ATTACHMENT 1 - RECLAMATION COMMENTS

DRAFT Reclamation Comments on Section 1; RPA Adjustments Outline

DRAFT; FOR DISCUSSION PURPOSES ONLY

October 12, 2016

Attachment 2 to this document represents a reformatted version of Section 1 – "Background and rationale for adjustment" from the September 23, 2016 version of the Draft Shasta Division RPA Adjustment Outline provided by the National Marine Fisheries Service (NMFS). The attachment was reformatted to add numbers on each of the original bullets in that section. Reclamation has conducted an initial review of those bullets, and questions the data and/or scientific basis for many of the bullet points in the background section. In addition, the following represents Reclamation's concerns with specific numbered bullet points:

2) Cold water pool volume is sensitive to Keswick releases in April, May and June – prior to the temperature management season on-set.

Reclamation does not agree that this applies in most years. Higher lake elevation in spring enables use of the upper gates which then allows for blending of warming upper lake levels. A primary issue in 2014 and 2015 was that the upper gates were not available, leading to the release of colder water than necessary earlier than needed.

2) a. Keswick release schedules (especially for April and May) need to be decided by April 15 in order for Sacramento River Settlement (SRS) Contractors to make planting decisions and purchases for the growing season.

Reclamation believes they likely make planting decisions sooner under normal circumstances (and will likely need to even earlier under warmer/drought conditions), and would prefer to know sooner.

3) Capping Keswick releases in June and July is an important and effective strategy to stretch the cold water temperature management season throughout September and October.

Capping releases at Keswick to a lower flow will deplete the cold water faster than higher releases. With lower flows, colder water would be needed to meet the downstream temperature compliance location. In addition, in a year with high spring storage (like 2016 - end of April storage of 4.23 MAF), capping releases in June and July can lead to ineffective use of the full cold water pool, as well as significant impacts to the Delta, Folsom storage/temperature operations on the American River, and water deliveries to Reclamation's contractors.

4) There was a loss of water temperature control when the full Shasta side gates were accessed for water releases

The loss of temperature control (or the depletion of the cold water pool) in 2014 was the result of a number of factors that began earlier in the Water Year and in the preceding Water Year (2013). Although RPA Action I.2.2.C.1 directs Reclamation to cut flows as soon as possible to 3,250 cfs in order to conserve storage, the fishery agencies decided to keep flows higher (to 6,250 cfs) in the fall to prevent redd dewatering. Keswick flows were not reduced to 3,250 cfs until January

5, 2014. Those actions combined with the second year of drought and very low inflows into Shasta resulted in low end of April storage (2.4 MAF). Reclamation warned early in the season that low storage would result in inability to employ the upper set of gates (the first time this had happened in TCD history). Reclamation also indicated that temperature model performance was very uncertain due to no model calibration in these circumstances.

5) Water temperatures at upstream redd locations are not correlated with flow (i.e., water quality, water quantity), but are strongly correlated with Keswick release temperatures.

Reclamation believes that water temperatures are correlated with flow; lower flows can impact temperature gains between Shasta and Keswick, and can require cooler release temperatures to reach downstream compliance locations depending on air temperatures.

6) Keswick releases could be maintained throughout the summer at 7,250 cfs for temperature management. They do not need to be upwards of 15,000 cfs.

Flows cannot be maintained at 7,250 cfs all summer without very serious impacts to other project operations at Folsom, Oroville and in the Delta (pumping and outflow). Low flows will also require release of colder water from Shasta to meet the temperature compliance point in the Sacramento River. Lower flows increase the sensitivity to heat waves and could undercut temperature compliance with releases at 7,250 cfs due to downstream heating. This will result in depleting the cold water resource quicker and put water temperatures at risk. In the past, Keswick flows were increased up to 8 days of 14,000 to 15,000 cfs. These short, high releases were to meet temperatures during heat waves or for other CVP demands and requirements including outflow, water quality, and Delta exports.

7) Spring maximum storage that allows access to the upper gates is important to conserve cold water throughout the season. For this reason and to meet 55°F 7DADM at the CDEC station CCR, spring storage of 4.2 million acre-feet should the attained when possible.

To maximize spring storage, conserving Shasta storage must start the prior year. In order to conserve Shasta Reservoir storage in October, the RPA requires Reclamation to minimize releases to 3,250 cfs. This requirement sometimes conflicts with flow stability concerns for red dewatering, as recent fall/winter flow records indicate.

8) Wilkins Slough can go, and be maintained, as low as 3800 cfs.

We believe this would need to be further evaluated, as the 5,000 cfs target has historically supported Sacramento diversions as well as downstream needs. Several CVP contractors were unable to divert at the low flows during 2015 and 2016.

9) Stable flows are needed to prevent winter-run, spring-run, and fall-run redd de-watering and juvenile stranding.
10) There are opportunities for fall transfers and fall flood up/pacific flyway created by these conditions

The only time there may be a possibility for fall water transfers is in a very dry/critical year when not enough project water is available in upstream reservoirs. In 2016, there was a significant amount of CVP project water in Shasta (however, restricted releases during the summer resulted in impacts to water deliveries and Folsom storage and water temperature operations). In addition, it may not be possible to increase Keswick releases in the fall to move water due to redd dewatering impacts. The water has the potential to end up "stranded" and at risk of spilling if there is wetter hydrology the following water year resulting in no benefits to fisheries or water supply.

11) The temperature model needs continued investment. The current Sacramento River Water Quality Model (SRWQM) has difficulty predicting water temperatures:
11) b. There is high uncertainty in the Shasta Reservoir lake stratification and temperature profile between February and May, making it difficult to plan for temperature management season prior to initial water contract allocations.

There is high uncertainty with any temperature model during the February through May timeframe due to uncertainties in all the variable factors that contribute to lake levels and stratification (uncertainty in hydrology, inflow timing and temperature, etc.). In the past when decisions have been made, it is very clear that these decisions are all risk management decisions. A temperature model can only give ranges, and in the past few years it seems that fishery agencies have been willing to accept higher risk tolerance than Reclamation by targeting cold river temperatures too early in the season. Coldwater depletion at the end of the year results from taking risks early in the season.

11) c. Inputs to the SRWQM are not conservative enough to reflect current warmer meteorological and climate conditions.

In 2014 and 2015, the meteorological conditions were warmer than average. In 2016, the meteorological inputs to the model were extremely conservative, with inputs from the hottest months from all the years on record. A potentially more reasonable input would have been a forecasted meteorology for the season with a 25% exceedance on the forecast. The extreme conservatism of the meteorology in 2016 led less than full utilization of cold water in Shasta to the detriment of many other beneficial uses of the water. A more moderate approach, tracking performance throughout the year, and adjusting based on measured data can better maximize fisheries and water supply.

11) d. The SRWQM generally assumes that operations can achieve temperature targets, and often underperforms, as evidenced in the historical record. For example, it did a poor job of characterizing the Temperature Control Device (TCD) performance once the TCD side gate operation went into real-time effect and there was a loss of water temperature control in 2014 when the full Shasta side gates were accessed for water releases.

The only time the SRWQM has "underperformed" has been in the last 2 years of extreme drought (2014 and 2015). In 2014, it was clearly noted with the model run that with low storage, the TCD performance was unknown. Even with this admonition, the operating strategy supported by the fishery agencies risked counting on the TCD to perform better. In 2014, the planned strategy was to bypass water when/if the TCD did not perform. Unfortunately there wasn't any cold water left even at the bypass elevation.

11) e. Outputs are sensitive to ambient air temperatures – Instead of using a 30-year historical average, we need to use warmer meteorological data to be conservative to more accurately reflect current warmer conditions

A potentially more reasonable input would have been a forecasted meteorology for the season, with a 25% exceedance on the forecast and tracking the cold water pool throughout the season with real time adjustments as necessary.

11) f. We need a reservoir model (stratification is difficult to predict)

See comment on 11.b.

12) The Shasta temperature control device leaks. There may be engineering solutions that should be investigated to prevent the loss of cold water (tarps, etc.)

The temperature control device is designed to leak to some degree so that it won't structurally collapse while in use. The tarps on the middle gates were used in 2015 due to the presence of warm water at the elevation of the gates. Leakage is a part of the blending that was intended to occur.

13) Various operations and their effects on water temperature should be studied, for example, power peaking at Whiskeytown Reservoir.

There was an assertion that power peaking at Whiskeytown Reservoir caused warming in the reservoir during the Annual Science Review in 2012, however, this assertion was disproven by Reclamation's presentation at the Review.

17) The performance criteria in the Shasta RPA have not been attained.

The immediate application of long-term performance criteria to the current drought does not seem reasonable given that performance is completely dependent on hydrology and, therefore, unpredictable (particularly for shorter time periods).