CSPA Proposed Alternative Shasta-Trinity Temperature Management Plan for 2021

Introduction

The California Sportfishing Protection Alliance, Save California Salmon, and the California Water Impact Network propose a comprehensive temperature management and operations plan for the Shasta-Trinity Division of the Central Valley Project for the months of June through October, 2021. For ease of description, this document refers to this plan as the "CSPA TMP."

The situation for operations of the Shasta-Trinity Division of the Central Valley Project (CVP) in 2021 is dire. CVP reservoir storage is critically low, and runoff in April and May to date has been substantially worse than forecasted, leaving cold water in Shasta and Trinity reservoirs lower than predicted and in poor condition to support salmon migration, spawning, incubation, holding, and rearing. The Bureau of Reclamation has made the task of allocating extremely limited water resources immeasurably more difficult by making excessive releases from Shasta Reservoir in April and May.

The operations that the Bureau of Reclamation has proposed would deplete the cold-water pool in Shasta Reservoir and cause most of the winter-run and fall-run Chinook salmon eggs and alevin in the Sacramento River to perish in excessively warm water. Those operations would also likely exhaust the cold-water pool in Trinity Reservoir by the time the important Klamath-Trinity fall-run Chinook move into the river system in August and September to spawn.

Proposed Actions

1. Limit June-through-October releases from Shasta-Keswick dams to 5000 cfs, using primarily cold-water pool, to maintain Keswick release at less than 54ºF.
2. Eliminate June-through-October use of the Spring Creek power tunnel between Whiskeytown and Keswick reservoirs.
3. Maintain June-through-October flow of 300 cfs to Whiskeytown Reservoir through the Carr powerhouse, increase June-October releases to Clear Creek to 300 cfs, and increase June-October releases from Trinity-Lewiston dams to the lower Trinity River to 800-870 cfs.

Figure 1. CSPA TMP Proposed Actions

	Apr	May	Jun	Jul	Aug	Sep	Oct
Average monthly values for daily releases/flows							
CSPA Proposed Shasta Release cfs		8100	5000	5000	5000	5000	5000
CSPA Proposed Clear Creek Release cfs		335	300	300	300	300	300
CSPA Proposed Sac. R. @ Clear Creek cfs		9235	5300	5300	5300	5300	5300
CSPA Proposed Lewiston Release to Trinity R cfs		1498	850	800	850	870	800

(Red font indicates approximate actual releases. CSPA et al. opposed high May Shasta releases.)
(Actual Lewiston release to Trinity River may be higher per Lower Klamath Record of Decision.)

A narrative description of the CSPA TMP accompanies a spreadsheet that quantifies proposed operations. The narrative describes the various components of the spreadsheet, including the actions and formulas that estimate changes in key project operations, reservoir conditions, and river flows that occur as a consequence of the proposed actions. The narrative also provides additional justification for the actions.

Purpose

The purpose of the proposed CSPA TMP is to improve survival of winter-run, spring-run, and fall-run salmon, and green and white sturgeon, in the Sacramento River, as well as to improve survival of spring-run and fall-run salmon in the Klamath/Trinity watershed. Steelhead in both watersheds should also benefit.

The CSPA TMP will meet its purpose by making more effective use of cold-water pools in Shasta and Trinity reservoirs.

The CSPA TMP will severely reduce the export of Trinity River water to Whiskeytown Reservoir. In addition, the CSPA TMP proposes to release all Trinity exports down Clear Creek, rather moving water from Whiskeytown through the Spring Creek Powerhouse into Keswick Reservoir. Thus, summer water from the Trinity will enter the Sacramento River 10 miles downstream of Keswick Reservoir. Water released to Clear Creek from Whiskeytown Reservoir is also colder than water released from Whiskeytown to the Spring Creek Powerhouse, because releases to Clear Creek are drawn from deeper in Whiskeytown Reservoir. Colder releases from Keswick Reservoir, no longer mixed with warmer releases through the Spring Creek Powerhouse, will improve survival of winter-run salmon eggs this summer in the prime 10-mile spawning reach of the Sacramento River downstream of Keswick Dam.

The CSPA TMP proposes to hold in Trinity Reservoir a substantial portion of the water not exported to the Sacramento. In addition, the CSPA TMP proposes to increase summer and fall releases from Trinity and Lewiston reservoirs to the Trinity River. This will improve habitat conditions for Trinity River and lower Klamath River salmon in this critically dry year.

The proposed changes in operation would save total storage and cold-water pool volume in both the Shasta and Trinity reservoirs for the coming summer and fall, and for next year. The proposal would substantially reduce power production and irrigation deliveries.

The CSPA TMP would help meet the State of California's stated objective[1] to:

> *Maintain stream flows and reservoir storage conditions on Sacramento River/Delta tributaries to protect cold water habitat for sensitive native fish species, including Chinook salmon, steelhead, and sturgeon. Cold water habitat conditions to be protected*

[1] State Water Board, Scientific Basis Report in Support of New and Modified Requirements for Inflows from the Sacramento River and its Tributaries and Eastside Tributaries to the Delta, Delta Outflows, Cold Water Habitat, and Interior Delta Flows (2017), p. 5-42. Available at: https://www.waterboards.ca.gov/water_issues/programs/peer_review/docs/scientific_basis_phase_ii/201710_bdphaseII_sciencereport.pdf

include maintaining sufficient quantities of habitat with suitable temperatures on streams to support passage, holding, spawning, incubation, and rearing while preventing stranding and dewatering due to flow fluctuations.

Goals

1. Conserve reservoir storage and cold-water pools in Shasta and Trinity reservoirs.
2. Improve survival of winter-run salmon eggs in the lower Sacramento River below Keswick Dam by providing colder water releases from Keswick Reservoir through the spring, summer, and fall of 2021.
3. Improve survival of green sturgeon eggs and fry in the Sacramento River during the spawning and early rearing period by maintaining cool spring water temperatures in the lower Sacramento River near Red Bluff.
4. Sustain over-summering of adult spring-run salmon in the Trinity River from Lewiston Dam downstream to Douglas City, in Clear Creek below Whiskeytown Reservoir, and in the Sacramento River below Keswick Dam.
5. Enhance late summer Trinity River flows to the lower Klamath River to help prevent fish disease and die-off in the lower Klamath, as occurred in 2002.
6. Provide adequate flows and water temperatures for spring-run and fall-run salmon spawning and egg incubation in the lower Sacramento River below Keswick Dam, in Clear Creek below Whiskeytown Dam, and in the Trinity River below Lewiston Dam, from August through October.
7. Provide adequate flows and water temperatures for winter-run, spring-run, and fall-run salmon rearing and emigration in the lower Sacramento River from spring through fall.
8. Provide enhanced flows in the Sacramento River downstream of Wilkins Slough in order to contribute to Delta inflow and salinity control.

Other Benefits

The proposed operational scenario will also provide the following ancillary improvements:

1. Improve rearing and migration conditions for steelhead in the Klamath, Trinity, Clear Creek, and Sacramento rivers.
2. Improve flows and water temperatures in the lower Klamath River below the mouth of the Trinity River to improve habitat conditions for salmon, steelhead, and sturgeon.
3. Improve migration conditions for juvenile and adult Coho salmon in the lower Trinity and lower Klamath rivers by providing higher spring-to-fall flows and higher carryover storage in Trinity Reservoir.
4. Increase end-of-water-year storage by over 500 TAF, with nearly one-third more storage in Shasta and Trinity reservoirs to begin the next water year.

Negatives

The proposal will have substantial negative effects on hydropower throughout the Shasta-Trinity Division hydropower system and on water deliveries to CVP contractors.

Unknowns

1. Reclamation made excessive releases of water from Shasta Reservoir in April and May 2021 that enabled high spring water deliveries to CVP contractors. Although the water temperature of these releases was high and had minimal direct draw on the reservoir's cold-water pool, these releases may have compromised the "blanket" of warm water that overlies and helps protect Shasta Reservoir's cold-water pool. It is likely that any such compromise of the cold-water pool would be worse in warmer summer months.
2. In addition to use of the river outlets at Shasta Dam, operation of the hydropower penstocks and the gates of the Shasta Temperature Control Device (TCD) may affect proposed water temperature regimes. Each of the five penstocks that moves water from Shasta Reservoir through Shasta Dam to the Shasta Powerhouse draws differently from the reservoir's depth layers through the TCD gate openings. The timing of daily hydropower peaking operations also affects the water temperature of these releases.
3. The river outlet on Shasta Dam's spillway bypasses the dam's hydropower generation system. Reclamation used the upper outlets in April and part of May to release warmer surface water in lieu of releasing deeper water from the cold-water pool through the TCD gates. This Plan assumes that Reclamation would not use Shasta Dam's spillway outlets from the top, middle, and lower locations for temperature control releases during the June through October period. This Plan assumes likewise for Trinity Dam's river outlets.
4. This Plan assumes that releases from Whiskeytown Dam to Clear Creek are colder water from deeper in the reservoir. It also assumes that releases to the Trinity River from Lewiston Dam are colder water from deeper dam outlets. Both of these releases provide very limited (Lewiston) or no hydropower.
5. This Plan assumes that the temperature curtain on Whiskeytown's outlet to the Spring Creek Tunnel and powerhouse (SPP) on Keswick Reservoir does not function properly, leading to warmer water releases to Keswick Reservoir. We do not know if Trinity or Lewiston outlet curtains function properly. We assume that Shasta's TCD does not function properly.
6. This Plan assumes that minimal thermal loading occurs in Keswick Reservoir and in the ten-mile reach below Keswick Dam, with little effect from flow rate and/or air temperature.

Reducing Trinity Exports Will Save Fish in the Sacramento and Trinity Rivers

The operation of the Trinity River Division of the CVP can adversely affect Sacramento River temperatures during the summer and fall. This adverse effect occurs when relatively warmer water exported from the Trinity system to Whiskeytown Reservoir subsequently discharges into Keswick Reservoir downstream of Shasta Dam (Figure 2 below). Water released from Trinity Dam is cold, but it warms as it moves through Lewiston Reservoir and is then diverted to Whiskeytown Reservoir via the Clear Creek Tunnel to the Carr Powerhouse. Trinity water warms even more in Whiskeytown Reservoir. before and during its entrance into the Spring Creek Tunnel, which discharges into Keswick Reservoir at the Spring Creek Powerhouse (SPP). In summer and fall, Spring Creek Powerhouse discharges can be several degrees warmer than discharges from Shasta Dam.

According to its May 5, 2021 Temperature Management Plan, Reclamation intends in 2021 to move 90 TAF to 110 TAF of Trinity water per month to the Spring Creek Powerhouse during the hottest part of the summer. Elimination of SPP releases in summer, which range in temperature between 53º and 60º F, will reduce demand on Shasta's cold-water pool, and thus significantly reduce Sacramento River temperatures for winter-run and fall-run Chinook, while also conserving cold water in Trinity Reservoir.

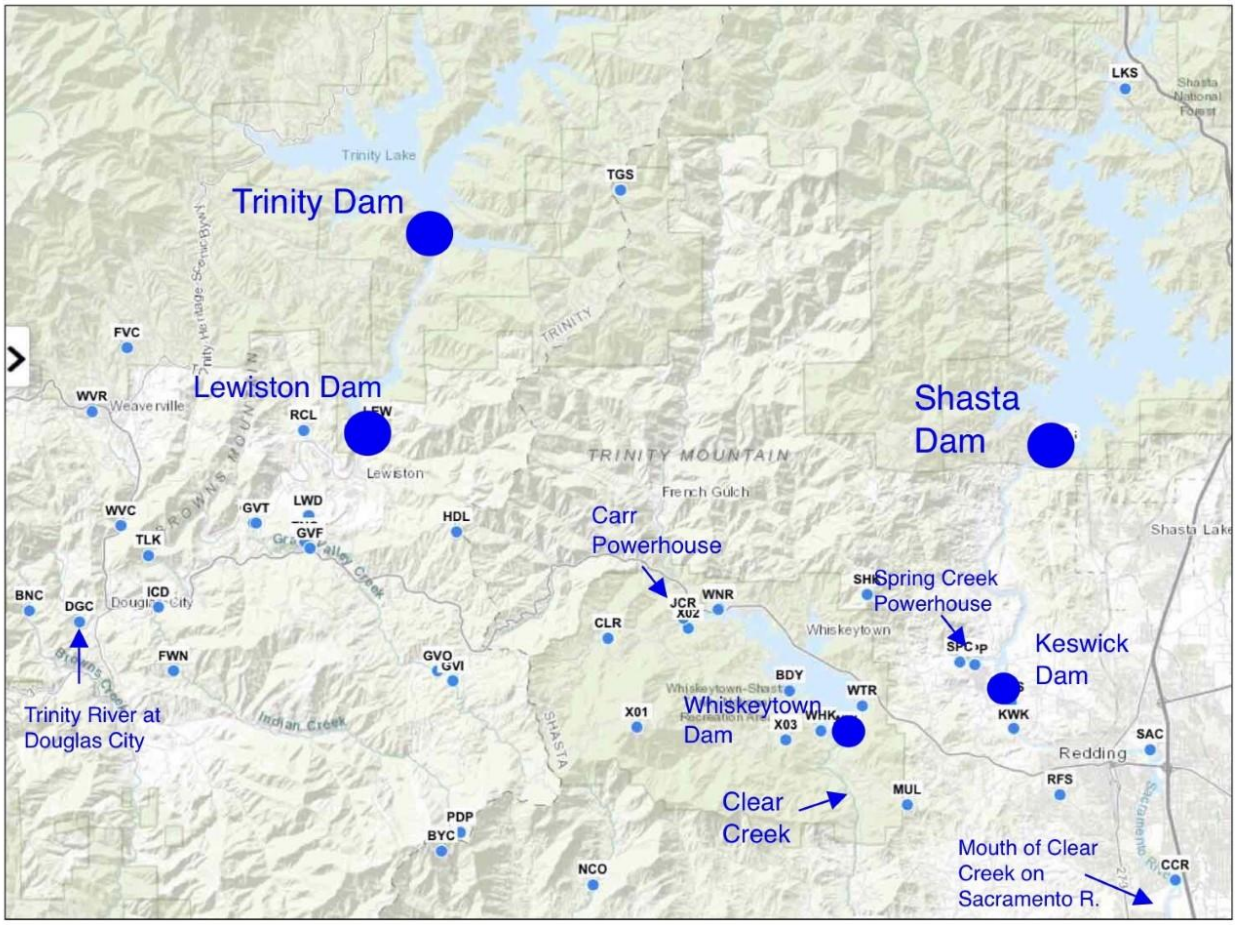

Figure 2. Shasta-Trinity Division of the CVP

However, eliminating or significantly reducing Trinity River Division exports to the Sacramento River can create a heating problem for the Trinity River. Lewiston Reservoir is seven miles long and is shallow. It will substantially heat up during the summer if there is not enough turnover of water moving through it.

Trinity River summer base flows are 450 cfs. These flows alone will not provide enough Lewiston turnover to meet North Coast Basin Plan Temperature Objectives for the Trinity River.2 A reduction in Trinity exports to the Sacramento River via the Clear Creek Tunnel

[2]"Water Quality Control Plan for the North Coast Region" Footnote 5, Table 3-1, page 3-8.00: Accessed at http://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/083105-bp/04_water_quality_objectives.pdf

(CCT) during summer base flows will result in violation of Trinity River temperature objectives and also Water Right Order 90-5, (pages 60-61), unless Trinity River instream flows are increased to 700-800 cfs. Review of the 2018 operation of the Trinity River Division during the Carr Fire shows that 700-800 cfs Trinity instream flows met Trinity temperature objectives with little or no CCT diversions.

Furthermore, inflow to Trinity Reservoir in 2021 is warmer than normal, which under Reclamation's proposed operation is likely to leave little cold water in in Trinity Reservoir in August through October. Cold water is needed in these months to release from Trinity and Lewiston dams into the Trinity River. Cold Trinity water is required to meet the requirements of the "Record of Decision for the Long Term Plan to Protect Adult Salmon in the Lower Klamath River,"3 otherwise known as the Lower Klamath ROD.

The Lower Klamath ROD was adopted to prevent widespread adult fish kills in the Lower Klamath River, similar to the 2002 fish kill in which 65,000 adult salmon perished in the Lower Klamath due to poor water quality, crowding, and disease. The Klamath River in 2021 is experiencing its worst drought ever, and it is certain that Trinity water will again be needed to assist in the fall Chinook migration. However, under Reclamation's current operations plan, Trinity water would not be as effective as in the past due to exhaustion of Trinity Reservoir's cold-water pool.

Reducing Power Generation Will Save Fish in the Sacramento and Trinity Rivers

Some may argue that Reclamation cannot afford the power loss of the CSPA TMP. On the contrary, Reclamation cannot afford to produce power because that luxury is dependent on sufficient cold water in Shasta and Trinity to keep Trinity exports cooler and to have sufficient cold water in Shasta to mix with warmer Trinity exports. Loss of hydropower generation in June through October 2021 is above all the product of low carryover storage from 2020.

Daily Average Not to Exceed	Period	River Reach
60°F	July 1- Sept 15	Lewiston to Douglas City Bridge
56°F	Sept 15-Oct 1	Lewiston to Douglas City Bridge
56°F	Oct 1- Dec 31	Lewiston to North Fork Confluence

[3] *See* description on the Bureau of Reclamation's webpage for the 2017 Lower Klamath ROD:

> The Bureau of Reclamation has prepared a Draft Environmental Impact Statement (DEIS) for the Long Term Plan to Protect Adult Salmon in the Lower Klamath River. The purpose of the DEIS is to address the potentially significant environmental effects of implementing flow-related actions to reduce the likelihood, and potentially reduce the severity, of an Ich (*Ichthyophthirius multifiliis*) epizootic event that could lead to an associated fish die-off in future years. Ich is a pathogen that can cause mortality in fish. Ich grows on the gills and suffocates the fish. Crowded holding conditions for pre-spawn adults, warm water temperatures, and presence of disease pathogens are the likely major factors contributing to the adult mortalities.

Available at: https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=22021

Higher storage and thus increased hydraulic "head" or pressure will offset some of the power generation lost due to reduced flow releases from Trinity and Shasta dams. Higher storage in Trinity Reservoir will also eliminate or reduce the need to use the power bypass at Trinity Dam. Power not generated in 2021 means more stored water available to generate power in the future.

And, though it must be measured against the effects on water temperature, generation capacity will remain available in 2021 for incidents of exceptional demand for electricity. It is completely unnecessary to maintain high generation all summer long in order to maintain such capacity. Power revenues are no excuse for killing fish.

Conclusion

The proponents of the CSPA Temperature Management Plan are painfully cognizant that their proposed operations are no panacea. Fish are still going to take a terrible hit in 2021, and not just in the area that this proposal addresses. So too are those who rely on these fish: commercial and recreational anglers, whose very industries are in jeopardy; tribes for whom salmon are integral to their ways of life; and Covid-decimated local economies dependent on recreation and tourism dollars.

The CSPA TMP also looks ahead to the future. It provides fish and communities a better chance for a decent next year, and less devastation should next year again be dry. The CSPA TMP will save 250 TAF in Shasta Reservoir storage, and close to 300 TAF in Trinity River storage. Reducing total releases will keep water colder in key river reaches and save fish.

Reclamation and many of its contractors drained their accounts of millions of acre-feet of water in a dry 2020. Now they want to start a new clock in seeking "balance" of beneficial uses. Balance has to account for the amount already spent, not just in 2020 but also in April and May of 2021, when Shasta releases were far more than Reclamation's initial TMP proposed. Balance must consider more than just a snapshot in time.

The State Water Board must act quickly and decisively under to determine reasonable use of limited water resources at this terrible moment. The Board must remember similar moments in 2014 and 2015, when it failed. And though the State Water Board cannot resolve the structural overallocation of Central Valley water at this moment, it must remember this moment's unacceptably limited options when it undertakes the actions suite of actions it must to address the State's structural water problems.

Attachment 1

PDF of
Spreadsheet
Showing
Proposed Operations
Under
CSPA TMP
(Submitted as
Separate PDF File)

Attachment 2

Spreadsheet
Showing
Proposed Operations
Under
CSPA TMP
(Submitted as
Separate Excel File)

Attachment 3

Description of Spreadsheet Components And Further Justification

Spreadsheet Components

Below are descriptions of each Spreadsheet component and additional justification.

As a general matter, the Spreadsheet derives values attributed to Reclamation from Reclamation's Draft Temperature Management Plan, posted by the State Water Board to its website on May 5, 2021. This is labeled in the Spreadsheet as "BOR 5/5 TMP."

However, the Spreadsheet adjusts the values from the BOR 5/5 TMP for April and May in order to reflect actual values through May 22, and in order to reflect projected values from May 23 through May 31 based on an extrapolation of actual values from May 22 and before. In particular, the Spreadsheet adjusted the storage level for Shasta Reservoir by reducing it 199 TAF. The Spreadsheet assumes that the CSPA TMP starts with the same adjusted storage level in Shasta Reservoir. As described below, the Spreadsheet does not make a similar adjustment for Trinity River storage.

Shasta End-of-Month Storage

The spreadsheet derives Shasta end-of-month (EOM) storage from the BOR 5/5 TMP. It adjusts BOR's 5/5 projected April-May storage estimate using actual April-May 22 storage and a May EOM extrapolated value as described above. The adjustment for end-of-May storage (reducing projected storage by 199 TAF from the estimate in the BOR 5/5 TMP) carries through each subsequent month. The Spreadsheet applies this 199 TAF reduction to both the BOR 5/5 TMP and the CSPA TMP.

The estimated Shasta storage under the CSPA TMP savings for EOM September is 1353 TAF. The estimated Shasta storage for EOM September under the adjusted BOR 5/5 TMP is 1031 TAF. Thus, the CSPA TMP would show an EOM September storage increase of 322 TAF. The estimated Shasta storage under the CSPA TMP savings for EOM October is 1244 TAF. The estimated Shasta storage for EOM October under the adjusted BOR 5/5 TMP is 992 TAF. Thus, the CSPA TMP would show an EOM October storage increase of 252 TAF (a 25% increase over Reclamation's estimate).

The CSPA TMP assumes that Reclamation would not add any water transfers to the proposed Shasta releases. It is unclear whether the BOR 5/5 TMP factored in water transfers, which if not considered could further deplete storage. Though neither TMP addresses November, it is likely that water transfers in November proposed by Reclamation would further decrease Shasta storage.

(For historical perspective on Shasta storage, *see* Figure 3, below.)

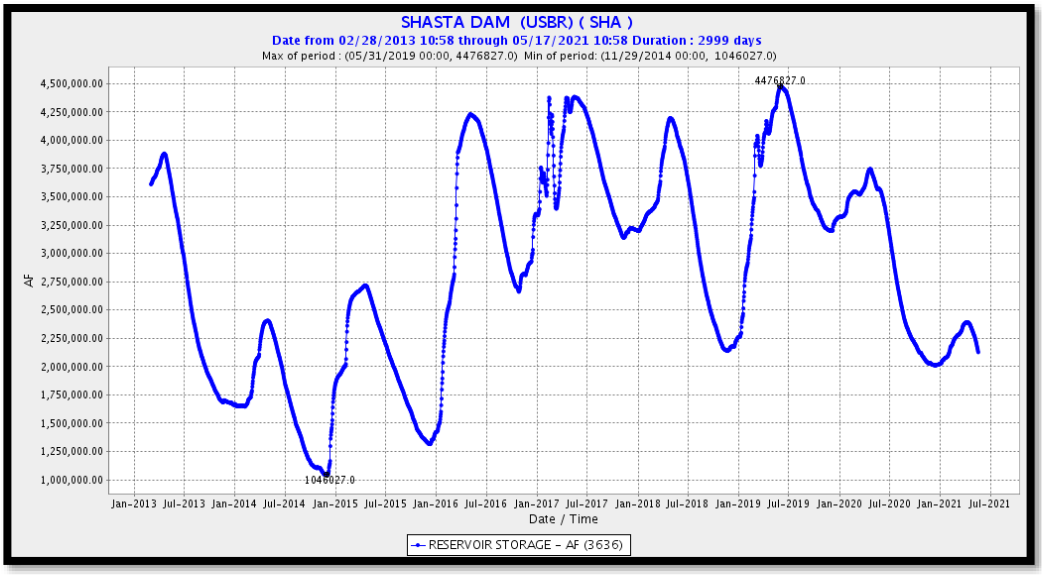

Figure 3. Shasta Reservoir storage, January 2013 through mid-May 2021

Trinity End-of-Month Storage

The CSPA TMP increases the BOR 5/5 TMP's estimated EOM storage for Trinity Reservoir each month, beginning with June. The storage increases under the CSPA TMP are the result of reduced cumulative releases from Trinity Reservoir, the consequence of reduced diversions to the Sacramento River watershed. Additional June through October Trinity River releases, as discussed below, partly reduce the storage savings in Trinity Reservoir. Overall, the CSPA TMP would increase the October EOM storage in Trinity Reservoir by 332 TAF. The BOR 5/5 TMP would take October EOM Trinity Reservoir storage down to the 2014 level, whereas CSPA TMP would keep Trinity Reservoir storage levels near the 2016 level (*see* Figure 4, below).

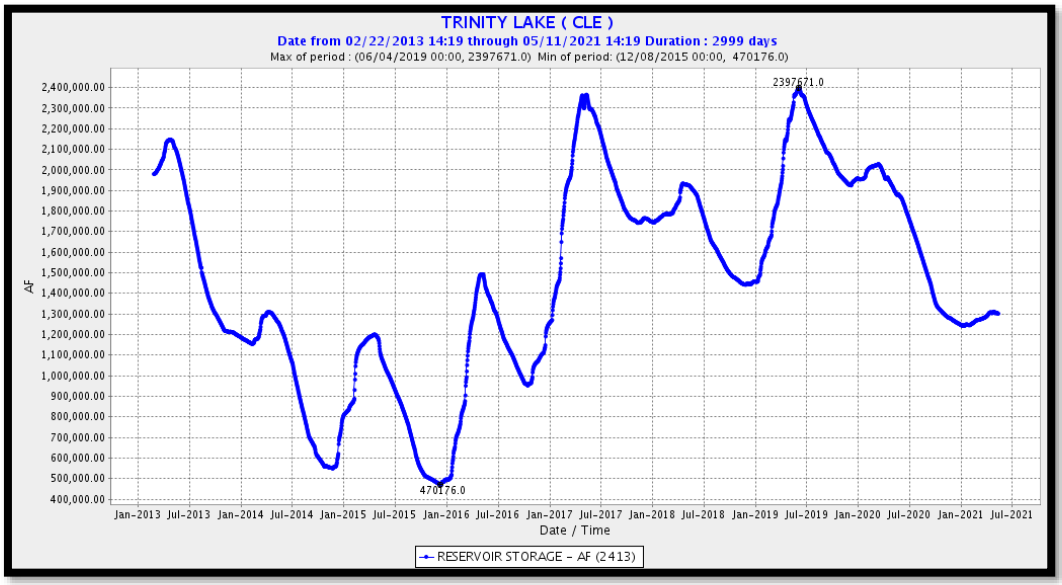

Figure 4: Trinity Reservoir storage, January 2013 through mid-May 2021

Actual storage in Trinity Reservoir at the end of April was 30 TAF lower than the value shown in the BOR 5/5 TMP. Because there are substantial prescribed may releases from Trinity Reservoir under the Trinity Record of Decision (ROD), the Spreadsheet did not adjust for this 30 TAF discrepancy between actual and predicted storage values. It also does not account for the potential for larger Lower Klamath ROD releases from Lewiston Dam to the Trinity River than the BOR 5/5 TMP for July, August and September.

Clear Creek Release (IGO) from Whiskeytown Reservoir

Cold-water releases from Whiskeytown Dam are necessary to sustain salmon and steelhead in Clear Creek through the summer. The CSPA TMP increases Clear Creek flows to improve survival conditions for over-summering spring-run salmon. The small increase in Clear Creek flow would replace a small part of the water supply lost to the lower Sacramento River due to overall reduction in Trinity exports. As described above, a key element of the CSPA TMP is elimination of relatively warm water releases from Whiskeytown Reservoir into Keswick Reservoir through the Spring Creek tunnel and powerhouse. The increase of summer Clear Creek flows from 200 cfs to 300 cfs is a positive step for Clear Creek salmon: it will help to maintain water temperatures in the creek below 60ºF for over-summering adult spring-run salmon. In part because reducing overall Trinity exports will keep the remaining export water cooler for a longer time, the flow in Clear Creek should also help to maintain water temperatures of less than 56ºF in Clear Creek during the September and October spawning period for spring-run and fall-run salmon. (For historical perspective on Clear Creek flow and water temperatures, *see* Figures 5 and 6 below).

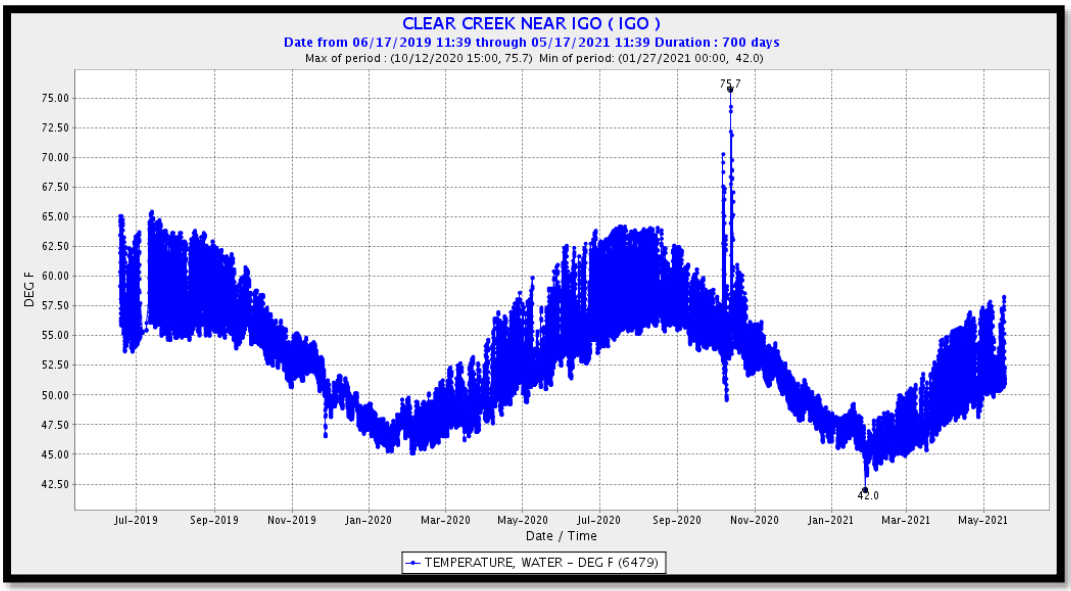

Figure 5. Clear Creek average daily flow at IGO gage 2013-2021

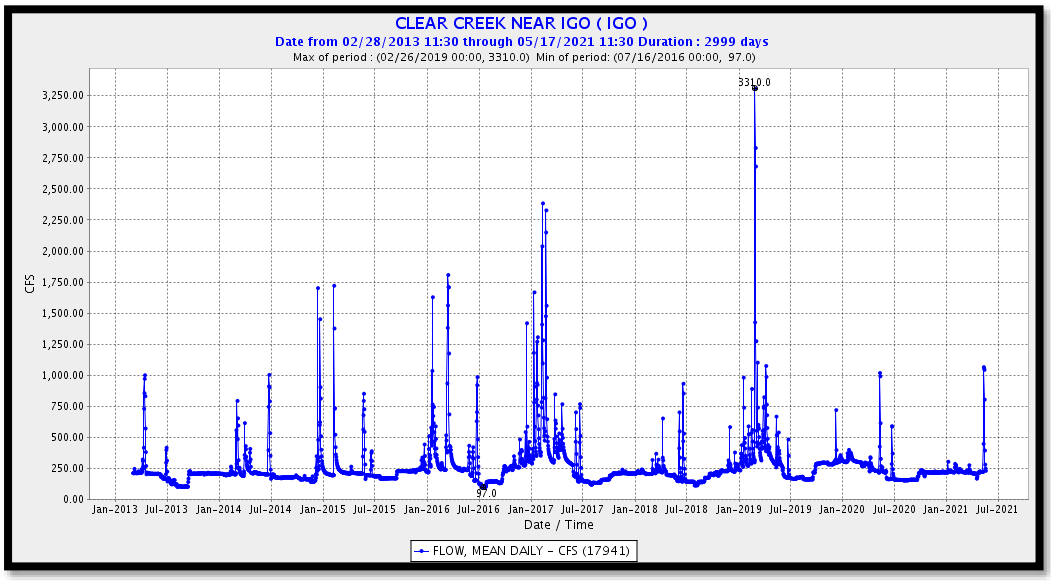

Figure 6. Clear Creek water temperature at IGO gage July 2019 to May 2021

Trinity River Release from Lewiston Reservoir

The CSPA TMP will increase releases from Lewiston Dam to the lower Trinity River from June through October to 800 cfs. This increase will limit the temperature increase of water as it passes through Lewiston Reservoir water in summer. It will also maintain cool water in the lower Trinity River to sustain over-summering adult spring-run salmon. Excessive stress and pre-spawn mortality of spring-run Chinook may occur when water temperatures exceed 60ºF (15.9ºC). The CSPA TMP would retain Reclamation's late-summer prescribed flow pulses.

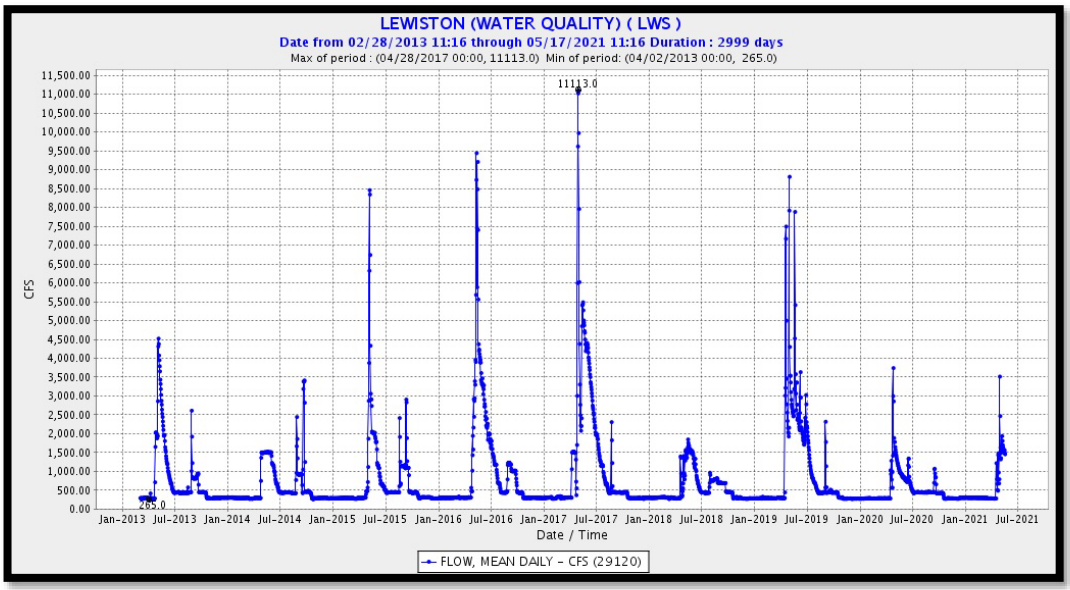

Figure 7. Flow in Trinity River below Lewiston, 2013-2021, with high August 2018 Carr Fire flows.

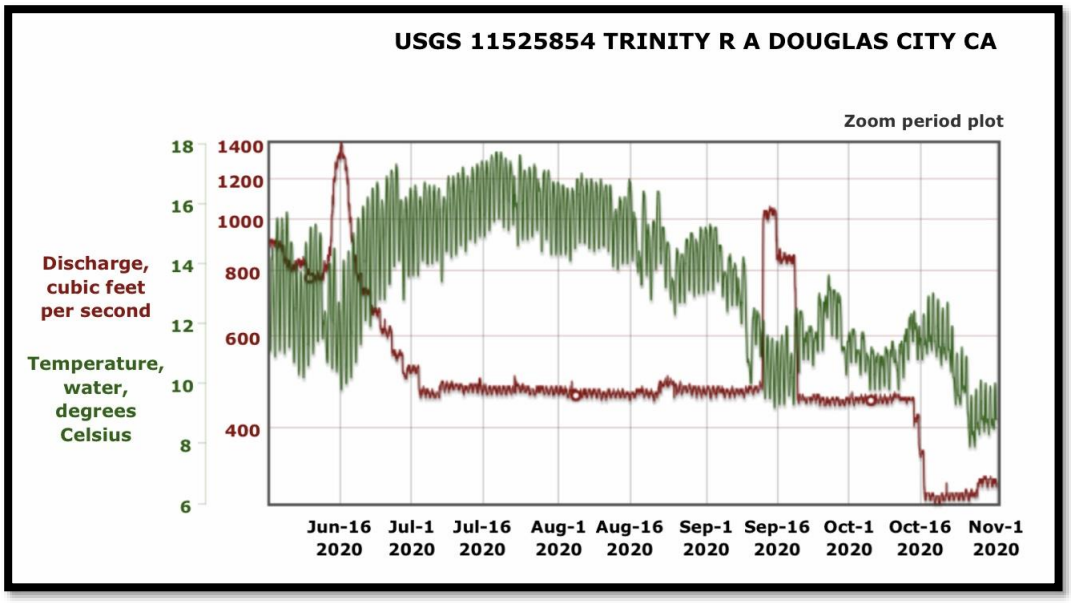

Figure 8. Trinity River at Douglas City, flow and water temperature, June through October 2020

Trinity Reservoir Storage Savings

Reduced exports from the Trinity River to Whiskeytown, minus the increased flow in the lower Trinity River account for the savings in Trinity Reservoir storage for each month in the spreadsheet.

Shasta Releases (SHA, SHD, KWK)

Releases from Shasta Dam can originate from the various outlet gates of the Shasta Temperature Control Device (TCD) or from various river outlets at different elevations within the dam's spillway. The CSPA TMP proposes to operate using only the TCD, with no releases from spillway outlets.

The CSPA TMP would operate various gate regimes to maintain Keswick release temperatures at less than 54ºF from June through October. The CSPA TMP estimates that a continuous managed release of a daily average of 5000 cfs, taking advantage of a full 24-hour operating regime, could maintain a 53ºF average daily temperature of the Shasta Dam release water (monitored at the SHD location) through October. Achievement of the 53ºF Shasta Dam release target may require modification of the daily hydropower peaking regimes and adjustment to TCD gate operation on a frequent basis, along with frequent monitoring of the cold-water pool and daily adjustments based on the weather.

A 5000 cfs release of water that is 53ºF or less may succeed given a starting 1,500 TAF end-of-May volume of the Shasta cold-water pool (water less than 52ºF). Accurate information,

adaptive management, and ongoing adjustments of releases based on ongoing modeling will likely be necessary to conserve the volume of the cold-water pool through October.

Though the CSPA TMP does not propose it on the front end, a shift to a target release temperature of 55ºF or less (rather than 53ºF or less) from Shasta Dam for September and October could allow further conservation of the volume of the Shasta cold-water pool. A similar strategy was employed in summer 2015 (*see* Figure 9 below). Note, however, that the 2015 summer water temperatures were subjected to subsequent mixing with warmer water from Spring Creek Powerhouse, and that water temperatures released from Keswick Dam sporadically exceeded 56ºF, resulting in high egg and embryo mortality that year. The CSPA TMP's elimination of inflow to Keswick Reservoir through Spring Creek Powerhouse will help keep the Keswick release temperatures close to the Shasta release temperatures.

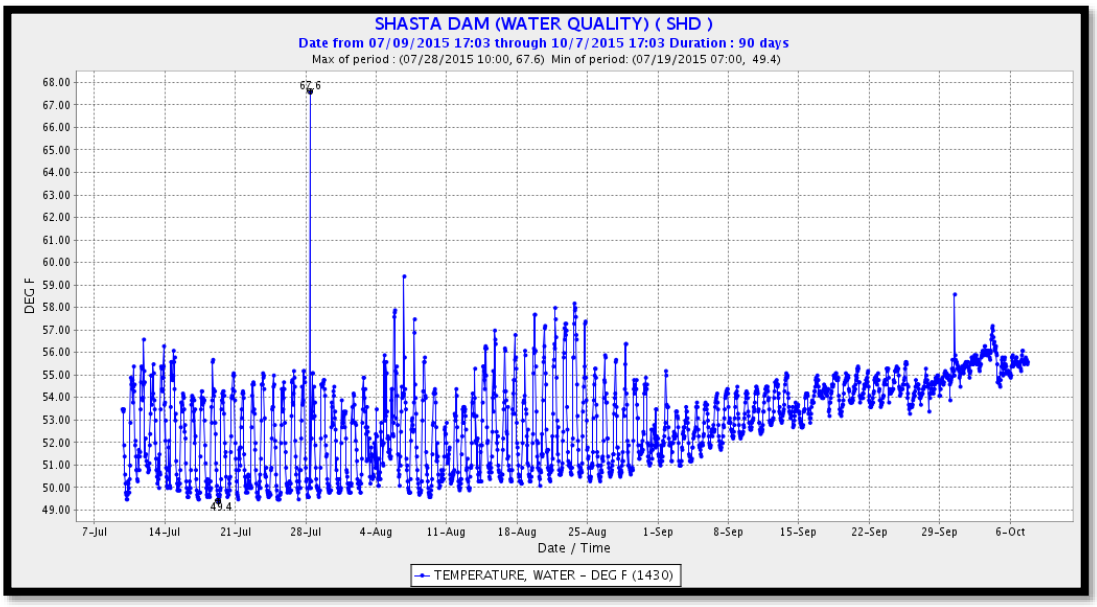

Figure 9: Summer 2015 water temperature of dam releases from Shasta Reservoir. September 2015 Shasta releases combined with warmer water releases through Spring Creek Powerhouse. The CSPA TMP would eliminate Spring Creek releases through October.

Shasta Reservoir Storage Savings

The difference between June through October Shasta Reservoir releases in the BOR 5/5 TMP and the June through October Shasta Reservoir releases in the CSPA TMP account for the savings in Shasta Reservoir storage for each month in the spreadsheet. Both start with the same end-of-May projected storage, as described above, at approximately the same level as 2014 and 2015 (Figure 10 below).

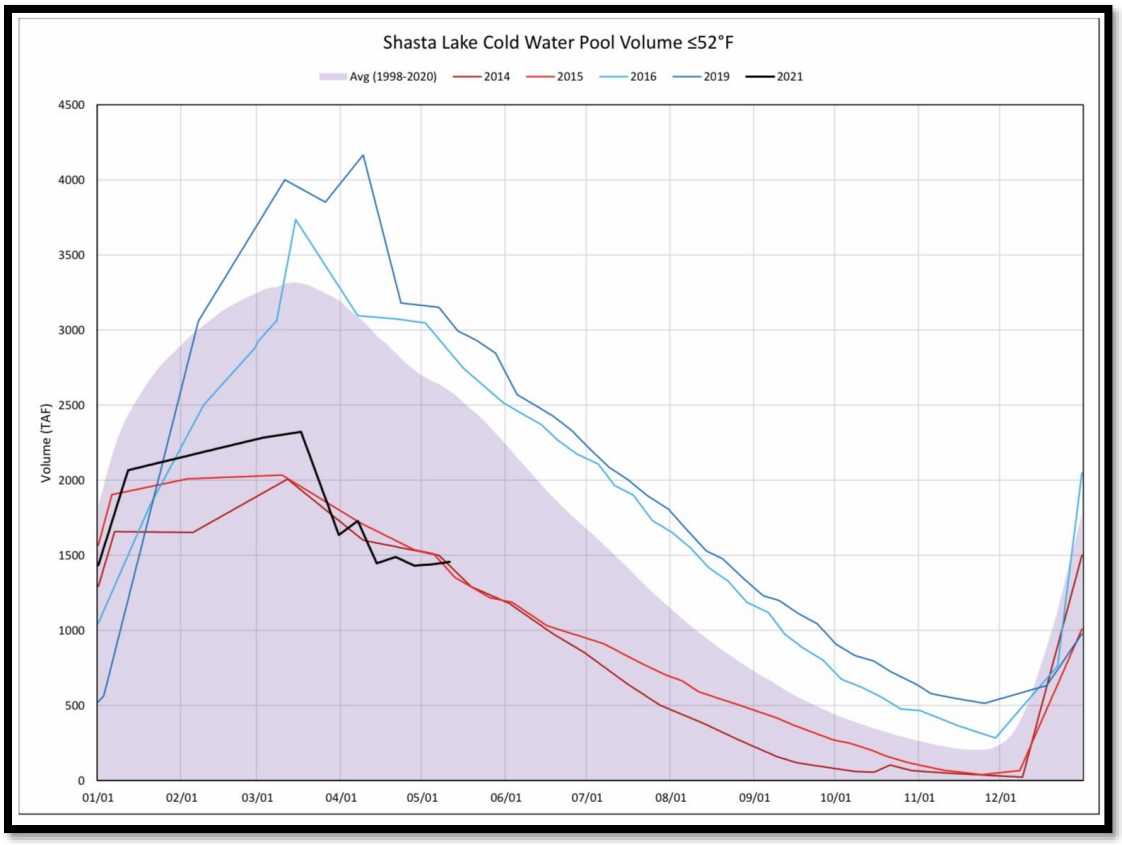

Figure 10. Shasta Reservoir cold-water pool volume as of about May 10, 2021, compared with volume in 2014 and 2015.

Deliveries

The Spreadsheet estimates total contractor deliveries from the lower Sacramento River by subtracting a 4000 cfs target Wilkins Slough gage flows from the sum of Keswick releases, Clear Creek releases, and estimated tributary inflows between Keswick Dam to Wilkins Slough. It bases summer 2021 projected Sacramento River tributary inflows on 2015 gage records.

Attachment 4

List of CDEC Gages
And
Other Acronyms

List of CDEC Gages and other Acronyms

CDEC – California Data Exchange Center Locations and Gages

SHA/SHD – Shasta Reservoir and Dam CDEC records and conditions including reservoir storage and dam release or outflow.

SPP – Spring Creek Powerhouse on lower Spring Creek at Keswick Reservoir.

LWD/LEW - Lewiston Reservoir and Dam below Trinity Reservoir/Dam on Trinity River.

DGC – Trinity River at Douglas City.

Carr Powerhouse (JCR) - located at exit of Clear Creek Tunnel to Whiskeytown Reservoir (WHI) – receives all water transferred from Trinity Reservoir to Keswick Reservoir and lower Clear Creek.

CCR – Sacramento River gage above mouth of Clear Creek near Redding.

KWK – Sacramento River gage below Keswick Dam/Reservoir.

Clear Creek (IGO) – gage downstream of Whiskeytown Dam on Clear Creek.

Trinity Reservoir (CLE) – reservoir storage and outflow to Lewiston Reservoir.

CVP – Central Valley Project operated by U.S. Bureau of Reclamation (Reclamation or BOR).

TCD – Temperature Control Device or tower on inside face of Shasta Dam that regulates the elevation from which water is drawn for dam discharge.

EOM – end of month

TAF – thousand acre-feet

TMP – Temperature Management Plan