

2009 CVP/SWP Operations RPA Shasta Division Operations Adjustment Outline
August 31, 2016

DRAFT, FOR DISCUSSION PURPOSES ONLY

1. Background and rationale for adjustment

- Temperature-related mortality led to winter-run Chinook salmon year class failures in 2014 and 2015.
- The stressor of water operations resulting in elevated water temperatures that have lethal and sub-lethal effects on egg and alevin incubation and juvenile rearing in upper Sacramento River still exists, including new science:
 - Critical temperature of 53.7°F, at which egg and fry mortality increases disproportionately with increasing water temperatures (Martin temperature-dependent mortality model)
- There is a lack of sufficient cold water in storage to allow for cold water releases to reduce downstream temperatures at critical times.
- Temperature needs for early life stages of winter-run Chinook salmon have not been met.
 - California WaterFix modeling indicates worsening of temperature effects

2. Ideas for adjustments

- a. Responsibilities and Procedures of Technical Teams (11.2.1.1) – This section needs to be updated to reflect the newly formed Shasta Water Interagency Management Team (SWIM Team) and its objectives, roles, and responsibilities. In addition, the objectives, roles, and responsibilities of Sacramento River Temperature Task Group (SRTTG) need to be updated to reflect a need for year-round flow and temperature planning and management.
- b. Research and Adaptive Management (11.2.1.2):
 - i. Investigate new ways to operate the Central Valley Project based on current and future meteorological and hydrological conditions

Rationale: Meteorological and hydrological conditions in the last four years of the drought are not indicative of historical conditions. Climate change is occurring and past conditions can no longer be used to operate the Central Valley Project. CVP operations must be updated to reflect current and future conditions.

- ii. Invest in new Shasta Reservoir and Sacramento River water temperature tools and monitoring, including: (1) develop a collaborative science plan for model improvements; (2) include the NMFS-SWFSC coupled reservoir and River Assessment Forecasting Tool (RAFT) modeled outputs into real-time operations and monthly forecasts; and (3) develop and implement an integrated Shasta/Whiskeytown/Trinity/Lewiston operations and temperature model.

Rationale: Currently there is no Shasta Reservoir model and the Sacramento River Water Quality Model (SRQWM) is an outdated inadequate tool to provide sufficient precision to determine future operations and meet the regulatory requirements in the CVP/SWP operations Opinion. In addition reservoir temperature models are needed to integrate the entire Shasta Division to better plan and manage operations.

- iii. Research and implement engineering solutions to utilize inaccessible cold water pool in Shasta Reservoir and prevent warm water leaks through the Shasta Dam temperature control device to improve Sacramento River temperature management.
- iv. Fund further studies to understand other stressors associated with water temperatures and operations, such as disease, predation, lack of spawning and rearing habitat, food web supply, bioenergetics, *etc.* This research critical towards avoiding jeopardy and recovery of the species.
- c. Monitoring and Reporting (11.2.1.3) – Updates to include funding of (1) redd-dewatering and juvenile stranding monitoring (that have been occurring since 2012); (2) additional temperature and dissolved oxygen monitoring in the Sacramento River; and (3) spawning gravel and juvenile rearing habitat monitoring. This monitoring is crucial towards understanding the biological effects of water operations.
- d. Shasta Division RPA Actions (11.2.2):
 - i. Action I.2.1: Performance Measures

Objective: To establish and operate to set of performance measures for temperature compliance points and End-of-September (EOS) carryover storage, enabling Reclamation and NMFS to assess the effectiveness of this suite of actions over time. Performance measures will help to ensure that the beneficial variability of the system from changes in hydrology will be measured and maintained.

Proposed Changes: Delete the 10-year running average for temperature compliance point, as it provides very little utility because it does not account for deleterious effects to winter-run in dry and critically dry water years. And change the Shasta Reservoir storage performance measures to be based on water year type and include explicit end-of-April (or May) storage requirements in addition to End-of-September storage requirements.

- ii. Action I.2.2: November through February Keswick Release Schedule (Fall Actions)

Objective: Minimize impact to listed species and naturally spawning non-listed fall-run from high water temperatures by implementing standard procedures for release of cold water from Shasta Reservoir.

Proposed Changes: Update language to reflect potentially new EOS storage requirements [e.g. EOS must be greater than 1.9 MAF and/or cold water volume (defined as water less than 49°F) must be greater than or equal to a certain volume]

and potentially new minimum flows to prevent redd dewatering and juvenile stranding. EOS storage volumes for water years 2013, 2014, and 2015 were not adequate to reduce the adverse effects of high water temperature in the summer months for winter-run. In addition, a Keswick Reservoir fall pulse-flow(s) timed to occur immediately after the first significant fall rains to restore a more natural hydrograph to the Sacramento River, will aid emigrating spring-run juveniles by providing improved water quality conditions (e.g. flow, turbidity, temperature).

iii. Action I.2.3: February Forecast: March – May 14 Keswick Release Schedule (Spring Actions)

Objective: To conserve water in Shasta Reservoir in the spring in order to provide sufficient water to reduce adverse effects of high water temperature in the summer months for winter-run and spring-run, without sacrificing carryover storage in the fall.

Proposed Changes: (1) require a March forecast instead of a February forecast prior to initial water allocation decisions. A March forecast would provide better accuracy for the water year and allocations than a February forecast; (2) update language to require initial minimum and maximum monthly Keswick release schedules for the water year and to delay full side gate operations as long as possible in low storage years to ensure the Shasta Reservoir cold water pool lasts throughout the temperature management season; (3) change temperature compliance point language to 61°F 7DADM during winter-run adult holding period (as recommended by EPA); (4) require pulse flows for spring-run juveniles from Deer and Mill creeks to aid in their emigration down the Sacramento River; (5) and implement bed load moving a pulse flow, if needed, to flush out accumulated vegetation and sediments in order to provide suitable spawning habitat in the upper Sacramento River.

iv. Action I.2.4 May 15 – October 31 Keswick Release Schedule (Summer Action)

Objective: To manage the cold water storage within Shasta Reservoir and make cold water releases from Shasta Reservoir to provide suitable habitat temperatures for winter-run, spring-run, CV steelhead, and Southern DPS of green sturgeon in the Sacramento River between Keswick Dam and Bend Bridge, while retaining sufficient carryover storage to manage for next year's cohorts. To the extent feasible, manage for suitable temperatures for naturally spawning fall-run.

Proposed Changes: (1) change the temperature compliance point language to manage operations not in excess of 55°F 7DADM to downstream most Sacramento River winter-run Chinook redd throughout spawning and egg incubation season (as recommended by EPA); (2) add language to stabilize Keswick releases to minimize the potential for redd dewatering and juvenile stranding; (3) establish Keswick release flow schedules by water year type, as necessary, to meet the above criteria; (4) add language to incorporate conservative meteorological forecasting and

exceedance triggers into temperature management plan until hydrological and forecasting model updates are completed.

v. Action I.4 Wilkins Slough Operations

Objective: Enhance the ability to manage temperatures for anadromous fish below Shasta Dam by operating Wilkins Slough in the manner that best conserves the dam's cold water pool for summer releases.

Proposed Change: Change the currently outdated 5,000 cfs navigation criterion to 3,800 cfs based on water users' minimum pumping requirements.

vi. Update Appendix 2-A, Decision Criteria and Processes for Sacramento River Water Temperature Management, to reflect current information and processes and resolve inconsistencies with RPA regarding acceptable criteria exceedances.

3. The updated RPA will include (1) track changes of pages in the RPA that have changes (not limited to the Shasta RPA, as there are other clarifications, *etc.*, needed since the 2011 adjustment) and (2) clean version of entire RPA, including revised section 11.3 Analysis of RPA