



# United States Department of the Interior

BUREAU OF RECLAMATION  
Central Valley Operations Office  
3310 El Camino Avenue, Suite 300  
Sacramento, California 95821

IN REPLY  
REFER TO:

CVO-400  
WTR 1.10

**APR 18 2014**

Ms. Maria Rea  
Assistant Regional Administrator  
California Central Valley Area Office  
National Marine Fisheries Service  
650 Capitol Mall, Suite 5-100  
Sacramento, CA 95814

Subject: Supplemental Information to the February 2014 Central Valley Project (CVP) Reservoir Operations Forecasts per 2009 National Marine Fisheries Service (NMFS) Biological Opinion

Dear Ms. Rea:

The 2009 NMFS Biological Opinion Reasonable and Prudent Alternative (RPA) Action I.2.3 requires Reclamation to submit a series of forecasts of CVP operations and corresponding Sacramento River temperature modeling runs to NMFS for review and concurrence. Our initial submittal of this information was transmitted to NMFS February 20, 2014. Reclamation plans to provide the next full monthly set of forecasts and temperature model runs consistent with RPA Action I.2.3 on or around April 25, 2014. Until that time, Reclamation is providing some supplemental information we have prepared to help support an announcement of improved hydrologic conditions and increased supplies available to Water Rights Settlement Contractors in the Sacramento Valley and wildlife refuges north of the Delta.

In our February 20, 2014, transmittal, Reclamation outlined forecasted conditions at Shasta Lake and water temperature conditions for both the February 90% exceedence hydrology and the February 50% exceedence hydrology. Reclamation also summarized our proposed announcement of available water supplies to Water Rights Settlement Contractors in the Sacramento Valley and to wildlife refuges north of the Delta. Given the forecasted inflow to Shasta Lake was well below 3.2 maf, the critical year shortage criterion was triggered for these Water Rights Settlement Contractors and wildlife refuges. The combination of this shortage criterion and the unique drought conditions prompted Reclamation to announce supplies of only 40% to 75% for both Water Rights Settlement Contractors in the Sacramento Valley and to wildlife refuges north of the Delta.

As described in our February 20, 2014, letter, Reclamation informed these Water Rights Settlement Contractors and wildlife refuges that they should plan to initially receive only a 40% water supply this year because of the extremely limited availability of water, and that Reclamation would work towards the contractual obligation to make available a 75% water supply as the hydrology and conditions improve.

Based the most recent April runoff projections at the 90% exceedence level, Reclamation believes conditions have improved such that the full critical year 75% contract supply is now available assuming close coordination of Keswick Reservoir releases and planned diversions by the major Water Rights Settlement Contractors. A primary area of attention continues to be the April and May period to

minimize effects to cold-water management on the Sacramento River and end-of-September storage at Shasta Lake. To this end, Reclamation has been working closely with your office and the Sacramento River Settlement Contractors to craft a voluntary shift of river operations that would serve to reduce April and May diversions allowing more water to remain in storage at Shasta Lake until higher releases are necessary to sustain temperature compliance downstream during the hotter months of June through September.

Reclamation is providing for your review the attached evaluation and temperature analysis we are using to help support our decision to announce a 75% supply to the Water Rights Settlement Contractors on the Sacramento River. This comparative analysis looks at Shasta Lake operations associated with a 40% supply vs. a 75% supply with a voluntary shift in diversion pattern. The results of this analysis show similar outcomes for Keswick Reservoir releases, end-of-month Shasta Lake storages, and Sacramento River temperatures.

This analysis also shows a continued improvement in Sacramento River temperature model results and Shasta Lake storage with the 90% exceedence hydrology. A 56° F temperature target at Clear Creek is now possible through about late September, with water temperatures nearing 58° F by mid-October. This is a significant improvement over our February results, where for the 90% exceedence, our analysis suggested that a temperature target location at Clear Creek was only possible through July, and that the Shasta Dam release temperature would be expected to exceed 56° F by mid-August, nearing 62° F by mid-September.

We greatly appreciate the continued collaborative effort by you and your staff as we work through this very difficult water year. If you have any questions, please contact me or Mr. Paul Fujitani at 916-979-2197.

Sincerely,



Ronald Milligan  
Operations Manager

Enclosure – 1

cc: Sue Fry  
Bay-Delta Office  
Bureau of Reclamation  
801 I Street, Suite 140  
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**Evaluation of Storage and Water Temperatures  
Sacramento River Settlement Contractors Supplies  
April 16, 2014**

**Introduction**

Reclamation continues to evaluate the water available to supply the Sacramento River Settlement (SRS) Contractors this critically dry year. The full natural inflow into Lake Shasta for the current water year is still projected to be well below 3.2 million acre-feet. Consistent with the SRS contracts, the limited natural inflow triggers a critical year water supply reduction, and the water supply under contract with Reclamation will be reduced by 25%.

In February of this year, Reclamation was concerned that the ongoing drought and unusually dry conditions in the Sacramento Valley would further limit available supplies to the SRS Contractors, and the SRS Contractors were notified that supplies could be as little as only 40% of their contract quantities.

Based the most recent April runoff projections at the 90% exceedence level, it appears conditions have improved such that the full 75% contract supply is now possible assuming close coordination of Keswick releases and planned diversions by the major SRS Contractor Districts. A primary area of attention has been the April and May period to assess the possible effects to cold-water management on the Sacramento River and end-of-September storage at Lake Shasta from operations associated with a 40% SRS supply vs. a 75% SRS supply with a voluntary shift in diversion pattern. The voluntary shift of diversion would serve to reduce April and May diversions allowing more water to remain in storage at Shasta Lake until higher releases are necessary to sustain temperature compliance downstream during the hotter months of June through September.

For our current analysis, Reclamation has run a comparative evaluation of Sacramento River temperature projections assuming both a 40% SRS supply and a 75% STRS supply with a voluntary shift in diversion pattern, both using the April 90% exceedence hydrology projections and estimates to diversion patterns. The results of this comparative analysis are presented below, and these results show similar outcomes for Keswick releases, Shasta Lake storages, and Sacramento River temperatures. For Sacramento River temperatures, both assumptions project a 56° F at the “@ Clear Creek gage” into September.

The estimated Keswick releases, Shasta storages, and Sacramento River temperature projections are all consistent with the recent Drought Operations Plan (DOP). Although the overall CVP Operational Forecast is not complete yet using the April runoff projections, we can confirm that Sacramento River at Wilkin Slough was targeted at 4,000 cfs in April and May prior to temperature operations, and that Delta outflow was adequate to meet the objectives consistent with the DOP.

**Upper Sacramento River – April 2014 Preliminary Temperature Analysis**

**Summary of Temperature Target Results by Month for both a 40% Supply and 75% Supply (shifted pattern)**

<b>Initial Target Location</b>	<b>JUN</b>	<b>JUL</b>	<b>AUG</b>	<b>SEP</b>	<b>OCT</b>
<b>90%-Exceedance Outlook (Figure 1)</b>					
<b>Sac. R. above Clear Creek (CCR)</b>	<b>CCR</b>	<b>CCR</b>	<b>CCR</b>	<b>CCR~56° F to 57° F</b>	<b>CCR~58° F</b>

**Temperature Model Inputs, Assumptions, Limitations and Uncertainty:**

1. Operation is based on the April 2014 Operation Outlooks (monthly flows, reservoir release, and end-of-month reservoir storage) for the 90% and 50% exceedances.
2. The profiles used for Shasta, Trinity and Whiskeytown were taken on [April 9](#), [March 18](#), and [April 9](#), respectively.
3. Guidance on forecasted flows from the creeks (e.g., Cow, Cottonwood, Battle, etc.) between Keswick Dam and Bend Bridge is not available beyond 5 days. Model input side flows (Cottonwood Cr & Bend Bridge local flow w/o Cottonwood Cr) were selected from the historical record, and are consistent with the forecast exceedance frequency. During spring, the relatively warm creek flows can be a significant percentage of the flows at Bend Bridge.
4. Although mean daily flows and releases are temperature model inputs, they are based on the mean monthly values from the operation outlooks. Mean daily flow patterns are user defined.
5. Cottonwood Creek flows, Keswick to Bend Bridge local flows, and diversions are mean daily synthesized flows based on the available historical record for a 1922-2002 study period.
6. Meteorological inputs were derived from a database of 86 years of meteorological data (1920-2005). The meteorological inputs in the model represent "Average" meteorological conditions.
7. Meteorology, as well as flow volume and pattern, significantly influences reservoir inflow temperatures and downstream tributary temperatures; and consequently, the development of the cold-water pool during winter and early spring.

### Temperature Analysis Results:

Note that for all exceedances, Lake Shasta storage is too low to utilize the upper gates of the TCD. This TCD limitation, along with the relatively small cold-water pool volume, significantly impacts temperature management.

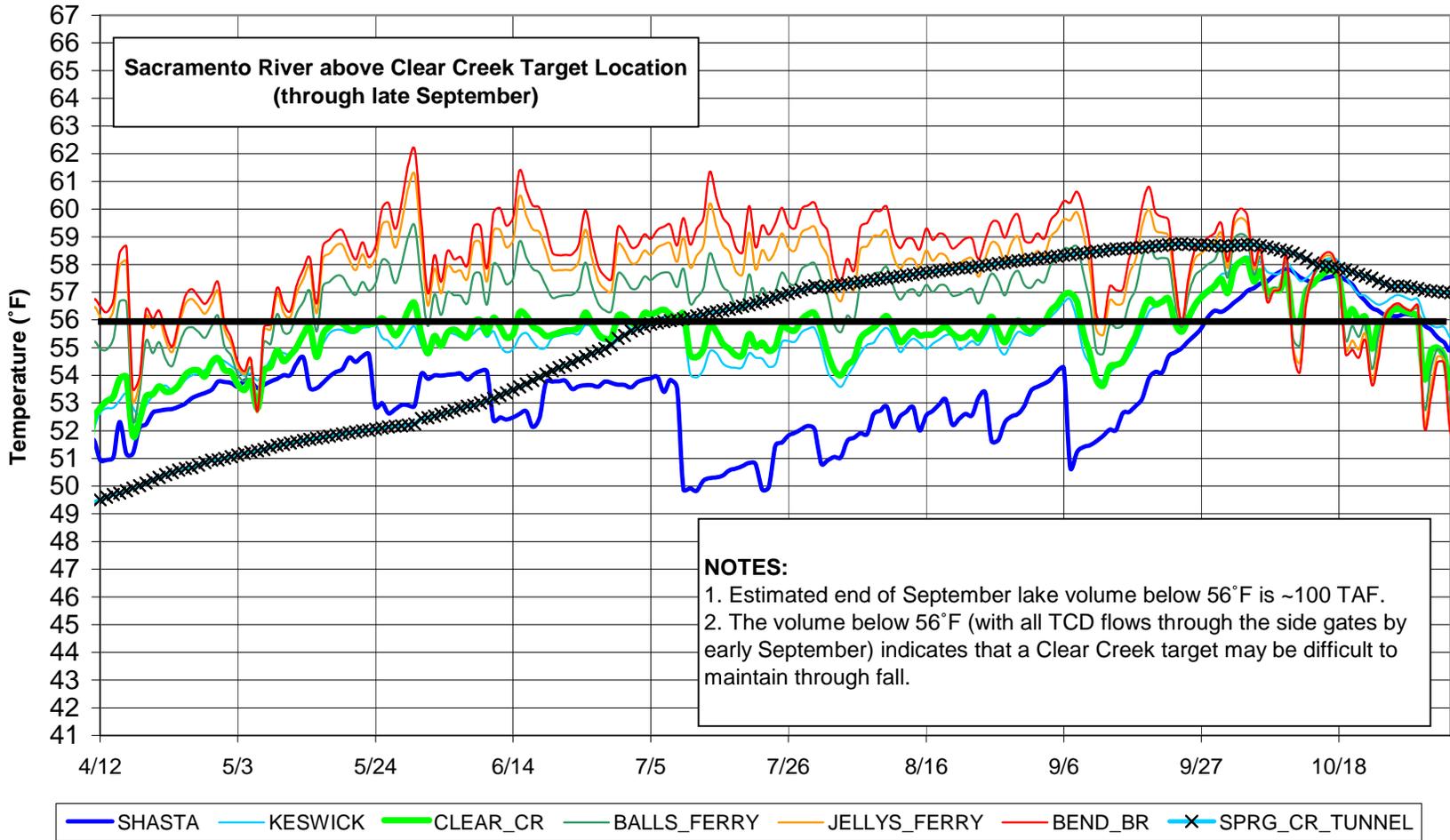
#### 90%-Exceedance for both supply scenarios:

A temperature target location above Clear Creek is possible through about late September (Figure 1). By early September, the TCD intake level will be through the side gates. Shasta Dam release temperature is expected to exceed 56° F by the end of September, nearing 58° F by mid-October.

This analysis also shows a continued improvement in Sacramento River temperature model results with the 90% exceedance hydrology. This is a significant improvement over our February results, where for the 90% exceedance, our analysis suggested that a temperature target location at Clear Creek was only possible through July, and that the Shasta Dam release temperature would be expected to exceed 56° F by mid-August, nearing 62° F by mid-September.

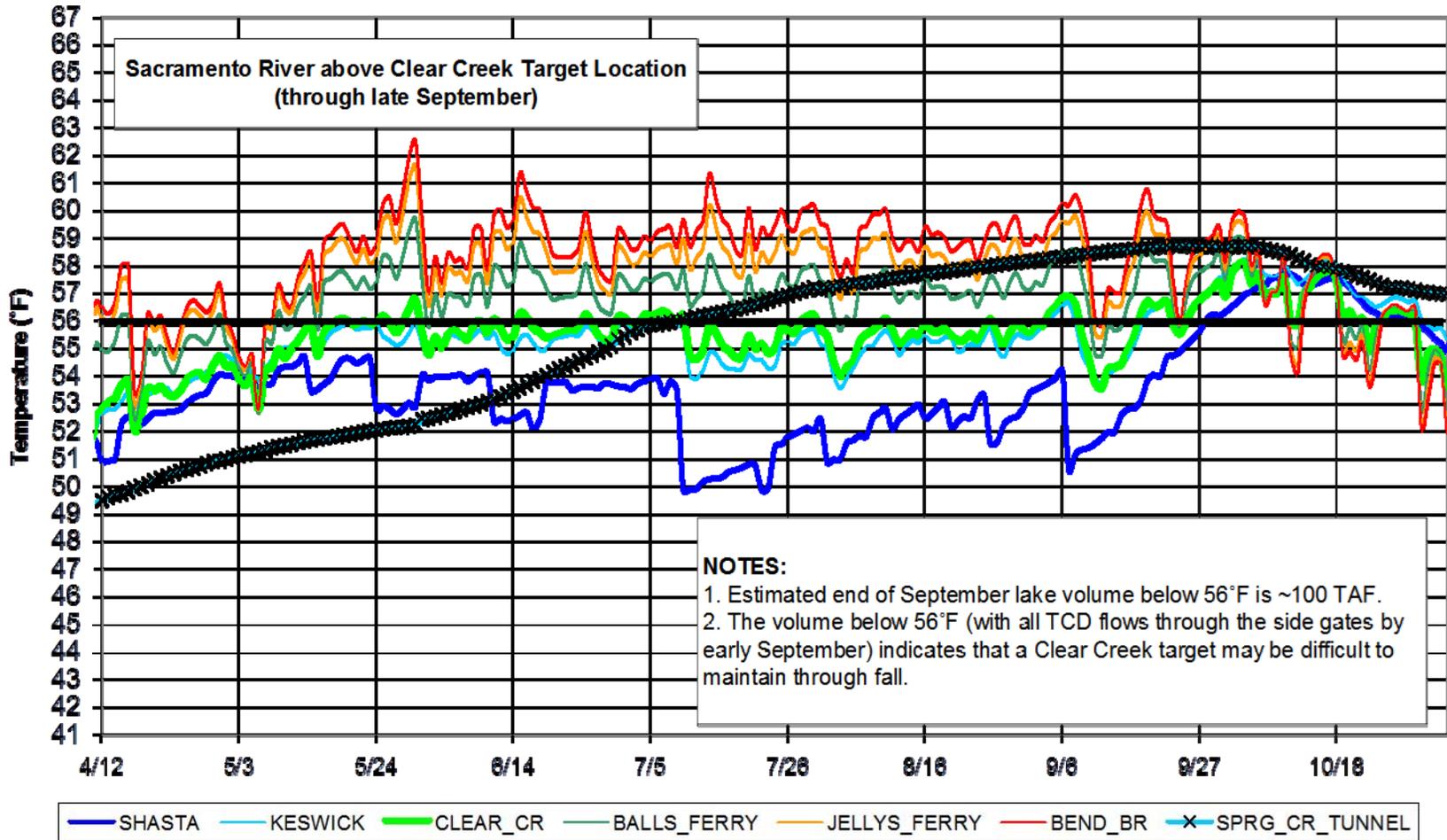
# Sacramento River Modeled Temperature 2014 April 90%-Exceedance Outlook

75% SRS Supply with shifted diversions



# Sacramento River Modeled Temperature 2014 April 90%-Exceedance Outlook

40% SRS Supply



Shasta Reservoir Storage and Keswick Release  
 90% Exceedence Forecast  
 75% SRS Supply with Shifted Diversion

	Apr	May	Jun	Jul	Aug	Sep	Oct
Shasta Storage, TAF	2,250	2,010	1,690	1,370	1,050	890*	870
Keswick Release, cfs	4,000	7,500	9,100	9,600	8,200	5,200	4,100

Shasta Reservoir Storage and Keswick Release  
 90% Exceedence Forecast  
 40% SRS Supply

	Apr	May	Jun	Jul	Aug	Sep	Oct
Shasta Storage, TAF	2,220	2,010	1,690	1,370	1,050	890*	870
Keswick Release, cfs	4,500	7,000	9,100	9,600	8,200	5,200	4,100

\* For comparison purposes, the end-of-September storage using the March 90% exceedence forecast (DOP, no salinity barriers) was 656 taf.