, CVO

Align with the Needs and Interests

- Purpose: Receiving input to improve MTC engagement and functions
- Intent: Initiate subgroup discussions by basin or by topic
- Feedbacks

Photo credit: John Hannon, Reclamation

Wrap Up and Next Steps

Randi Field, CVO

Yung-Hsin Sun, Ph.D., P.E., Stantec

Next Steps

- TM development and distribution for review
  - Data management plan TM
  - Data inventory
- Model development and framework implementation
- Initiation of subgroup discussions

Upcoming MTC and Topics

- Next MTC Meeting: April 7, 2022; 1 – 4 pm
- Upcoming topics (see handout):
  - Closure discussion
    - DMS
  - Model development topics
    - Sacramento/Trinity River Water Temperature Model (continued)
    - American River Water Temperature Model (introductory)
- You have the registration link already – do it today.
- Reminder: Submit your comments on data request and habitat/data to Randi

Information Sharing and Contacts

- Project contact: mppublicaffairs@usbr.gov
- Key team members presenting today
  - Randi Field, RField@usbr.gov
  - Mike Deas, Mike.Deas@watercourseinc.com
  - John DeGeorge, jfdegeorge@rmanet.com
  - Yung-Hsin Sun, yung-hsin.sun@stantec.com
- Project Information:
  - Contract: mppublicaffairs@usbr.gov
  - Website - https://www.usbr.gov/mp/bdo/cvp-wtmp.html


NEXT MTC MEETING: April 7, 2022; 1:00 p.m. – 4:00 p.m.
BUREAU OF
RECLAMATION