BUREAU OF RECLAMATION

Stanislaus Watershed Team Yearly Summary of Activities Water Year 2020

Central California Area Office, Folsom, CA
Interior Region 10- California-Great Basin

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Cover Photo: Spawning gravel placement in the vicinity of Goodwin Dam. (Reclamation/John Hannon)

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The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Yearly Summary of Activities
Water Year 2020

New Melones Reservoir, CA
Interior Region 10- California-Great Basin

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Acronyms and Abbreviations

Term	Definition
7DADM	Seven-Day-Average of the Daily Maximum Temperature
AN	Above Normal water year type
AF	Acre-feet
BiOp	Biological Opinion
BN	Below Normal water year type
cfs	Cubic feet per second
CDEC	California Data Exchange Center
CDFW	California Department of Fish & Wildlife
cfs	cubic feet per second
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CV	Central Valley
D-1422	Water Rights Decision 1422
Districts	Oakdale and South San Joaquin Irrigation Districts
D.O.	Dissolved Oxygen
GDW	Stanislaus River at Goodwin Dam (CDEC gauge)
KF or KFS	Knights Ferry
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OBB	Stanislaus River at Orange Blossom Bridge (CDEC gauge)
PA	Proposed Action
PSMFC	Pacific States Marine Fisheries Commission
Reclamation	U.S. Bureau of Reclamation
RMP	Reasonable and Prudent Measures
RPA	Reasonable and Prudent Alternative
RIP	Stanislaus River at Ripon (CDEC gauge for dissolved oxygen)
ROD	Record of Decision
SEWD	Stockton East Water District
SOG	Stanislaus Operations Group
SRP	New Melones Stepped Release Plan
SWP	State Water Project
SWT	Stanislaus Watershed Team
SWRCB	State Water Resources Control Board

Term	Definition
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish & Wildlife Service
USGS	United States Geological Survey
WAPA	Western Area Power Administration
WIF	Winter Instability Flow
WOMT	Water Operations Management Team
WY20	Water Year 2020

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Chapter 1 Introduction and Background

1.1 Introduction

This Summary of Activities provides an overview of biological, fishery and operational discussions, and operational decisions related to the Stanislaus River in Water Year 2020 (WY20). In February 2020, the United Stated Bureau of Reclamation (Reclamation) began implementing the Alternative 1 (Preferred Alternative) as described in the 2020 Record of Decision (ROD) for the Coordinated Long-Term Operation of the Central Valley Project (CVP) and State Water Project (SWP), and analyzed in the 2019 National Marine Fisheries Service (NMFS) Biological Opinion (BiOp). Previously, from October 2019 to February 2020, the CVP and SWP were operated to the NMFS 2009 BiOp on the Coordinated Long-Term Operation of the CVP and SWP. WY 2020 (October 1, 2019 to September 30, 2020) comprised both the NMFS 2009 BiOp and the 2020 ROD, and this summary of activities captures WY 2020 in its entirety.

1.2 Background

The Stanislaus River is important to a variety of stakeholders, including fishery management agencies, the public, water users and federal government agencies. The United States Army Corps. of Engineers (USACE), the United States Fish and Wildlife Service (USFWS), NMFS, California Department of Fish and Wildlife (CDFW), and the State Water Resources Control Board (SWRCB) in conjunction with Reclamation are agencies that hold trust responsibilities for fishery and water resources in the Stanislaus River. Reclamation is responsible for operating the East Side Division, which includes New Melones Dam and powerplant. The East Side Division is operated to provide flood control, water supply, power generation, general recreation, water quality, and fish and wildlife enhancement. A partnership between the Oakdale Irrigation District (OID) and the South San Joaquin Irrigation District (SSJID) (collectively, the Districts), known as the Tri Dam Project, owns and operates multiple features on the Stanislaus River. These include Donnells and Beardsley dams and reservoirs (upstream of New Melones) and Tulloch Dam and Reservoir (downstream of New Melones). The Districts own Goodwin Dam and Reservoir located downstream of Tulloch Dam. A map of key locations in or near the Stanislaus River watershed is provided in Figure 1-1.

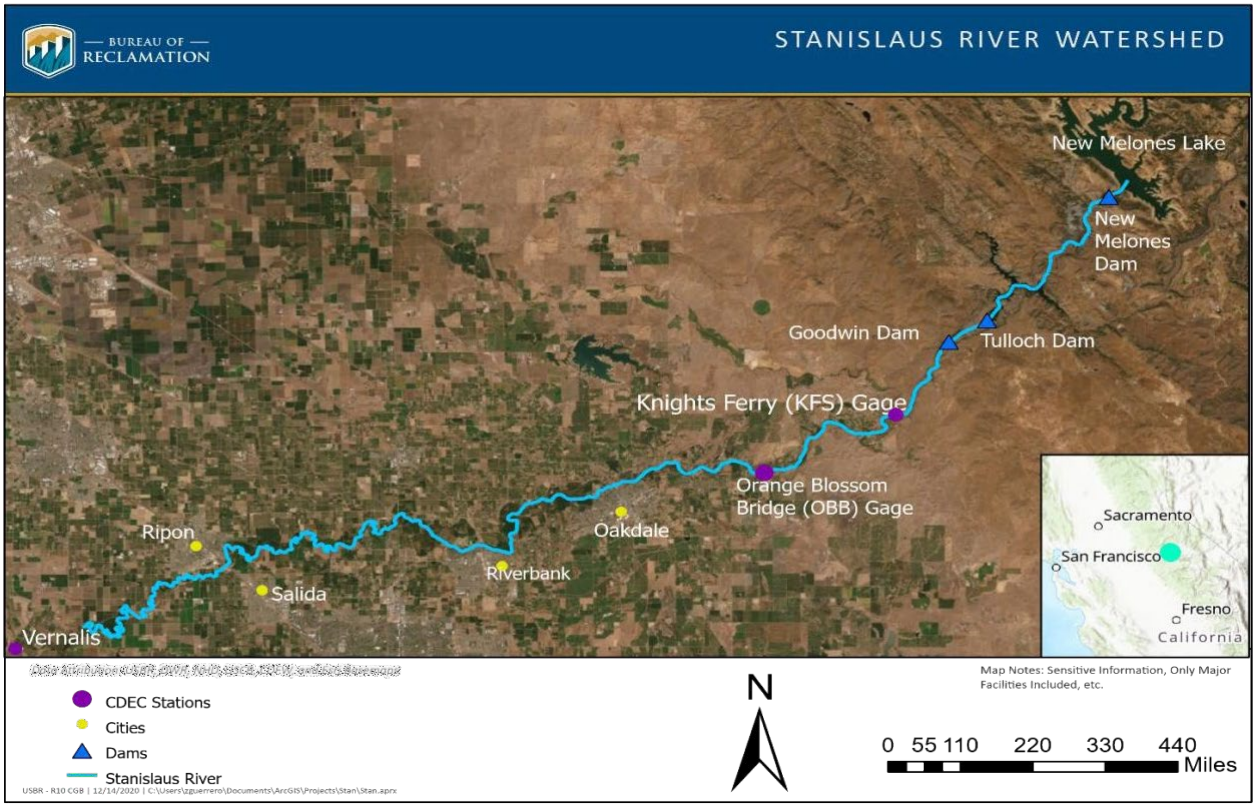

Figure 1-1. Key locations in or near the Stanislaus River watershed.

1.3 Transition from NMFS 2009 BiOp to 2020 ROD

On June 4, 2009, NOAA Fisheries issued a BiOp to Reclamation that included Reasonable and Prudent Alternative (RPA) which described how CVP and SWP operations could be implemented in a manner that would avoid the likelihood of jeopardy to listed species or adverse modification of critical habitat. On April 7, 2011, NOAA Fisheries provided an RPA amendment, which consistent with the Delta Stewardship Council's Independent Review Panel, corrected errors in the 2009 RPA and provided clarification. The NMFS 2009 BiOp required Reclamation to create the Stanislaus Operations Group (SOG), a technical team providing advice to NMFS and the Water Operations Management Team (WOMT) on issues related to the Stanislaus River fishery and water resources (2011 NMFS RPA Amendments, pp. 8-9).

On August 2, 2016, Reclamation and the California Department of Water Resources (DWR) jointly requested the reinitiation of Endangered Species Act (ESA) consultation on the coordinated long-term operation of the CVP and SWP. NOAA Fisheries accepted the reinitiation request on August 17, 2016. On January 31, 2019, Reclamation transmitted their Biological Assessment (BA) to NOAA Fisheries (revised BA submitted October 21, 2019).

NOAA Fisheries finalized and issued its biological opinion (BiOp) on the coordinated operations of the CVP and SWP on October 21, 2019. NOAA Fisheries concluded that Reclamation's proposed operations will not jeopardize threatened or endangered species or adversely modify their designated critical habitats.

Reclamation signed a Record of Decision (ROD) February 19, 2020, to implement project operations as described in the Final EIS and analyzed in the 2019 USFWS and NMFS BiOps.

As part of the Preferred Alternative, Reclamation committed to convene the Stanislaus Watershed Team (SWT) (successor to the SOG), consisting of agency representatives and local stakeholders having direct interest on the Stanislaus River to share operational information and improve technical dialogue on the implementation of the New Melones Stepped Release Plan (SRP). The SWT also provides input on the shaping and timing of monthly or seasonal flow volumes to optimize biological benefits.

1.4 SWT Membership

On March 18, 2020 the SWT convened for the first time. Reclamation contracted with a meeting facilitation management firm to help develop and implement a transition plan for the technical team from SOG to SWT. In July 2020, local stakeholders (the Districts and Stockton East Water District [SEWD]) were incorporated into the SWT.

SWT member agencies and local stakeholders during WY20 included:

- Reclamation
- USFWS
- NMFS
- CDFW
- DWR
- SWRCB
- SSJID
- SEWD
- OID

Chapter 2 Preferred Alternative

2.1 Summary of Preferred Alternative Action Components

Implementation of the 2020 ROD began on February 19, 2020. The Preferred Alternative for the Stanislaus River operations includes flow and non-flow components, summarized below.

Table 2-1. Components of the Preferred Alternative related to the Stanislaus River system per Table 4-7 in Chapter 4 of the Biological Assessment

Component	Page #
Seasonal Operations	4-23
Stanislaus River Stepped Release Plan (including pulse flows)	
Alteration of Stanislaus DO Requirement	
Spawning and Rearing Habitat Restoration	
Temperature Management Study	
Yellow-billed Cuckoo Surveys	

The following non-flow components of the Preferred Alternatie are not discussed in this report as they have not been standing topics of discussion at SWT meetings during WY20.

- Temperature Management Study: Reclamation will study approaches to improving temperature for listed species on the lower Stanislaus River, to include evaluating the utility of conducting temperature measurements/profiles in New Melones Reservoir.
- Yellow-billed Cuckoo Surveys: Reclamation will coordinate with the USFWS to develop a baseline survey for the Yellow-billed cuckoo. The survey for this action would focus on the critical habitat areas, associated project sites, and occupied habitat within the action area.
- Alteration of Stanislaus DO Requirement: During the summer: Reclamation is required to maintain applicable dissolved oxygen standards on the lower Stanislaus River for species protection. Reclamation currently operates to a 7.0 mg/L dissolved oxygen requirement at Ripon from June 1 to September 30. Reclamation proposes to move the compliance location to Orange Blossom Bridge, where the species are primarily located at that time of year.

Chapter 3 SWT Discussion Topics

Because New Melones and Goodwin dams were operated in accordance with the 2009 NMFS BiOp before the 2020 ROD was adopted, the following section outlines topics consistent with both NMFS 2009 BiOp and 2020 ROD components, as well as other agenda items, discussed at monthly SOG/SWT meetings from October 2019 through September 2020. Meeting notes and supplemental SWT documents were made available to SWT members and posted on the SWT Technical Group website[1].

3.1 Monthly Discussion Topics

- Hydrology and temperature updates
- Operations Update and Forecast
- Stanislaus River Forum Call Review
- Fish Monitoring and Studies
- Restoration Project Updates
- Progress Update on Proposed Action Elements
- Flow Planning (seasonal)

Chapter 4 Water Operations Summary

4.1 Water Year Conditions and Operations

The WY20 Stanislaus River operations were heavily influenced by the New Melones reservoir storage. Flows released downstream of Goodwin Dam into the Stanislaus river were mostly for storage management for New Melones early in the water year. The 2019 Fall Pulse flow occurred October 9, 2019 through November 7, 2019. The Stanislaus River flows were higher than the minimum flow following the Fall Pulse flow due to high storage at New Melones. From November 8, 2019 to February 13, 2020, releases were higher than the minimum flows for storage management at New Melones. The releases ranged from 300 cfs to 4,000 cfs to maintain storage management. The higher releases were to maintain New Melones storage to be within the allowable storage boundaries. Once New Melones was within the allowable storage on February 13, 2020, releases

[1] The SWT Technical Team webpage can be found here: https://www.usbr.gov/mp/bdo/stanislaus-watershed-team.html

were needed from Goodwin Dam to help meet the D-1641 Vernalis Bay Delta Flow Requirement. Flows from Goodwin Dam averaged 1,650 cfs during the time period of February 19, 2020 to March 11, 2020 to meet the Vernalis Bay Delta Flow Requirement. In April 2020, the Spring Pulse Flow was implemented and ranged from 150 cfs to 1,500 cfs from April 8, 2020 to May 10, 2020. Following the Spring Pulse Flow, releases were increased in anticipation of theD-1641 Vernalis Flow Bay Delta Requirement. Higher flows continued through June 30, 2020 to meet the Vernalis Flow Bay Delta Requirement. For the rest of the year, flows from Goodwin Dam were kept at 200 cfs, the minimum release determined by the 75% exceedance San Joaquin Valley Water Year Type Index (60-20-20).

4.2 New Melones Stepped Release Plan

The Stanislaus River watershed has annual obligations that can exceed the average annual runoff in a given year due to several factors, including SWRCB water rights decisions D-1641, D-1422 and D-1616, the 1987 CDFW agreement, CVPIA objectives, ESA requirements, the 1988 Agreement and Stipulation with OID and SSJID, riparian water right diverters, and CVP water delivery contracts.

Over the past decade, Reclamation has worked with Stanislaus River water users and related agencies in developing a revised operating plan for New Melones Reservoir that addresses multiple objectives, including a more predictable and sustainable operation, minimizing low storage conditions in successive drought years, and providing flows to support listed species and critical habitat. These efforts have allowed multiple agencies and stakeholders to provide input on potential solutions; however, a final plan has not been completed. The Stepped Release Plan (SRP) is representative of Reclamation's contribution to any current or future flow objectives on the Lower San Joaquin River at Vernalis.

Reclamation operates New Melones Reservoir (to provide targeted releases measured at Goodwin Dam) in accordance with an SRP that varies by hydrologic condition/water year type as shown in Table 3-1.

Table 4-1. New Melones SRP Annual Releases by Water year type

Water Year Type	Annual Release (TAF)
Critical	185.3
Dry	234.2
Below normal	345.7

Water Year Type	Annual Release (TAF)
Above normal	345.7
Wet	483.7

The SRP is implemented with a default daily hydrograph, and the ability to shape monthly and seasonal flow volumes to meet specific biological objectives. The default daily hydrograph is the same as prescribed under the NMFS 2009 BiOp for critical, dry, and below normal water year types. The difference occurs in above normal and wet water year types, where the minimum requirement for larger releases is reduced from current operations to promote storage for potential future droughts and preserve cold water pool. The complete daily hydrograph for the New Melones SRP is available in Appendix D of this report.

4.3 Flow Management

Figure 4-1 summarizes New Melones Reservoir operations during WY20, including information on local precipitation, inflow and outflow from the reservoir, and reservoir storage throughout the year in comparison to the top of the conservation pool.

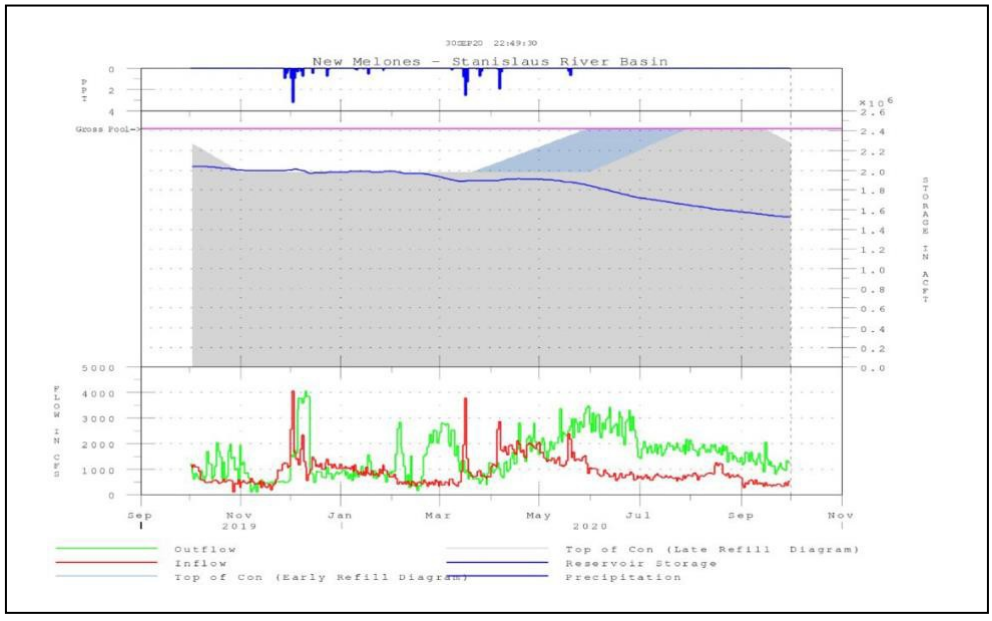

Figure 4-1. Summary of New Melones Reservoir Operations during WY20.

The WY20 classifications for determining minimum flows, based on the New Melones Index (NMI), are provided in Table 4-1. Minimum flows based on the New Melones Index were implemented only through February 2020. From March 2020 on, under the 2020 ROD, the water year classification started being based on the 75% exceedance of the San Joaquin Valley Water Year Type Index (60-20-20). The San Joaquin Valley "60-20-20" Water Year Hydrologic Classification (60-20-20) was developed for D-1641 implementation. Previous operating plans for New Melones Reservoir used the NMI to determine water year type, calculated by summing end-of-February storage and forecasted inflow through September. Because the reservoir can store more than twice its average inflow, the NMI resulted in a water year type determination that was more closely tied to storage rather than hydrology. Changing from the NMI to 60-20-20 is expected to provide operations that better represent current hydrology and correlate more closely to water year types for other nearby tributaries.

Table 4-2. Water Year Classification by Month during WY20

Month	NMI Annual Water Supply Category	Water Year Type Index (60-20-20) 75% Exceedance
October	Wet	N/A
November	Wet	N/A
December	Wet	N/A
January	Below Normal	N/A
February	Below Normal	N/A
March	N/A	Critical
April	N/A	Critical
May	N/A	Dry
June	N/A	Dry
July	N/A	Dry
September	N/A	Dry

4.4 Seasonal Operations

4.4.1 Fall 2019 Pulse Flow (NMFS 2009 BiOp)

At the September 17, 2019 monthly meeting, SOG members agreed to advise a four-peaked alternative, Alternative A, (Figure 2-1) to the default flow schedule for 2019. The reshaped flow schedule had the same volume (27,174 AF; calculated using the default schedule and assuming a base flow of 400 cfs in October and 300 cfs in November) as the default Wet water year type fall pulse flow schedule. The SOG advised an alternative reshaped fall pulse volume into one smaller and three larger jagged peak flows that provided flow variability expected to deter spawning at the higher flows that will not be sustained through egg incubation and fry emergence. The maximum daily release in both the default and alternative schedule is 1,500 cfs. SOG believed the alternative flow schedule met the intent of the RPA action, namely, improving instream conditions and providing an attraction cue for adult salmonids returning to spawn.

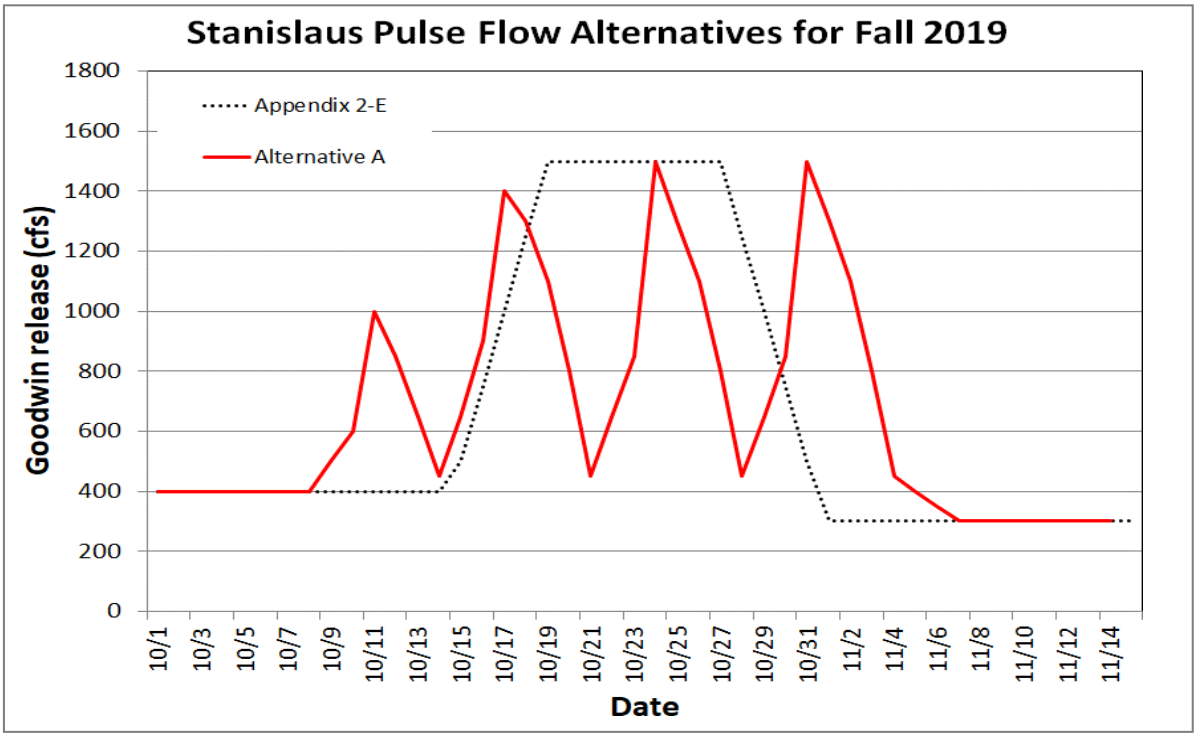

Figure 4-2. Stanislaus fall pulse flow schedules considered by SOG for October-November 2019.

One function of the fall pulse flow is to help buffer water temperatures to provide conditions suitable for the migration and holding of adult salmonids. By starting the fall pulse flow the second week of October and extending the reshaped fall pulse flow into November, SOG expected the

higher-than-base flows would help buffer water temperatures during the seasonal transition to cooler air temperatures. Scheduled flows in the advised alternative were drawn down to a base flow level of 300 cfs in early November, before peak spawning was expected to occur.

Reclamation submitted the fall pulse flow advice to NMFS for concurrence on September 27, 2019 and NMFS approved it on September 29, 2019. See Appendix A for full fall 2019 pulse flow advice.

4.4.2 Winter 2020 Instability Flows (NMFS 2009 BiOp)

The default flow schedule requires a winter instability flow in both January and February. On December 19, 2019, SOG advised a modified January winter instability flow (WIF). Because the latest hydrology forecast at that time indicated that the water year type might change mid-January based on the January 2020 forecast, SOG provided an alternative WIF schedule for both Wet and Above Normal water year types based on the water volume available in each water year type. For each year type, the proposed January WIF was reshaped to include a higher peak flow to better provide variability in the winter hydrograph by simulating a small storm pulse. The higher flows in the pulse would inundate a greater portion (relative to the default flow schedule) of restoration areas where short-term inundation of shallow water habitat can provide benefits to rearing salmonids. The duration of each alternative pulse schedule was similar to that in the default schedule, and the water volume is identical to default schedule. SOG also advised that the pulse be shifted to coincide (if possible) with a natural storm event. Reclamation submitted the January WIF advice (Appendix B) to NMFS for concurrence on December 19, 2019, and NMFS approved it on the same day. In terms of actual flows during January, more volume than required by the default schedule was released for reservoir management purposes; the shaping was based on SOG advice for a wet year default schedule flow volume.

At its January 15, 2020 meeting, SOG discussed alternative designs for the February 2020 WIF and the preliminary spring 2020 pulse flow. Advice regarding the shaping of the February 2020 WIF incorporated both the unanticipated shift to a Below Normal year type (in December 2019, SOG didn't expect the year type to be drier than Above Normal) and an early peak using volume from the spring pulse flow. As for the January 2020 WIF advice, SOG noted that reservoir management releases in February 2020 onward may be sufficient to satisfy or exceed the reshaped flow schedule. If reservoir management releases were beyond the reshaped flow volumes needed, SOG encouraged that, to the extent possible and within the ramping rates in the 2009 NMFS BiOp, those releases be shaped to mimic a storm hydrograph in early February 2020, and, in coordination with SOG, support the Cramer Fish Sciences studies at the restoration areas in February 2020 and throughout the spring of 2020. Reclamation provided this advice to NMFS for concurrence on January 29, 2020. NMFS approved it on January 31, 2020.

The water year type for February 2020 was Below Normal and the following Alternative, Figure 2-2, was implemented.

See Appendix B for full advice.

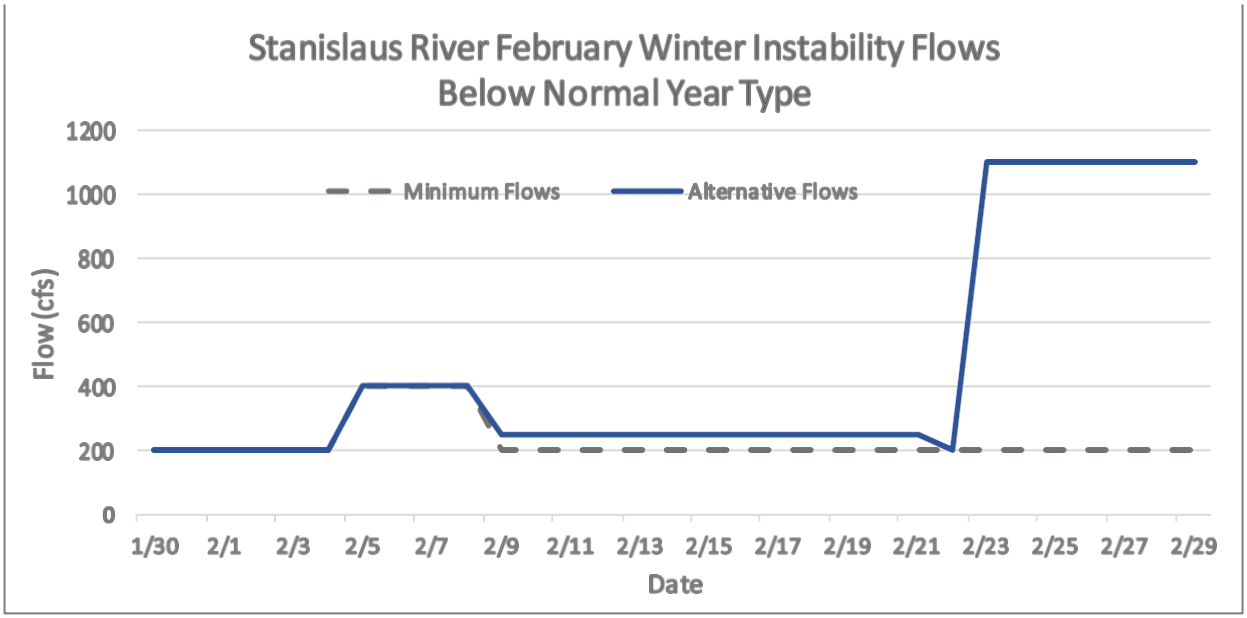

Figure 4-3. Plot of reshaped February 2020 winter instability flow and early peak of the spring pulse flow for a below normal water year type.

4.4.1 Spring Pulse Flows (2020 ROD)

A spring pulse flow is a component of the daily flow schedule in the Stanislaus River SRP pursuant to Section 4.10.6.1 2020 ROD.

At the March 18, 2020 SWT meeting, the technical team discussed various alternatives for the WY2020 spring pulse flow schedule, given the change in water year type from Dry to Critical based on the March 2020 forecast. Reclamation presented a Draft Operations Plan that offered two options (Alt-Critical 1 and Alt-Critical 2) for WY20 spring pulse flows. Based on discussion, and in order to (a) move a higher volume of water into the default April 15-May 15 Vernalis pulse flow period, and (b) accommodate flows needed for important predation studies on the Stanislaus River in May 2020, the SWT provided feedback on these options. SWT discussions led to the design of Alt-Critical 3. Upon further analysis of Alt-Critical 3, Reclamation determined that the proposed Alt-Critical 3 recommended pulse flow volumes do not align with a 31-day Vernalis pulse flow period. Reclamation, and the SWT, then designed Alt-Critical 4 (see figure 4-3 and flow schedule alternatives, including the default schedule in the SRP, in Appendix E).

The Alt-Critical 4 schedule had the same total volume (67,240 AF, including base flows) for the March 16-June 30 period as the default SRP Critical water year type schedule, as described in Section I of the plan. Reclamation, and the SWT, believed that the Alt-Critical 4 reshaping optimized

biological benefits by providing a spring pulse flow that may cue anadromy and improved migratory habitat in both the Stanislaus River and in the mainstem San Joaquin River and southern delta. In the Stanislaus River, higher flows were expected to reduce water temperature (or at least buffer daily maximum water temperature) and inundate some shallow water habitat which may provide juvenile salmonids with short-term growth benefits as well as potential refuge from predation. In the mainstem San Joaquin River and south delta, higher flows from the Stanislaus River (and other San Joaquin tributaries) were expected to convey out-migrating salmonids more rapidly along their migratory pathway, which may improve outmigration success.

For WY20, Reclamation implemented a reshaped spring pulse flow according to the flow schedule described in Alt-Critical 4 (see details in Appendix E).

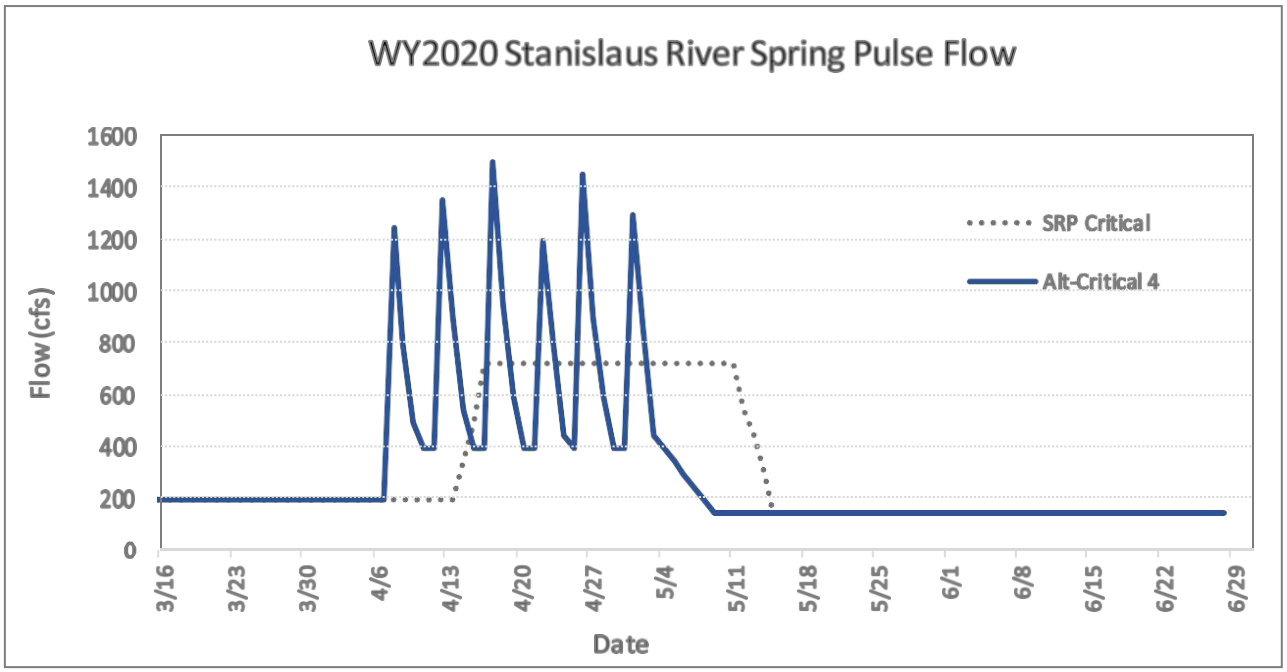

Figure 4-4. Daily flows from March 10 to June 10 in the default SRP-Critical schedule, Alternative-Critical 3 and 4 schedules.

4.5 Storage Management and Flood Control Releases

During high storage and high inflow conditions at New Melones Reservoir, Reclamation operates for flood control in accordance with the USACE flood control manual. Because New Melones Reservoir is a large reservoir relative to its annual inflow, flood control is relatively infrequent; however, Tulloch Lake, located downstream of New Melones Reservoir, is subject to high local inflows, and may be in flood control operations for brief periods when New Melones Reservoir is

not. During these periods, releases from Tulloch may be used to meet flow objectives, schedules, or requirements on the lower Stanislaus River below Goodwin Dam.

WY20 began with New Melones Reservoir storage at 147 per cent of the 15-year average with 2,033,200 acre-feet (AF) of water in the reservoir. Seasonal inflow on the Stanislaus at New Melones Reservoir in WY20 was 153 percent of the 15-year average with 1,749,000 AF. WY20 snowpack was below the 15-year average; the average snow water equivalent to 10.1 inches or a 34 percent of the April 1, 15-year average.

At the beginning of WY20 New Melones Reservoir storage was high and the first quarter of the year was operated for storage management. New Melones Reservoir storage was just above the allowable storage per the USACE flood control manual. After discussions and coordination with SOG, Reclamation increased flows starting October 9, 2019 for the 2019 Fall Pulse Flow. Following this pulse, releases were higher than the minimum instream flow parameters required. Higher flows continued until the end of February 2020 for storage management. Starting in March 2020, higher flows were required to meet the D-1641 Vernalis Flow requirements. By March 12, 2020 flows were down to the minimum release requirements per the SRP. Releases from Goodwin Dam were increased for the WY2020 spring pulse flow, between April 8 to May 10, 2020, and the flows ranged from 200 cfs to 1,450 cfs. Because it was a Dry water year type, releases were increased to meet theD-1641 Vernalis flow requirements from May 12 to June 30, 2020. Releases peaked as high as 1,500 cfs to meet this flow requirement. The releases from Goodwin Dam were at the minimum release of200 cfs for the remainder of the year. By the end of WY20, New Melones Reservoir storage was below the conservation storage limit (the maximum amount of storage allowed by USACE for flood control).

4.6 Water Temperature Management (NMFS 2009 BiOp)

The Stanislaus River temperatures are influenced by the upstream reservoir systems at Goodwin Dam, Tulloch Dam, and New Melones Dam (additional reservoir systems further upstream are assumed to have minimal effect on water temperature due to the large size of New Melones Reservoir). No temperature control devices or other physical structures are available to manage for temperature at these facilities except for a low-level outlet at New Melones that can only be used when the water surface elevation is below 808.0 feet. The outlet controls at both New Melones Dam and Tulloch Dam typically draw the coolest water available in those reservoirs. In the series of reservoirs (New Melones, Tulloch, and Goodwin), downstream temperature can be somewhat influenced with increased flows from Goodwin Dam. However, there are operational limitations to utilizing additional water due to Reclamation's obligations met through New Melones Reservoir storage. There is also a desire to preserve cold water for fishery purposes later in the year.

RPA action III.1.2 of the NMFS 2009 BiOp required Reclamation to manage the cold-water supply within New Melones Reservoir and make cold water releases from New Melones Reservoir to provide suitable temperatures for California Central Valley (CV) steelhead (*Oncorhynchus mykiss*) rearing, spawning, egg incubation, smoltification and adult migration in the Stanislaus River downstream of Goodwin Dam.

RPA Action III.1.2 provided a temperature exception procedure, which required Reclamation to notify NMFS if the temperature requirement was expected to be exceeded, based on a 3-day average daily maximum. Reclamation was also required to provide an evaluation of the conditions and identify conflicts with Reclamation's nondiscretionary requirements. The temperature exceptions in WY20 (see exceedances prior to February 19, 2020, in Figure 4-5) were noted and discussed within SOG.

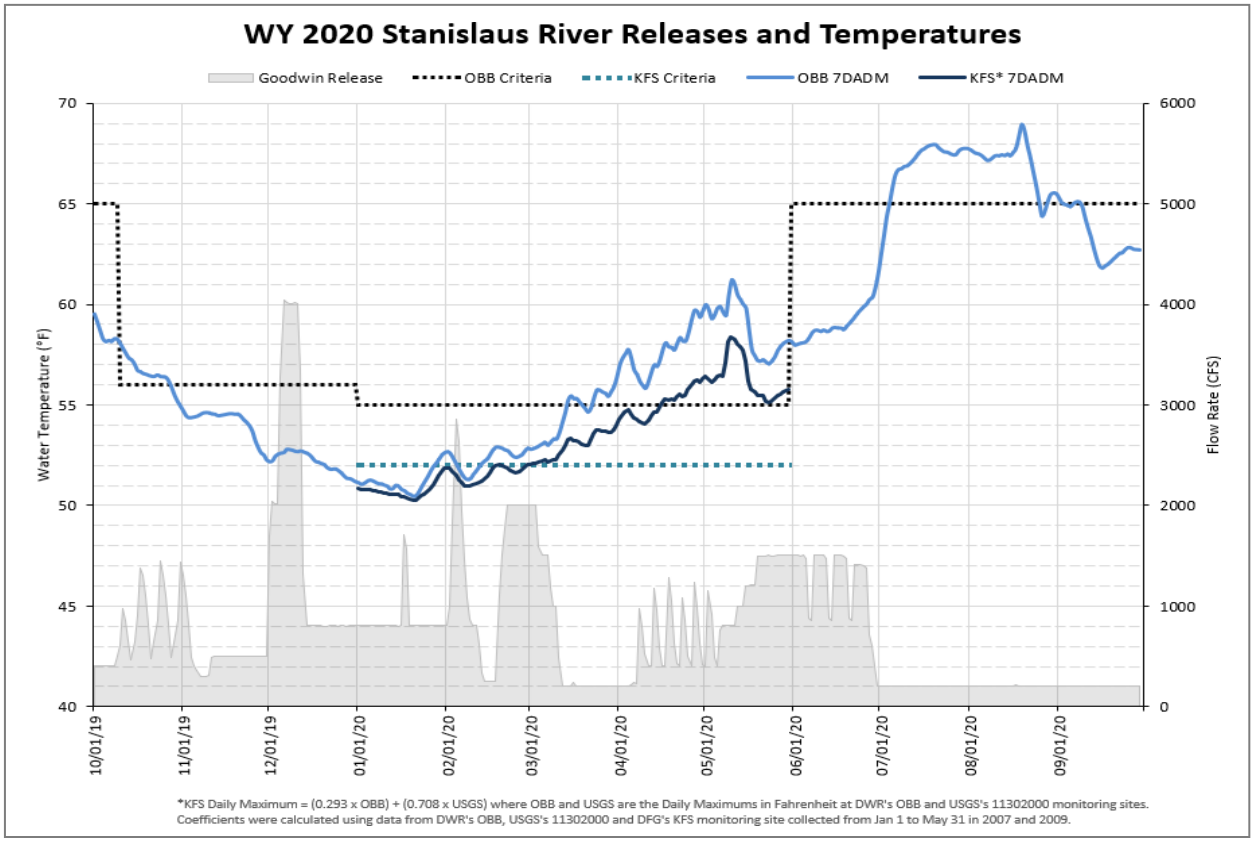

Figure 4-5. Stanislaus River Temperatures Measured at Orange Blossom Bridge (OBB) at Knights Ferry (KFS). Note that the criteria at Orange Blossom Bridge and Knights Ferry were only in effect until February 19, 2020, when the 2019 PA went into effect.

There are no temperature criteria under the 2019 PA.

Chapter 5 Stanislaus River Fish Monitoring Data and Non-flow Conservation Measures

5.1 Fish Monitoring Data

Monitoring data from the Stanislaus River are summarized below for both fall-run Chinook salmon (*O. tshawytscha*) and CV steelhead (*O. mykiss*). The locations of monitoring sites are shown in Figure 5-1.

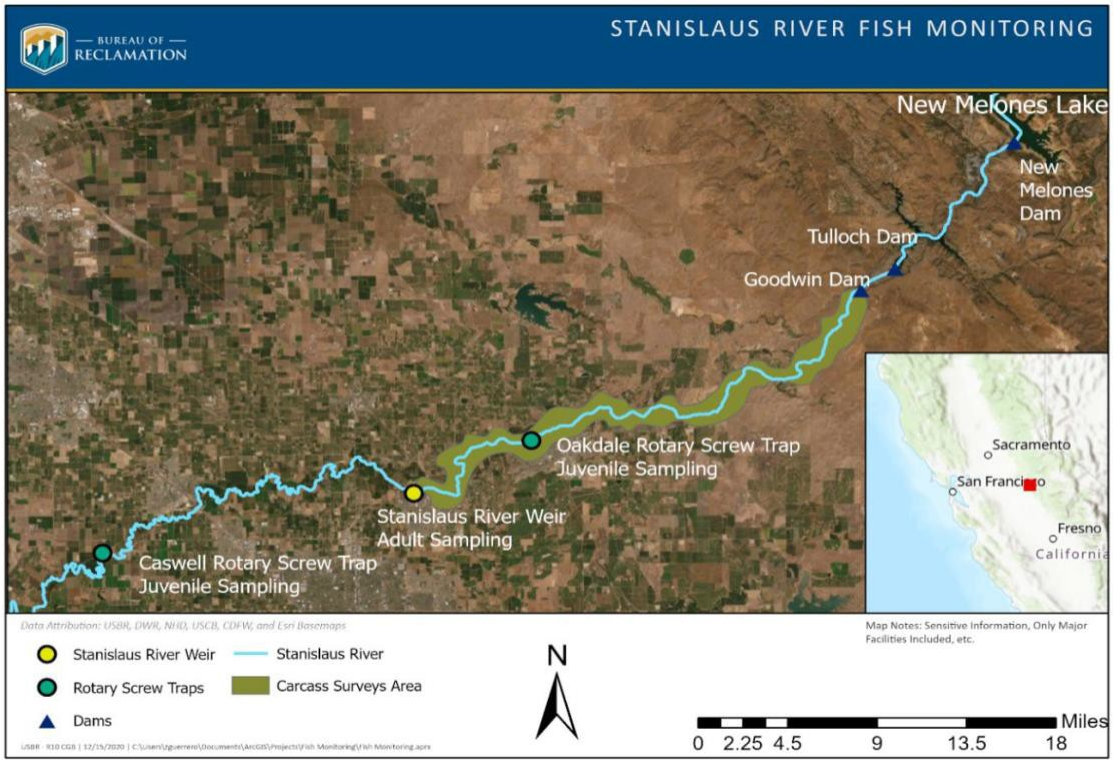

Figure 5-1. Locations of fish monitoring efforts on the Stanislaus River

5.1.1 California Department of Fish and Wildlife Carcass Survey

The CDFW began conducting fall-run Chinook salmon carcass surveys the week of October 7, 2019 and completed surveys the week of January 23, 2020. Throughout the 16-week survey period, CDFW observed a maximum of 332 redds on the Stanislaus River (compared to 212 on the Tuolumne River and 679 on the Merced River). Maximum weekly redd counts are used when analyzing the distribution of spawning because no effort is made to avoid counting the same redd every time a riffle was surveyed; this means maximum weekly redd counts provide the best estimation of overall spawning within a riffle. Redds were built throughout the survey area, with riffles closer to Goodwin Dam having more use than riffles further downstream (Figure 5-2). The CDFW carcass survey counts live fish as they move upstream past the boat, with peak counts occurring during the weeks of November 11th. Redd and carcass counts both peaked during the week of November 24, 2019. Figure 5-3 includes weekly live, redd, and carcass counts as well as mean daily flow and water temperature measured at Orange Blossom Bridge (data from CDEC).

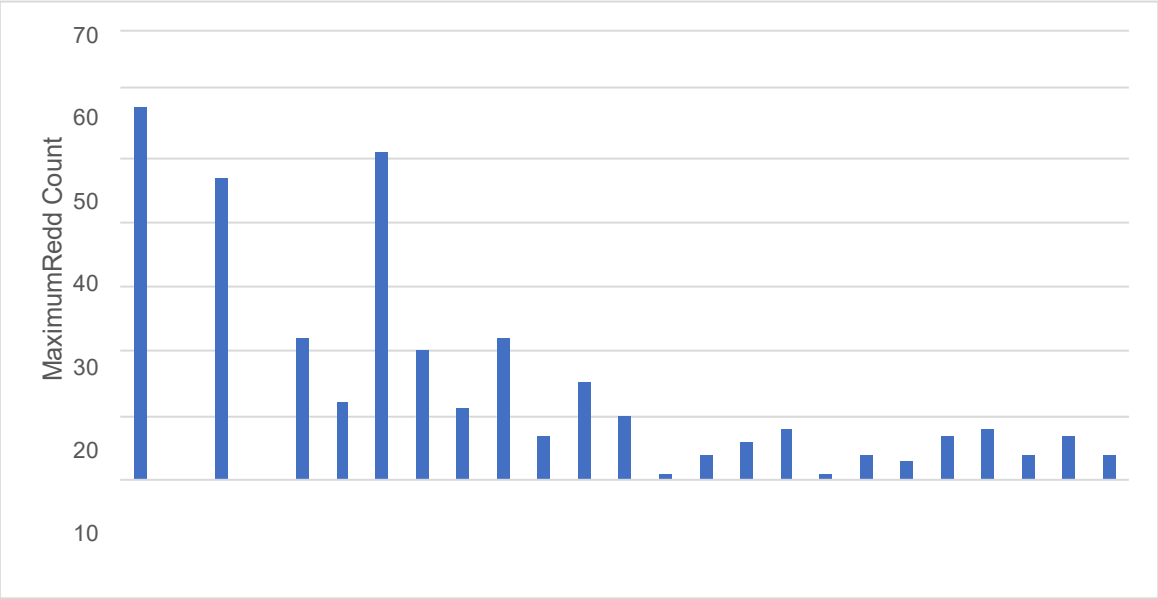

Figure 5-2. Sum of maximum redd count by river mile (note: RM 57&55 not surveyed due to access issues).

The 2019 preliminary Stanislaus River escapement estimate for fall-run Chinook salmon, as reported May 22, 2020 in GrandTab was 1,482 (compared to 927 for the Tuolumne River and 3,225 for the Merced River; the Merced River total combines 1,014 fish taken at the Merced River Hatchery and an estimated 2,211 adults that spawned in river). High flows caused challenges throughout the survey resulting in riffles that were not surveyed due to accessibility or safety concerns. Side channels at RM 49.6 and 39.0 were occasionally inaccessible due to high flows (8 and 10 complete surveys; respectively). The high flows associated with the flood control releases from December 1-

15, 2019 resulted in only partial surveys of the river with numerous riffles skipped throughout the river including the entire section from Goodwin Dam to Knight's Ferry. The estimate of 1,482 is likely a conservative estimate due to high flows and partial surveys. On the other hand, the Cormack-Jolly Seber model, used to produce the estimate, does make allowances for changes in recapture rate over the season as may have occurred during the periods of high flows.

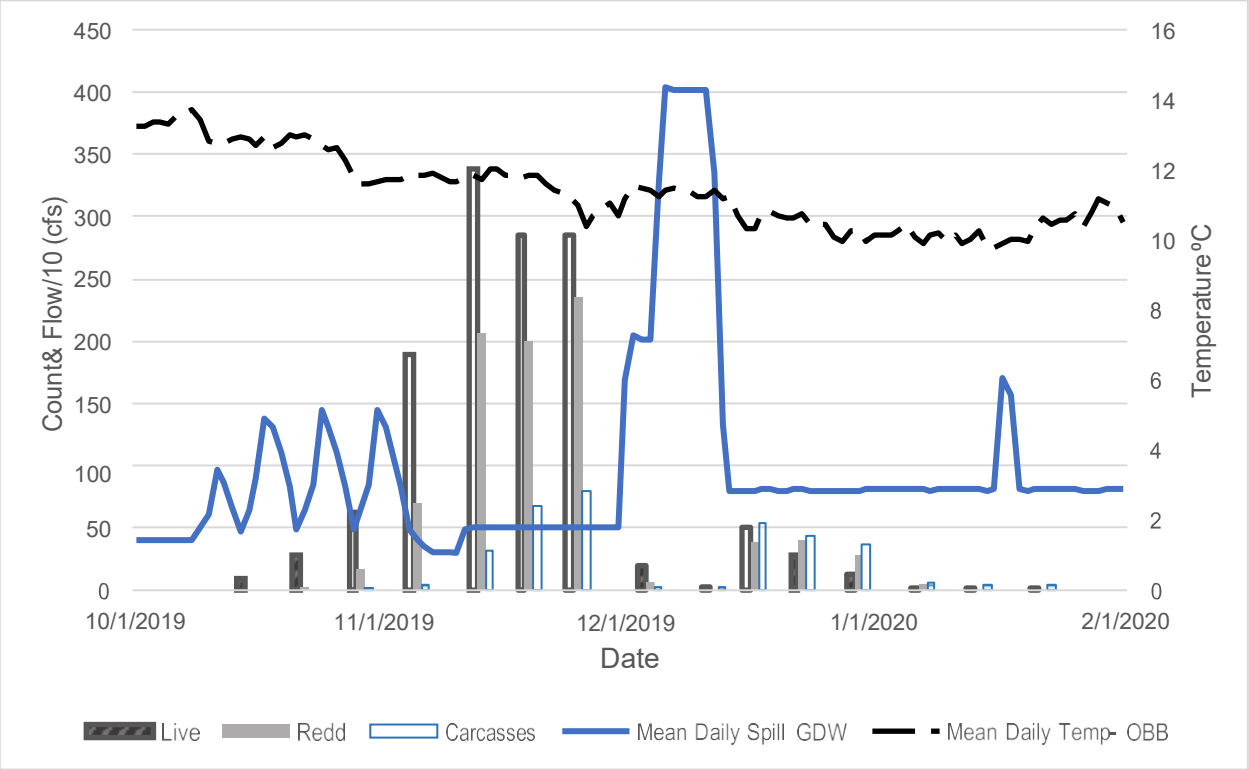

Figure 5-3. Weekly live, redd and carcass counts, and mean daily spill measured at Goodwin Dam and temperature measured at Orange Blossom Bridge for the 2019 Stanislaus Carcass Survey. Note: live, redd and carcass counts are summed by week.

5.1.2 Stanislaus Weir

The Districts and Tri-Dam Project fund FISHBIO to conduct adult weir monitoring near Riverbank, California (approximately river mile 31) and juvenile rotary screw trap monitoring near Oakdale, California (approximately river mile 40). Monitoring at the weir near Riverbank (for upstream passage of adult salmonids) began for the season on 8/29/19 and ended on 12/3/19. Monitoring concluded sooner than usual due to high flows on the Stanislaus River (the weir is

unable to sample at flows exceeding 2,000 cfs) that were expected to remain high. The cumulative net upstream passage through 12/3/19 is 2602 Chinook (21% were ad-clipped, indicating a hatchery origin) and 31 *Oncorhynchus mykiss* (16 *O. mykiss* were greater than 16 inches in length indicating possible anadromy; 42% were ad-clipped, indicating a hatchery origin). The graphs in Figures 5-4 and 5-5 were provided by FISHBIO on December 4, 2019, in their final Stanislaus River Weir Update.

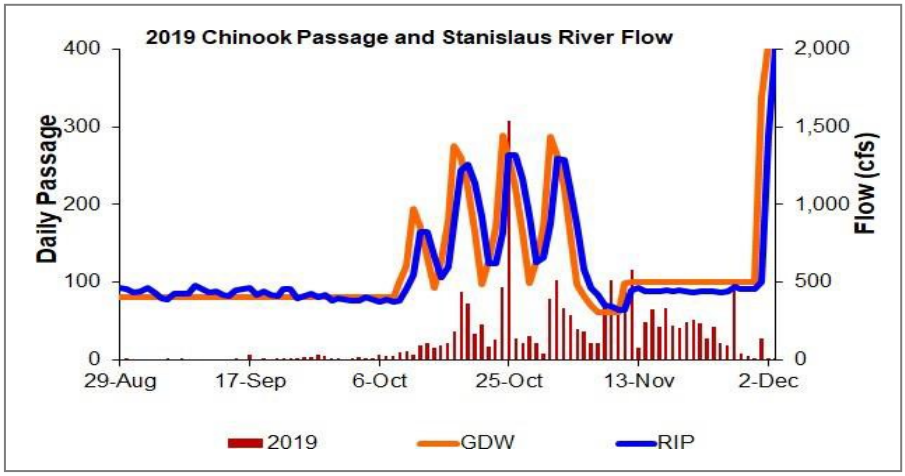

Figure 5-4. Daily Chinook salmon passage through December 3, 2019, at the Stanislaus River weir near Riverbank. Data courtesy of FISHBIO.

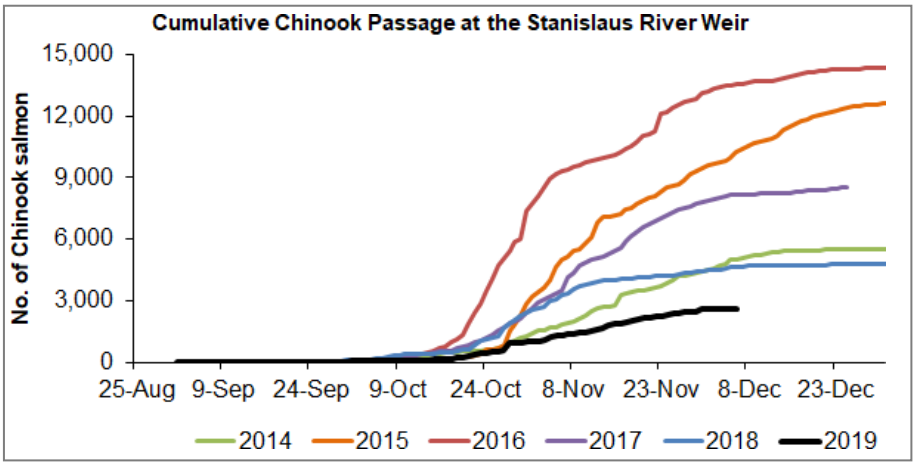

Figure 5-5. Cumulative Chinook salmon passage through December 3, 2019, at the Stanislaus River weir near Riverbank. Data courtesy of FISHBIO.

5.1.3 Rotary Screw Traps near Oakdale and Caswell

Rotary screw trap monitoring at Oakdale (approximately river mile 40, monitoring conducted by FISHBIO) and at Caswell [approximately river mile 9, monitoring funded by USFWS and conducted by the Pacific States Marine Fisheries Commission (PSMFC)] for the 2019/2020 outmigration season (for monitoring of outmigrating juvenile salmonids) began in late December (at Oakdale) and early January (at Caswell). Both FISHBIO and PSMFC suspended sampling in mid-March due to COVID-19 concerns. PSMFC resumed sampling in late March and FISHBIO resumed sampling in early April. Chinook catch and fork lengths from each location are summarized in Figures 5-6 and 5-7 (Oakdale; figures provided by FISHBIO) and Figures 5-8 and 5-9 (Caswell; figures provided by PSMFC).

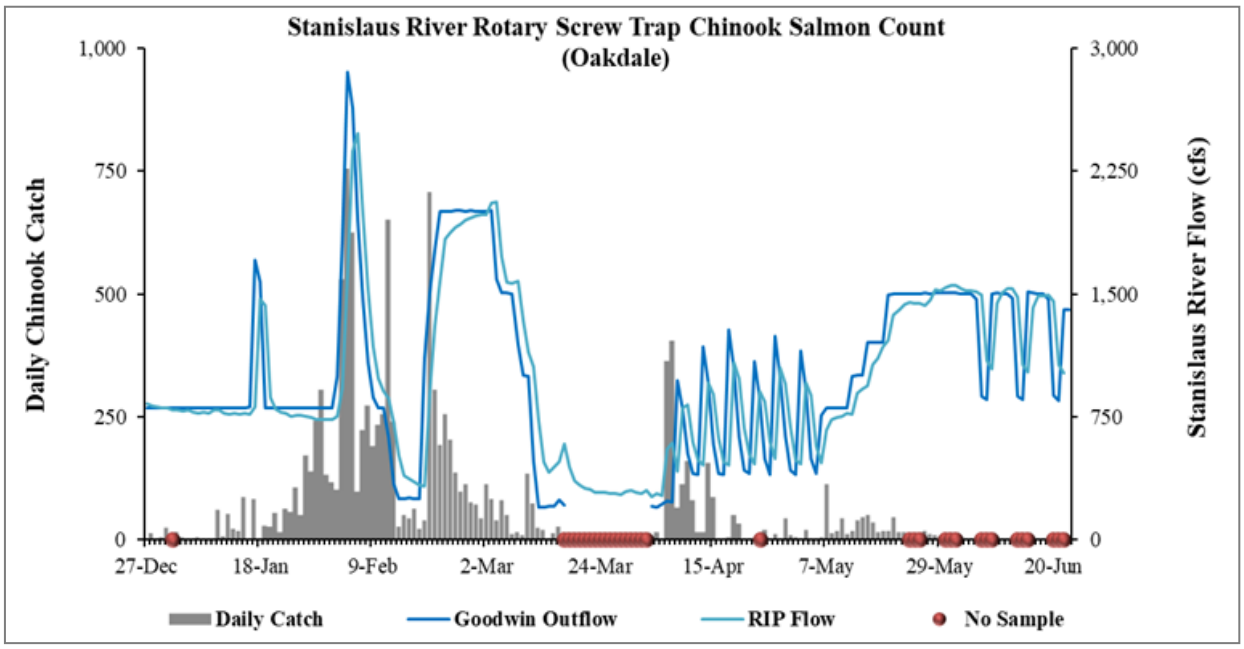

Figure 5-6. Juvenile Chinook catch through May 12, 2020, at the rotary crew trap near Oakdale. Figure provided by FISHBIO in their May 13, 2020 San Joaquin Basin Update.

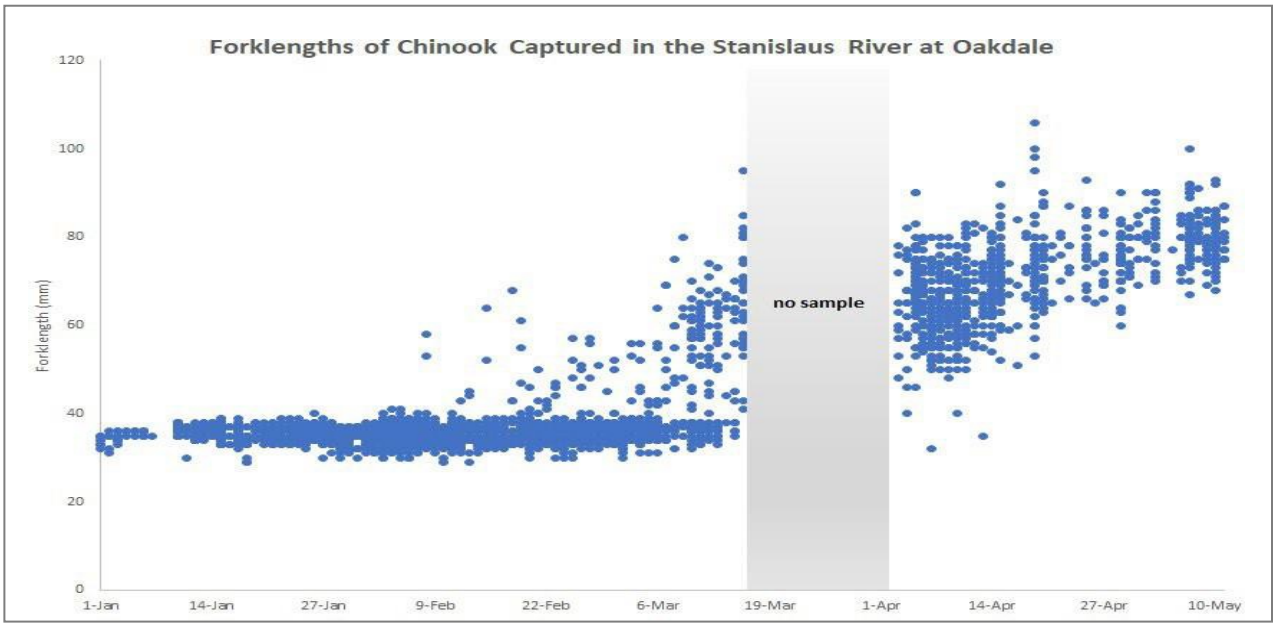

Figure 5-7. Fork lengths of juvenile Chinook catch through May 11, 2020, at the rotary crew trap near Oakdale. Data provided by FISHBIO.

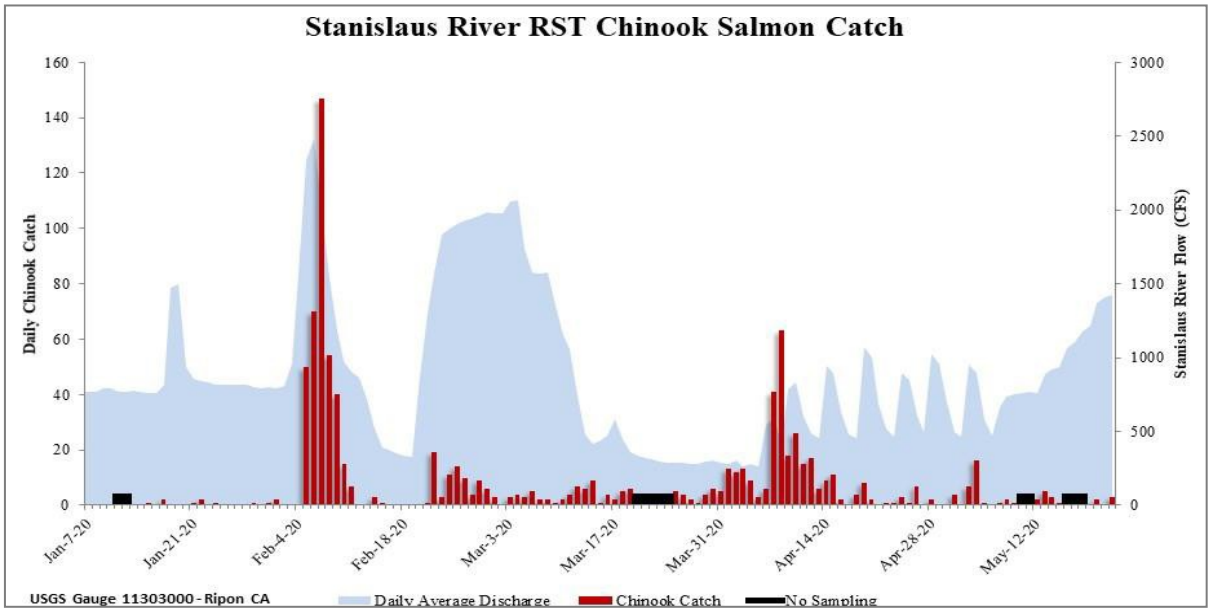

Figure 5-8. Juvenile Chinook catch through April 10, 2020, at the rotary crew trap near Caswell State Park. Data provided by PSMFC.

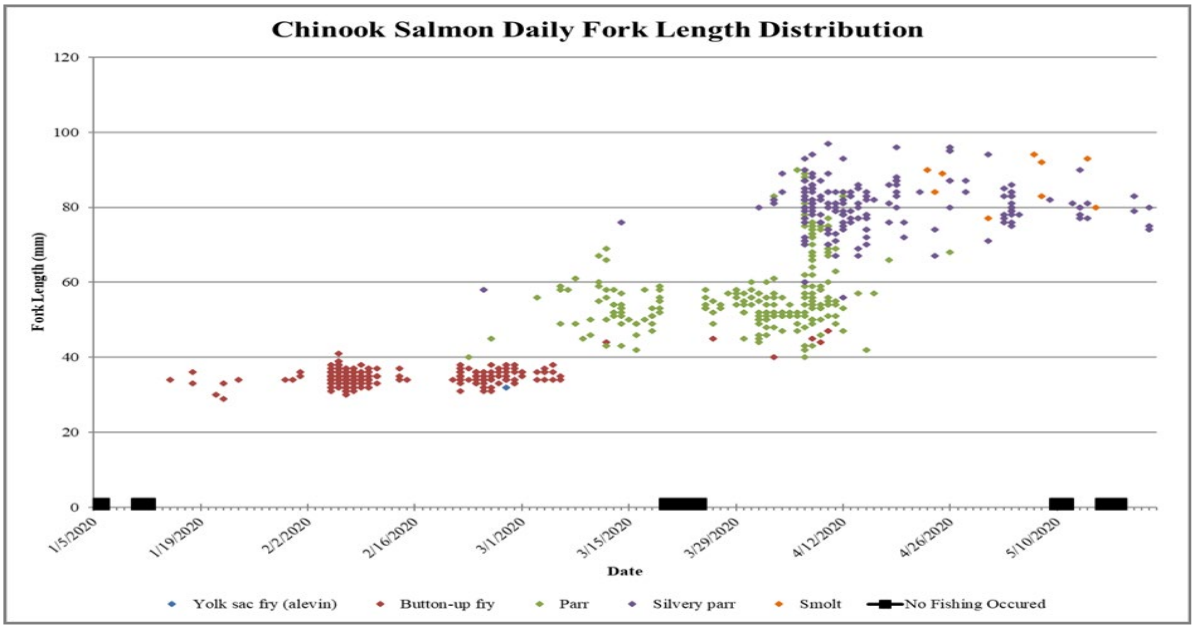

Figure 5-9. Fork lengths of juvenile Chinook catch through April 10, 2020, at the rotary screw trap near Caswell State Park. Data provided by PSMFC.

5.1.4 *M*ossdale Trawl

USFWS conducts the Mossdale Trawl on the mainstem San Joaquin River for much of the year. From the start of the water year (October 1, 2019) through March 20, 2020, four Chinook salmon (one ad-clipped) and no *O. mykiss* were reported at that monitoring location (based on data from Bay Delta Live: https://www.baydeltalive.com/fish/djfmp-highlights). USFWS suspended sampling at Mossdale in late March due to COVID-19 concerns and sampling was not resumed by either USFWS or CDFW (which normally runs the Mossdale trawl April-June) in WY 2020.

5.2 Conservation Measures

As part of the Preferred Alternative, conservation measures were proposed to avoid, minimize or compensate for CVP and SWP project effects. These two were the focus of attention in WY20:

- Spawning Habitat Restoration: Under the CVPIA (b)(13) program, Reclamation's annual goal of gravel placement is approximately 4,500 tons in the Stanislaus River.
- Rearing Habitat Restoration: Reclamation proposes to construct an additional 50 acres of rearing habitat adjacent to the Stanislaus River by 2030.

The following tables describe habitat restoration activities since 2009.

Table 5-1. Gravel augmentation annual averages over different time periods.

Time Period	Average Amount of Gravel Added Annually	Annual Target	Percent of Target Achieved
1994-2008	3,647 cy	N/A	N/A
2009-2014	1,995 cy	8,333 cy*	24%
2015-2019	1,759 cy	8,000 cy**	22%
2020 (ROD)	15,000 tons	4,500 tons	300%

*Action III.2.1 "catch-up" requirement is for the "addition of 50,000 cubic yards of gravel by 2014." The 8,333 cubic yard annual target is an approximation, assuming the 50,000 target is uniformly spread over the six-year 2009-2014 period. NMFS had granted an extension.

**Action III.2.1 "maintenance" requirement is for the "minimum addition of 8,000 cubic yards per year for the duration of the Project Actions."

Table 5-2. Completed gravel[2] (since 2009) habitat restoration projects on the Stanislaus River.

Project	Project extent
Goodwin Canyon at cable crossing - 2011	2,941 cubic yards
Goodwin Canyon at float tube pool - 2012	1,765 cubic yards
Goodwin Canyon at cable crossing - 2015	4,706 cubic yards

[2] Completed gravel augmentation projectsfor spawning habitat at all locations; some gravel placed at the cable crossing in Goodwin Canyonintended formobilization and downstream placement byriverflows.

Project	Project extent
Main channel and floodplain bench at Honolulu Bar - 2012	8,000 cubic yards total used for spawning riffles in main channel and 0.7-acre floodplain bench
Buttonbush - 2017	2,838 cubic yards
Rodden Road - 2018	1,250 cubic yards
Goodwin Canyon - 2020	15,000 tons*

**15,000 tons = 10,000 cubic yards*

Table 5-3. Completed restoration[3](since 2009) habitat restoration projects on the Stanislaus River.

Project	Project Extent
Lancaster Road side-channel - 2011	640 linear feet of side-channel and 2 acres of floodplain habitat
Side-channel at Honolulu Bar - 2012	Improvement of existing side-channel to reduce stranding risk
Floodplain at Honolulu Bar - 2012	2.4 acres of floodplain habitat
Buttonbush – 2017	4.4 acres of side-channel and floodplain habitat and 2,400 linear feet of side-channel habitat
Rodden Road - 2018	4.9 acres of side-channel habitat

[3] Completed floodplainand side-channel restorationprojects for improved rearing habitat, improved migratory habitat, improved connectivity to avoid stranding.

Project	Project Extent
Goodwin Canyon Float Tube Pool - 2020	0.25 acre of side-channel habitat located on the south-side/downstream end of the Float Tube Pool.
Honolulu Bar Maintenance - 2020	Maintenance was conducted in the project area redirect flow into the side channel. Scour of gravel in the main channel had reduced flows into the side-channel. The project would be improved with the addition of more gravel to the main channel and installing a gravel bench on the upstream side of the island.

Figure 5-10. Restoration of 1/4 acre of side channel habitat downstream of the float tube pool.

Table 5-4. In-progress gravel and habitat restoration projects.

Project	Project extent
Goodwin Canyon	Anticipated gravel: 4,500 cubic yards/year as described in the 2020 ROD.
Migratory Corridor Rehabilitation	Anticipated gravel and habitat: TBD

Table 5-5. Potential gravel and habitat restoration projects.

Project	Project extent
Kerr Park Restoration	Anticipated gravel and habitat: TBD
Two Mile Bar	Anticipated gravel: 6,000 cubic yards. Anticipated habitat: To Be Determined This side channel rearing and spawning habitat restoration project has a design near completion. Two Mile Bar is not likely a viable restoration project in the near-term because of land access issues.
Honolulu Bar Phase II	Anticipated gravel and habitat: TBD
Lovers Leap	Anticipated gravel and habitat: TBD
Honolulu Bar Gravel augmentation.	Anticipated gravel and habitat: TBD

Chapter 6 References

Bay Delta Live. (2020). DJFMP Highlights. https://www.baydeltalive.com/fish/djfmp-highlights

National Marine Fisheries Service (NMFS). 2009. Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project. NMFS-Southwest Region, Long Beach, California. 844 pages plus appendices. http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocap.html

NMFS. 2011. Letter transmitting the 2009 Reasonable and Prudent Alternative with 2011 Amendments. NMFS Southwest Region, Long Beach, California. April 7. http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocap.html,

NMFS. 2019. Biological Opinion on Long-Term Operation of the Central Valley Project and State Water Project. NMFS, West Coast Region. https://repository.library.noaa.gov/view/noaa/22046

United States Bureau of Reclamation (USBR). 2019. Biological Assessment on the Reinitiation of Consultation on the Coordinated Long-Term Operation of the Central Valley Project and State Water Project. Central Valley Project, Mid-Pacific Region. https://www.usbr.gov/mp/bdo/lto/biop.html

USBR. 2020. Record of Decision (ROD). Reinitiation of Consultation on the Coordinated Long-Term Modified Operations of the Central Valley Project and State Water Project. https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=39181

Appendix A. Fall Pulse Flows SOG Advice

NMFS determination RE: SOG WY19 Stanislaus Fall Pulse Flow and Temp Criterion advise

1 message

Garwin Yip - NOAA Federal <garwin.yip@noaa.gov> Sun, Sep 29, 2019 at 6:55 PM
To: Levi Johnson <lejohnson@usbr.gov>
Cc: "Perrin, Sarah" <sperrin@usbr.gov>, Brad Hubbard <bhubbard@usbr.gov>, Zarela Guerrero <zguerrero@usbr.gov>, Elizabeth G' 'Kiteck <EKiteck@usbr.gov>, "Marshall, Spencer" <smarshall@usbr.gov>, "Washburn, Thuy T" <TWashburn@usbr.gov>, Barbara Byrne <Barbara.Byrne@noaa.gov>, Monica Gutierrez <Monica.Gutierrez@noaa.gov>, "womt@water.ca.gov" <womt@water.ca.gov>

Levi,

As you know, Action III.1.3 (page 49 of the 2011 RPA Amendments to the NMFS Biological Opinion) provides for the adaptive management of the flow schedule in Appendix 2-E of the NMFS Biological Opinion. Specifically, "…based upon the advice of SOG and the concurrence by NMFS, the flows may be implemented with minor modifications to the timing, magnitude, and/or duration, as long as NMFS concurs that the rationale for the shift in timing, magnitude, and/or duration is deemed by NMFS to be consistent with the intent of the action." (page 50 of the 2011 RPA Amendments to the NMFS Biological Opinion).

NMFS agrees that for 2019, the fall pulse flow may be reshaped according to the "Alternative A" schedule in Attachment 1 of the attached SOG advice. NMFS determines that the proposed change in the fall pulse flow schedule is consistent with the implementation procedures of RPA Action III.1.3.

NMFS also concurs with the advice to shift the initiation date for the fall temperature criterion at Orange Blossom Bridge to October 17, 2019, the date of the highest flow within the first of the larger peaks of the reshaped fall pulse flow, and determines that the proposed initiation window for the fall temperature criterion is consistent with the implementation procedures of RPA Action III.1.2.

WOMT--In the interest of following the process provided in NMFS' Opinion section 11.2.1.1, this e-mail is to inform WOMT of NMFS' determination, and to provide WOMT with an opportunity to discuss the proposal. If anyone wants to discuss the SOG advice or NMFS determination, please initiate a WOMT meeting as soon as possible. Thanks.

-Garwin-

Garwin Yip
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NOAA Fisheries West Coast Region
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NOAA FISHERIES West Coast Region

---------- Forwarded message ---------
From: **Johnson, Levi** <lejohnson@usbr.gov>
Date: Fri, Sep 27, 2019 at 3:20 PM
Subject: SOG WY19 Stanislaus Fall Pulse Flow and Temp Criterion advise
To: Garwin yip <Garwin.Yip@noaa.gov>
Cc: Sarah Perrin <sperrin@usbr.gov>, Bradley Hubbard <bhubbard@usbr.gov>, Zarela Guerrero <zguerrero@usbr.gov>, ELIZABETH KITECK <ekiteck@usbr.gov>, Spencer Marshall <smarshall@usbr.gov>, Thuy Washburn <TWASHBURN@usbr.gov>, Barb Byrne <barbara.byrne@noaa.gov>, Monica Gutierrez <monica.gutierrez@noaa.gov>

Hi Garwin,
The Stanislaus Operations Group (SOG) met on Aug. 17, 2019 to discuss, among other items, a fall pulse flow regime and fall temperature criterion for October and November of this year. This advice is in lieu of the Appendix 2-E flow schedule (per Action III.1.3) and temperature criterion (per Action III.1.2) found in the NMFS Biological Opinion (2011 RPA Amendments). The intent of the fall pulse flow is to improve in-stream conditions sufficiently to attract CV steelhead to the Stanislaus River. The intent of the fall temperature criterion is to provide temperatures suitable for migration and holding of CV steelhead. Attached is the SOG Alternative A flow schedule and temperature criterion advice for implementing these RPA actions during the fall of WY19.

To summarize, the proposed fall pulse flow schedule includes four pulse peaks (one smaller and three larger) starting the second week of October and extending into November. The intent is to provide flow variability and buffer water temperatures during the seasonal transition to cooler air temperatures. Maximum daily flows will not exceed 1,500 cfs. The advice also suggests a fall temperature criterion of 56°F at Orange Blossom Bridge beginning October 17, 2019.

With that, Reclamation requests concurrence from NMFS on the Alternative A fall pulse flow schedule and temperature criterion for WY19. Please let me know if you have any questions or concerns.

Sincerely,
Levi

--
Levi Johnson
Water Resources/RPA Branch Chief

Interior Region 10, California-Great Basin
USBR Central California Area Office
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(916) 224-8942 cell

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SOG ADVICE RE: IMPLEMENTATION OF THE STANISLAUS RPA ACTIONS DURING OCTOBER AND NOVEMBER 2019 – FALL PULSE FLOW SCHEDULE AND INITIATION DATE FOR FALL TEMPERATURE CRITERION

September 27, 2019

Background

Flow

Fall attraction flow on the Stanislaus River is one component of the daily flow schedule in Appendix 2-E of the NMFS BiOp[1] required per Action III.1.3 of the Reasonable and Prudent Alternative (RPA). As noted in the 2011 RPA Amendments[2] (p. 50), the fall attraction flow is intended "…to improve in-stream conditions sufficiently to attract Central Valley (CV) steelhead to the Stanislaus River." The RPA further notes (p. 50) that "…based upon the advice of SOG and the concurrence by NMFS, the flows may be implemented with minor modifications to the timing, magnitude, and/or duration, as long as NMFS concurs that the rationale for the shift in timing, magnitude, and/or duration is deemed by NMFS to be consistent with the intent of the action."

Temperature

The 56°F fall temperature criterion at Orange Blossom Bridge (OBB) required per Action III.1.2 of the RPA is intended to provide temperatures suitable for the migration and holding of adult CV steelhead. The BiOp notes (p. 47 of the 2011 RPA Amendments) that "This criterion shall apply as of October 1 or as of initiation date of fall pulse flow as agreed to by NMFS."

Below, the Stanislaus Operations Group (SOG) advises a reshaped fall pulse flow schedule and initiation date for the fall temperature criterion that we believe is consistent with the intent of RPA actions III.1.3 and III.1.2.

SOG advice

Flow

For 2019, SOG advises that the fall pulse flow (Wet yeartype) be reshaped according to the "Alternative A" flow schedule described in Table 1 and Figure 2 of Attachment 1.

> *Pulse shaping:*
> SOG members started review and discussion of draft fall pulse flow schedules at the 9/17/19 SOG meeting. At the 9/17/19 SOG meeting, SOG members agreed to advise a four-peaked alternative ("Alternative A") to the default 2-E flow schedule for 2019. The reshaped flow schedule has the same volume (27,174 AF; calculated using the default Appendix-2E schedule and assuming a base flow of 400 cfs in October and 300 cfs in

[1] Available online at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/nmfs_biological_and_conference_opinion_on_the_long-term_operations_of_the_cvp_and_swp.pdf

[2] Available online at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/040711_ocap_opinion_2011_amendments.pdf

November) as the default Wet yeartype fall pulse flow schedule in Appendix 2-E. The SOG-advised alternative reshapes the fall pulse volume into one smaller and three larger jagged peaks that provide flow variability expected to deter spawning at the higher flows that will not be sustained through egg incubation and fry emergence. The maximum daily release in both the default 2-E and alternative schedule is 1,500 cfs. The technical team believes the alternative flow schedule meets the intent of the RPA action, namely, improving instream conditions and providing an attraction cue for adult salmonids returning to spawn.

Pulse timing (Stanislaus basin considerations):
One function of the fall pulse flow is to help buffer water temperatures to provide conditions suitable for the migration and holding of adult salmonids. By starting the fall pulse flow the second week of October and extending the reshaped fall pulse flow into November, SOG expects the higher-than-base flows will help buffer water temperatures during the seasonal transition to cooler air temperatures. Scheduled flows in the advised alternative are down to base flows in early November, before peak spawning is expected to occur.

Pulse timing (San Joaquin basin considerations):
When shaping the fall pulse flow schedule for the Stanislaus, SOG also considers the fall pulse flow schedules planned in other San Joaquin River tributaries. In 2019, the fall pulse flow releases are scheduled as follows:

- Mokelumne River: a two week pulse (peak=1,900 cfs) in the second half of September followed by five approximately week-long peaks (peak=1,650 cfs) from October through early November.
- Tuolumne River: three pulses during October (peaks of 1,050 cfs, 1,300 cfs, and 650 cfs)
- Merced River: single pulse (peak=1,200 cfs) in mid-October
- Approximate projected Vernalis flows (assuming a 2-day lag for flows from the Stanislaus River and Tuolumne River and a 3-day lag for flows from the Merced River) are shown in Figure 1.

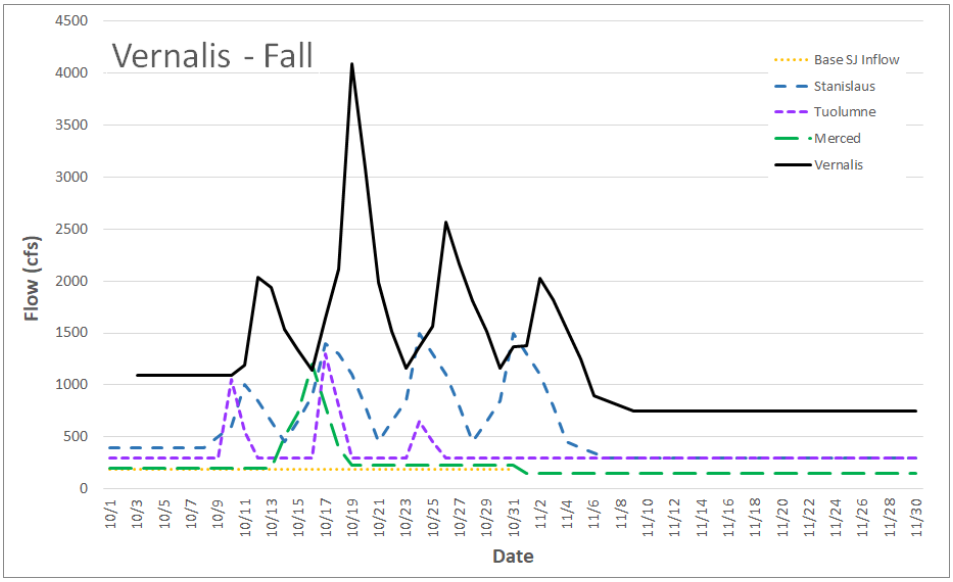

Figure 1. Approximate projected Vernalis flows based on expected fall pulse flows from the Stanislaus, Tuolumne, and Merced rivers.

The full list of considerations discussed by SOG at the 9/17/19 meeting is summarized in Table 2 of Attachment 1.

Temperature

For 2019, SOG advises that the fall temperature criterion of 56°F at Orange Blossom Bridge (OBB) apply beginning October 17, 2019, the day of highest flow within the first of the larger peaks of the reshaped "Alternative A" fall pulse flow. SOG expects that few CV steelhead will migrate into the Stanislaus before the fall pulse flow and has no evidence this year to suggest otherwise. For the period 8/29/19 through 9/24/19 (based on Fishbio's "Stanislaus River Weir Update through 9/24/19"), a net passage of four *Oncorhynchus mykiss* has been reported at the Stanislaus Weir near Riverbank (two of which were over 16 inches and ad-clipped). The net upstream cumulative count of fall-run Chinook salmon over the same period was 18 fish (four of which were ad-clipped). These data provide no clear indication of "early migration" of salmonids into the watershed that might require temperature management to begin on October 1.

From 9/1/19 to 9/26/19, daily maximum temperatures measured at OBB[3] have ranged between 59.0°F and 62.3°F. The 7 day average of the daily maximum temperature (7DADM, the type of temperature criterion applied under Action III.1.2) at OBB as of 9/26/19 was 60.5°F. Because of progressively shorter day length and cooler night temperatures, SOG expects that water temperatures will continue falling even before the pulse flow begins.

[3] See links to monthly summaries of water quality for "STANISLAUS R AT ORANGE BLOSSOM BRIDGE" at: http://cdec.water.ca.gov/wquality/

ATTACHMENT 1

Stanislaus fall pulse flow schedule advised by SOG for October-November 2019

Table 1. Stanislaus fall pulse flow schedules considered by SOG for October-November 2019. SOG advises that the "Alternative A" pulse be implemented rather than the Appendix 2-E schedule. Gray cells indicate an unofficial breakdown of base vs. pulse flows since the BiOp does not specify base flows during the pulse period. Dark blue cells indicate weekend days.

Appendix 2-E
Stanislaus River Minimum Fish Flow Schedule
Water Year Type: Wet

		Daily					Cumulative	
		Total CFS	Total AF	Base CFS	Pulse CFS	Pulse AF	Pulse AF	Total AF
OCT	10/1	400	793	400	0	0	0	793
	10/2	400	793	400	0	0	0	1587
	10/3	400	793	400	0	0	0	2380
	10/4	400	793	400	0	0	0	3174
	10/5	400	793	400	0	0	0	3967
	10/6	400	793	400	0	0	0	4760
	10/7	400	793	400	0	0	0	5554
	10/8	400	793	400	0	0	0	6347
	10/9	400	793	400	0	0	0	7140
	10/10	400	793	400	0	0	0	7934
	10/11	400	793	400	0	0	0	8727
	10/12	400	793	400	0	0	0	9521
	10/13	400	793	400	0	0	0	10314
	10/14	400	793	400	0	0	0	11107
	10/15	500	992	400	100	198	198	12099
	10/16	750	1488	400	350	694	893	13587
	10/17	1000	1983	400	600	1190	2083	15570
	10/18	1250	2479	400	850	1686	3769	18050
	10/19	1500	2975	400	1100	2182	5950	21025
	10/20	1500	2975	400	1100	2182	8132	24000
	10/21	1500	2975	400	1100	2182	10314	26975
	10/22	1500	2975	400	1100	2182	12496	29950
	10/23	1500	2975	400	1100	2182	14678	32926
	10/24	1500	2975	400	1100	2182	16860	35901
	10/25	1500	2975	400	1100	2182	19041	38876
	10/26	1500	2975	400	1100	2182	21223	41851
	10/27	1500	2975	400	1100	2182	23405	44826
	10/28	1250	2479	400	850	1686	25091	47306
	10/29	1000	1983	400	600	1190	26281	49289
	10/30	750	1488	400	350	694	26975	50777
	10/31	500	992	400	100	198	27174	51769
NOV	11/1	300	595	300	0	0	27174	52364
	11/2	300	595	300	0	0	27174	52959
	11/3	300	595	300	0	0	27174	53554
	11/4	300	595	300	0	0	27174	54149
	11/5	300	595	300	0	0	27174	54744
	11/6	300	595	300	0	0	27174	55339
	11/7	300	595	300	0	0	27174	55934
	11/8	300	595	300	0	0	27174	56529
	11/9	300	595	300	0	0	27174	57124
	11/10	300	595	300	0	0	27174	57719
	11/11	300	595	300	0	0	27174	58314
	11/12	300	595	300	0	0	27174	58909
	11/13	300	595	300	0	0	27174	59504
	11/14	300	595	300	0	0	27174	60099
	11/15	300	595	300	0	0	27174	60694

Alternative A
Stanislaus River Minimum Fish Flow Schedule
Water Year Type: Wet

		Daily					Cumulative	
		Total CFS	Total AF	Base CFS	Pulse CFS	Pulse AF	Pulse AF	Total AF
OCT	10/1	400	793	400	0	0	0	793
	10/2	400	793	400	0	0	0	1587
	10/3	400	793	400	0	0	0	2380
	10/4	400	793	400	0	0	0	3174
	10/5	400	793	400	0	0	0	3967
	10/6	400	793	400	0	0	0	4760
	10/7	400	793	400	0	0	0	5554
	10/8	400	793	400	0	0	0	6347
	10/9	500	992	400	100	198	198	7339
	10/10	600	1190	400	200	397	595	8529
	10/11	1000	1983	400	600	1190	1785	10512
	10/12	850	1686	400	450	893	2678	12198
	10/13	650	1289	400	250	496	3174	13488
	10/14	450	893	400	50	99	3273	14380
	10/15	650	1289	400	250	496	3769	15669
	10/16	900	1785	400	500	992	4760	17455
	10/17	1400	2777	400	1000	1983	6744	20231
	10/18	1300	2579	400	900	1785	8529	22810
	10/19	1100	2182	400	700	1388	9917	24992
	10/20	800	1587	400	400	793	10711	26579
	10/21	450	893	400	50	99	10810	27471
	10/22	650	1289	400	250	496	11306	28760
	10/23	850	1686	400	450	893	12198	30446
	10/24	1500	2975	400	1100	2182	14380	33421
	10/25	1300	2579	400	900	1785	16165	36000
	10/26	1100	2182	400	700	1388	17554	38182
	10/27	800	1587	400	400	793	18347	39769
	10/28	450	893	400	50	99	18446	40661
	10/29	650	1289	400	250	496	18942	41950
	10/30	850	1686	400	450	893	19835	43636
	10/31	1500	2975	400	1100	2182	22017	46612
NOV	11/1	1300	2579	300	1000	1983	24000	49190
	11/2	1100	2182	300	800	1587	25587	51372
	11/3	800	1587	300	500	992	26579	52959
	11/4	450	893	300	150	298	26876	53851
	11/5	400	793	300	100	198	27074	54645
	11/6	350	694	300	50	99	27174	55339
	11/7	300	595	300	0	0	27174	55934
	11/8	300	595	300	0	0	27174	56529
	11/9	300	595	300	0	0	27174	57124
	11/10	300	595	300	0	0	27174	57719
	11/11	300	595	300	0	0	27174	58314
	11/12	300	595	300	0	0	27174	58909
	11/13	300	595	300	0	0	27174	59504
	11/14	300	595	300	0	0	27174	60099
	11/15	300	595	300	0	0	27174	60694

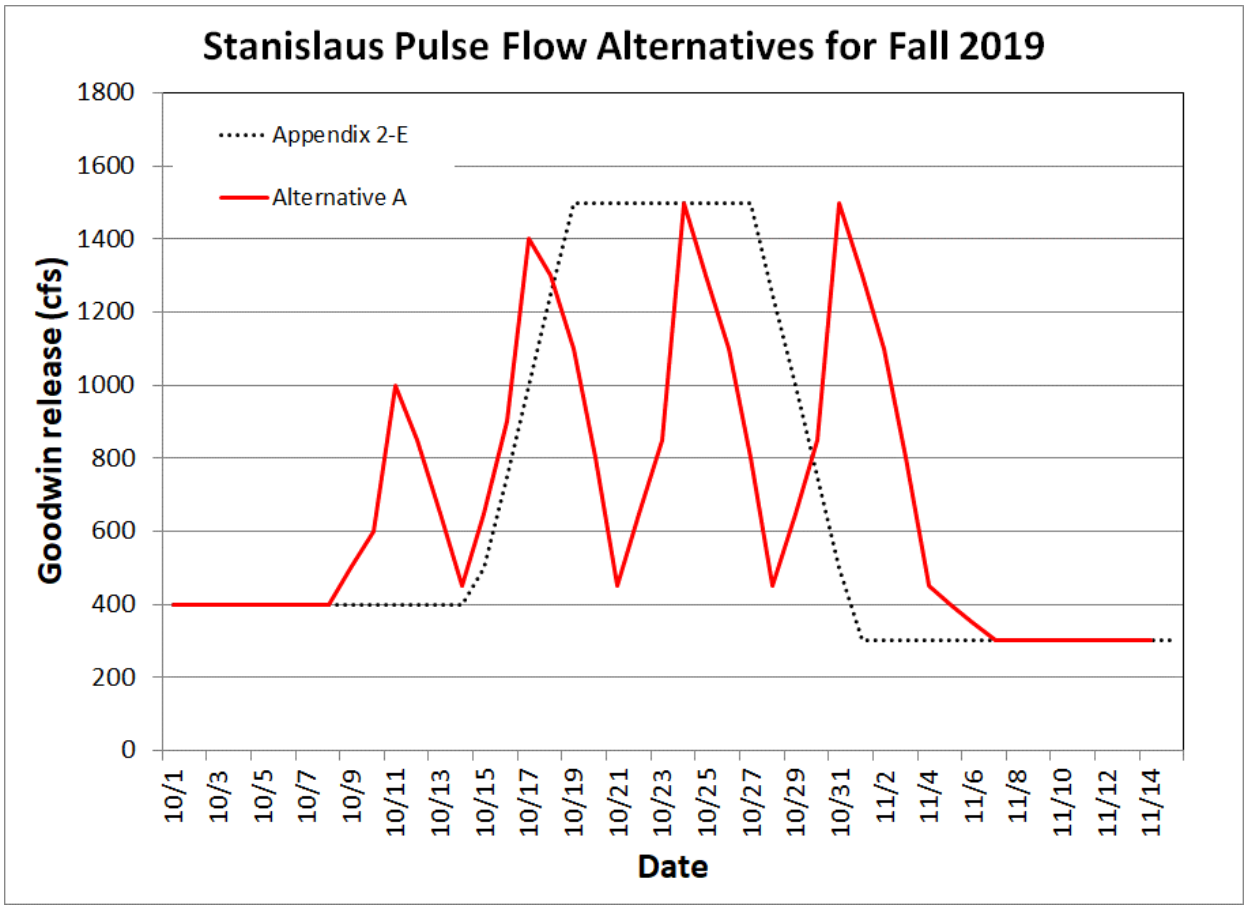

Figure 2. Stanislaus fall pulse flow schedules considered by SOG for October-November 2019. SOG advises that the " Alternative A" pulse be implemented rather than the Appendix 2-E schedule.

Table 2. Factors considered in the design of the SOG-advised fall pulse flow for 2019.

Driver	Location	Lifestage	Notes
Agriculture	lower tributary	N/A	The NMFS Appendix 2-E flow schedule does, in some months in some yeartypes, require flows above 1,500 cfs. Because of seepage concerns, NMFS limited the duration of those flows to no more than 10 consecutive days. When the default Appendix 2-E flow schedule for a pulse event does not exceed 1,500 cfs, NMFS will not require that a reshaped flow exceed 1,500 cfs.
D.O.	Vernalis	Adult	The combined pulse should, ideally, provide sufficient flow to achieve a D.O. of at least 7ppm in the deepwater ship channel.
Migration Window	Vernalis	Adult	Provide temperature/D.O. suitable for upmigration for at least several weeks.
Monitoring	Riverbank	N/A	Weir operation is impacted when flows exceed 1,500 cfs, or last for more than a few days at 1,500 cfs.
Redd Scour/Stranding	Tributary/ spawning area	redd/eggs/fry	The main pulse should occur before a significant number of the season's redds are created. Historically, peak spawning occurs mid-November.
Redd Stranding	Tributary/spawning area	redd/eggs/fry	The pulse should avoid sustained flows that would encourage redd construction in areas that will be dewatered during post-attraction-pulse flows.
Temperature	Vernalis	Adult	Pulse should be late enough to provide cool enough temperatures for upmigrants through the San Joaquin to avoid egg mortality within migrating adults.
Temperature	Tributary/spawning area	Adult	Pulse should be shaped and timed to provide and maintain instream temperatures sufficient to avoid egg mortality for returning adults.
Preferred rafting flows	Goodwin Canyon to Knights Ferry	N/A	Preferred flows for rafting are 800-1,300 cfs and 1,700-2,500 cfs between 10am and 4pm on

Driver	Location	Lifestage	Notes
Coordination with other San Joaquin River tributaries	San Joaquin basin	Adult	USFWS facilitates coordination of basin-wide fall pulse flow scheduling in the Merced River, Tuolumne River, Stanislaus River, and Mokelumne River and shares information with SOG.
1987 CDFW-USBR Agreement	Goodwin releases	Adult/redd/ eggs/fry	Checked-in with CDFW and Reclamation regarding any flow request per the 1987 CDFW-USBR Agreement.
CDFW carcass survey schedule	Goodwin Canyon	N/A	A preference for flows not to exceed 450 cfs on Mondays when carcass survey crews will be working in Goodwin Canyon.
Restoration Projects	Stanislaus River	N/A	Check-in on any flow considerations for in-water work associated with any restoration projects.
SalmonCam at the Stan Salmon Festival	Knights Ferry	N/A	If possible, keep flows <300 cfs on the day of the festival (second Saturday in November) to allow installation of the SalmonCam.

Appendix B. January Winter Instability Flows SOG Advice

Fwd: January 2020 winter instability flows SOG advice

1 message

Garwin Yip - NOAA Federal <garwin.yip@noaa.gov> Thu, Dec 19, 2019 at 9:56 AM
To: Levi Johnson <lejohnson@usbr.gov>
Cc: Barb Byrne <barbara.byrne@noaa.gov>, Sarah M <sperrin@usbr.gov>, Zarela R <zguerrero@usbr.gov>, Bradley C <BHubbard@usbr.gov>, ELIZABETH G <EKiteck@usbr.gov>, Spencer R <smarshall@usbr.gov>, THUY T <TWashburn@usbr.gov>, Monica Gutierrez <Monica.Gutierrez@noaa.gov>, "womt@water.ca.gov" <womt@water.ca.gov>

Levi--As you know, Action III.1.3 (page 49 of the 2011 RPA Amendments to the NMFS Biological Opinion) provides for the adaptive management of the flow schedule in Appendix 2-E of the NMFS Biological Opinion. Specifically, "…based upon the advice of SOG and the concurrence by NMFS, the flows may be implemented with minor modifications to the timing, magnitude, and/or duration, as long as NMFS concurs that the rationale for the shift in timing, magnitude, and/or duration is deemed by NMFS to be consistent with the intent of the action." (page 50 of the 2011 RPA Amendments to the NMFS Biological Opinion)

NMFS agrees that for January 2020, the winter instability flow may be (1) reshaped according to the attached SOG advice [according to the Alt-Wet (if still in a Wet water year type) or Alt-AN (if the water year type changes to Above Normal in mid-January) flow schedule], and (2) shifted in timing to coincide with a natural storm event or scheduled to be initiated by the end of January 2020 if no rainfall event occurs. Until the January winter instability flow is implemented, Goodwin releases must not be less than the minimum base flow in the Appendix 2-E schedule for January (300 cfs for the Wet water year type, 200 cfs for all other water year types).

NMFS determines that the proposed changes in the shaping and timing of the January winter instability flow is consistent with the implementation procedures of RPA Action III.1.3.

WOMT--In the interest of following the process provided in NMFS' Opinion section 11.2.1.1, this e-mail is to inform WOMT of NMFS' determination, and to provide WOMT with an opportunity to discuss the proposal. If anyone wants to discuss the SOG advice or NMFS determination, please initiate a WOMT meeting or bring it up during the next WOMT call. Thanks.

-Garwin-

Garwin Yip
Water Operations and Delta Consultations Branch Chief
NOAA Fisheries West Coast Region
U.S. Department of Commerce
California Central Valley Office
650 Capitol Mall, Suite 5-100
Sacramento, CA 95814
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NOAA FISHERIES West Coast Region

---------- Forwarded message ---------
From: **Johnson, Levi E** <lejohnson@usbr.gov>
Date: Thu, Dec 19, 2019 at 8:13 AM
Subject: January 2020 winter instability flows SOG advice
To: Garwin yip <garwin.yip@noaa.gov>
Cc: Barb Byrne <barbara.byrne@noaa.gov>, Perrin, Sarah M <sperrin@usbr.gov>, Guerrero, Zarela R <zguerrero@usbr.gov>, Hubbard, Bradley C <BHubbard@usbr.gov>, KITECK, ELIZABETH G <EKiteck@usbr.gov>, Marshall, Spencer R <smarshall@usbr.gov>, WASHBURN, THUY T <TWashburn@usbr.gov>, Monica Gutierrez <Monica.Gutierrez@noaa.gov>

Dear Garwin,
The Stanislaus Operations Group (SOG) met on Dec. 18, 2019 to discuss, among other items, advice forJanuary 2020 winter instability flows (WIF), a component of the Appendix 2-E flow schedule (per Action III.1.3) in the 2009 NMFS Biological Opinion (2011 RPA Amendments). SOG advises a modified January 2020WIF regime that we believe is consistent with the intent of the RPA action (see attached). Two different reshaped pulse flows and a shift in their timing are proposed in anticipation of a potential change in water year type (from wet to above normal). SOG expects to provide separate advice for the February 2020 WIF that may include a shift in water from the spring pulse volume.

To summarize the advice, the proposed January 2020 WIF would be reshaped to include a higher peak flow to better provide variability in the winter hydrograph by simulating a small storm pulse. Early portions of the pulse will inundate a greater portion of restoration areas where short-term inundation of shallow waterhabitat can provide benefits to rearing salmonids. The duration of each alternative pulse is similar to that in Appendix 2-E. The reshaped pulse monthly volumes are the same as those in Appendix 2-E.

In addition, SOG recommends that the January WIF (for both wet and above normal water year types) be shifted from the Appendix 2-E start date of January 3 to coincide with a natural storm event (if possible). Regardless, a pulse will be initiated no later than January 31.

With that, Reclamation requests concurrence from NMFS on the proposed January 2020 WIF SOG advice.Please let me know if you have any questions or concerns. Thank you Garwin and have a nice holiday.

Sincerely,
Levi

Levi Johnson
Water Resources/RPA Branch Chief
Interior Region 10, California-Great Basin
USBR Central California Area Office
(916) 537-7070 office
(916) 224-8942 cell

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STANISLAUS OPERATIONS GROUP (SOG) ADVICE RE: IMPLEMENTATION OF THE STANISLAUS RPA ACTIONS DURING JANUARY 2020
12/19/2019

Background

Winter instability flows (WIF) in January and February are a component of the daily flow schedule in Appendix 2-E of the National Marine Fisheries Service (NMFS) Biological Opinion (BiOp)[1] required per Action III.1.3 of the Reasonable and Prudent Alternative (RPA). As noted in the 2011 RPA Amendments[2] (p. 50), the winter instability flows are intended "…to simulate natural variability in the winter hydrograph and to enhance access to varied rearing habitats." The RPA further notes (p. 50) that "…based upon the advice of the Stanislaus Operations Group (SOG) and the concurrence by NMFS, the flows may be implemented with minor modifications to the timing, magnitude, and/or duration, as long as NMFS concurs that the rationale for the shift in timing, magnitude, and/or duration is deemed by NMFS to be consistent with the intent of the action."

Below, SOG advises a modified WIF for implementation in January 2020 that we believe is consistent with the intent of the RPA action. SOG expects to provide separate advice for the February pulse that may include a shift in water from the spring pulse volume.

SOG notes that reservoir management releases in January may be sufficient to satisfy the WIF, for example if releases for reservoir management remain at or above 500 cfs. If reservoir management releases beyond the Appendix 2-E volume are needed, SOG encourages that, to the extent possible and within the ramping rates in the 2009 NMFS BiOp, those releases to be shaped to mimic a storm hydrograph similar to the shaping shown in Figure 1 (i.e. to have a rapidly ascending limb and a slowly declining limb).

SOG Advice

Flow per RPA Action III.1.3

For January 2020, SOG advises that the winter instability flow be (a) reshaped according to the Alt-Wet (if still in a Wet water year type) or Alt-AN (if the water year type changes to Above Normal in mid-January) flow schedule described in Table 1 and Figures 1 and 2, and (b) shifted in time to coincide with a natural storm event or scheduled to be initiated by the end of each calendar month if no rainfall event occurs. SOG would prefer the January winter instability flow to be implemented in mid- to late January.

a) RESHAPING: The reshaped Alt-Wet and Alt-AN pulses have the same volume (3,570 AF in addition to the 300 cfs base flow for Alt-Wet and 1,983 AF in addition to the 200 cfs base flow for Alt-AN) as the Wet and Above Normal water year type WIF pulses in Appendix 2-E but have been reshaped to include a higher peak flow. SOG believes each reshaped pulse alternative meets the intent of the RPA action, namely, it provides

[1] The BiOp and all appendices are available online at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocap.html

[2] Available online at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/040711_ocap_opinion_2011_amendments.pdf

variability in the winter hydrograph by simulating a small storm pulse. The shape of each alternative pulse, with its more rapidly rising limb and slowly descending limb, is characteristic of the flow pattern associated with storm events. Reshaping the sub-daily flow pattern to increase the peak flow (to 1,500 cfs in the Alt-WET schedule and to 1,000 cfs in the Alt-AN schedule) for the early portion of the pulse will inundate a greater portion of the Honolulu Bar, Lancaster Road, and Buttonbush restoration areas. Short-term inundation of shallow water habitat can provide benefits to rearing salmonids such as: temporary spatial refuges from large predators, increased temperatures that may allow short-term increases in growth rate and increased allochthonous input to the main channel. The duration of each alternative pulse is similar to the duration (six days for Wet, five days for Above Normal) of the WIF schedule in Appendix 2-E.

If the water year type based on the New Melones water supply parameter (currently Wet) changes in mid-January (when the first updated forecast of the current water year is available) to something other than Above Normal before the January WIF is implemented, SOG will provide new advice on how to reshape the water volume of the winter instability flow for that new water year type.

b) SHIFT IN TIME: According to the flow schedule in Appendix 2-E, the January WIF (for both Wet and Above Normal water year types) is scheduled to begin on January 3. Shifting the WIF in time to coincide with a natural storm event (if feasible) is expected to better capture the characteristics of a natural hydrograph as the runoff, turbidity, meteorological conditions, etc. associated with a storm event will co-occur with the pulse of regulated flow.

Flow variability could cue outmigration for juvenile California Central Valley steelhead (*Oncorhynchus mykiss)* throughout January, but few fall-run Chinook fry will have emerged in early January. SOG would prefer the January WIF to be implemented in mid- to late January, when more fall-run Chinook fry will have emerged from redds and available to be redistributed by the flow.

Reclamation will monitor the forecasted precipitation and will solicit SOG input on scheduling the January WIF pulse. If the pulse has not been scheduled by January 15, 2020, then SOG will discuss scheduling at the January 15, 2020 SOG meeting to ensure a pulse is initiated no later than January 31.

Table 1. Winter instability flow shape advised by SOG (Alt-Wet or Alt-AN, pulse days highlighted in yellow), in comparison to the pulse as described in Appendix 2-E. Average hourly flow (in cfs) shown at the top is based on flows for Days 1-6. That six-day period is the default pulse period for the Wet year type in Appendix 2-E.

		Appendix 2E (Wet)	Alt-Wet	Appendix 2E (AN)	Alt-AN
Average Hourly CFS (Days 1-6)		600	600	367	367
Day	Time	Appendix 2E (Wet)	Alt-Wet	Appendix 2E (AN)	Alt-AN
0	17	300	300	200	200
0	18	300	300	200	200
0	19	300	300	200	200
0	20	300	300	200	200
0	21	300	300	200	200
0	22	300	300	200	200
0	23	300	300	200	200
0	24	300	300	200	200
1	1	600	300	400	200
1	2	600	300	400	200
1	3	600	300	400	200
1	4	600	300	400	250
1	5	600	300	400	300
1	6	600	400	400	300
1	7	600	400	400	300
1	8	600	500	400	400
1	9	600	500	400	400
1	10	600	600	400	400
1	11	600	750	400	500
1	12	600	850	400	500
1	13	600	1000	400	500
1	14	600	1100	400	700
1	15	600	1250	400	700
1	16	600	1350	400	700
1	17	600	1500	400	1000
1	18	600	1500	400	1000
1	19	600	1400	400	1000
1	20	600	1400	400	900
1	21	600	1300	400	900
1	22	600	1300	400	900
1	23	600	1200	400	800
1	24	600	1200	400	800

		Appendix 2E (Wet)	Alt-Wet	Appendix 2E (AN)	Alt-AN
Average Hourly CFS (Days 1-6)		600	600	367	367
Day	Time	Appendix 2E (Wet)	Alt-Wet	Appendix 2E (AN)	Alt-AN
2	1	600	1100	400	700
2	2	600	1100	400	700
2	3	600	1100	400	700
2	4	600	1000	400	700
2	5	600	1000	400	600
2	6	600	1000	400	600
2	7	600	1000	400	600
2	8	600	1000	400	600
2	9	600	1000	400	600
2	10	600	1000	400	500
2	11	600	900	400	500
2	12	600	900	400	500
2	13	600	900	400	500
2	14	600	900	400	500
2	15	600	900	400	450
2	16	600	800	400	450
2	17	600	800	400	450
2	18	600	800	400	450
2	19	600	800	400	450
2	20	600	800	400	450
2	21	600	800	400	450
2	22	600	800	400	450
2	23	600	800	400	450
2	24	600	800	400	400
3	1	600	800	400	400
3	2	600	800	400	400
3	3	600	700	400	400
3	4	600	700	400	400
3	5	600	700	400	400
3	6	600	700	400	400
3	7	600	700	400	400
3	8	600	700	400	400
3	9	600	700	400	400
3	10	600	700	400	400
3	11	600	700	400	400
3	12	600	600	400	350

		Appendix 2E (Wet)	Alt-Wet	Appendix 2E (AN)	Alt-AN
Average Hourly CFS (Days 1-6)		600	600	367	367
Day	Time	Appendix 2E (Wet)	Alt-Wet	Appendix 2E (AN)	Alt-AN
3	13	600	600	400	350
3	14	600	600	400	350
3	15	600	600	400	350
3	16	600	600	400	350
3	17	600	600	400	350
3	18	600	600	400	350
3	19	600	600	400	350
3	20	600	600	400	350
3	21	600	600	400	350
3	22	600	600	400	350
3	23	600	600	400	350
3	24	600	600	400	350
4	1	600	600	400	350
4	2	600	600	400	300
4	3	600	500	400	300
4	4	600	500	400	300
4	5	600	500	400	300
4	6	600	500	400	300
4	7	600	500	400	300
4	8	600	500	400	300
4	9	600	500	400	300
4	10	600	500	400	300
4	11	600	500	400	300
4	12	600	500	400	300
4	13	600	500	400	300
4	14	600	500	400	300
4	15	600	500	400	300
4	16	600	500	400	300
4	17	600	500	400	300
4	18	600	400	400	300
4	19	600	400	400	250
4	20	600	400	400	250
4	21	600	400	400	250
4	22	600	400	400	250
4	23	600	400	400	250
4	24	600	400	400	250

		Appendix 2E (Wet)	Alt-Wet	Appendix 2E (AN)	Alt-AN
Average Hourly CFS (Days 1-6)		600	600	367	367
Day	Time	Appendix 2E (Wet)	Alt-Wet	Appendix 2E (AN)	Alt-AN
5	1	600	400	400	250
5	2	600	400	400	250
5	3	600	400	400	250
5	4	600	400	400	250
5	5	600	400	400	250
5	6	600	400	400	250
5	7	600	400	400	250
5	8	600	400	400	250
5	9	600	400	400	250
5	10	600	400	400	250
5	11	600	400	400	250
5	12	600	400	400	250
5	13	600	350	400	250
5	14	600	350	400	250
5	15	600	350	400	200
5	16	600	350	400	200
5	17	600	350	400	200
5	18	600	350	400	200
5	19	600	350	400	200
5	20	600	350	400	200
5	21	600	350	400	200
5	22	600	350	400	200
5	23	600	350	400	200
5	24	600	350	400	200
6	1	600	300	200	200
6	2	600	300	200	200
6	3	600	300	200	200
6	4	600	300	200	200
6	5	600	300	200	200
6	6	600	300	200	200
6	7	600	300	200	200
6	8	600	300	200	200
6	9	600	300	200	200
6	10	600	300	200	200
6	11	600	300	200	200
6	12	600	300	200	200

		Appendix 2E (Wet)	Alt-Wet	Appendix 2E (AN)	Alt-AN
Average Hourly CFS (Days 1-6)		600	600	367	367
Day	Time	Appendix 2E (Wet)	Alt-Wet	Appendix 2E (AN)	Alt-AN
6	13	600	300	200	200
6	14	600	300	200	200
6	15	600	300	200	200
6	16	600	300	200	200
6	17	600	300	200	200
6	18	600	300	200	200
6	19	600	300	200	200
6	20	600	300	200	200
6	21	600	300	200	200
6	22	600	300	200	200
6	23	600	300	200	200
6	24	600	300	200	200
7	1	300	300	200	200
7	2	300	300	200	200
7	3	300	300	200	200
7	4	300	300	200	200
7	5	300	300	200	200
7	6	300	300	200	200
7	7	300	300	200	200
7	8	300	300	200	200
7	9	300	300	200	200
7	10	300	300	200	200

Figure 1: Plot of winter instability flow shapes from Table 1 for a Wet water year type. Note that the horizontal "Hour" axis is not intended to imply any particular date since the advice is to implement the pulse, if possible, coincident with a natural storm event rather than on a specific calendar date.

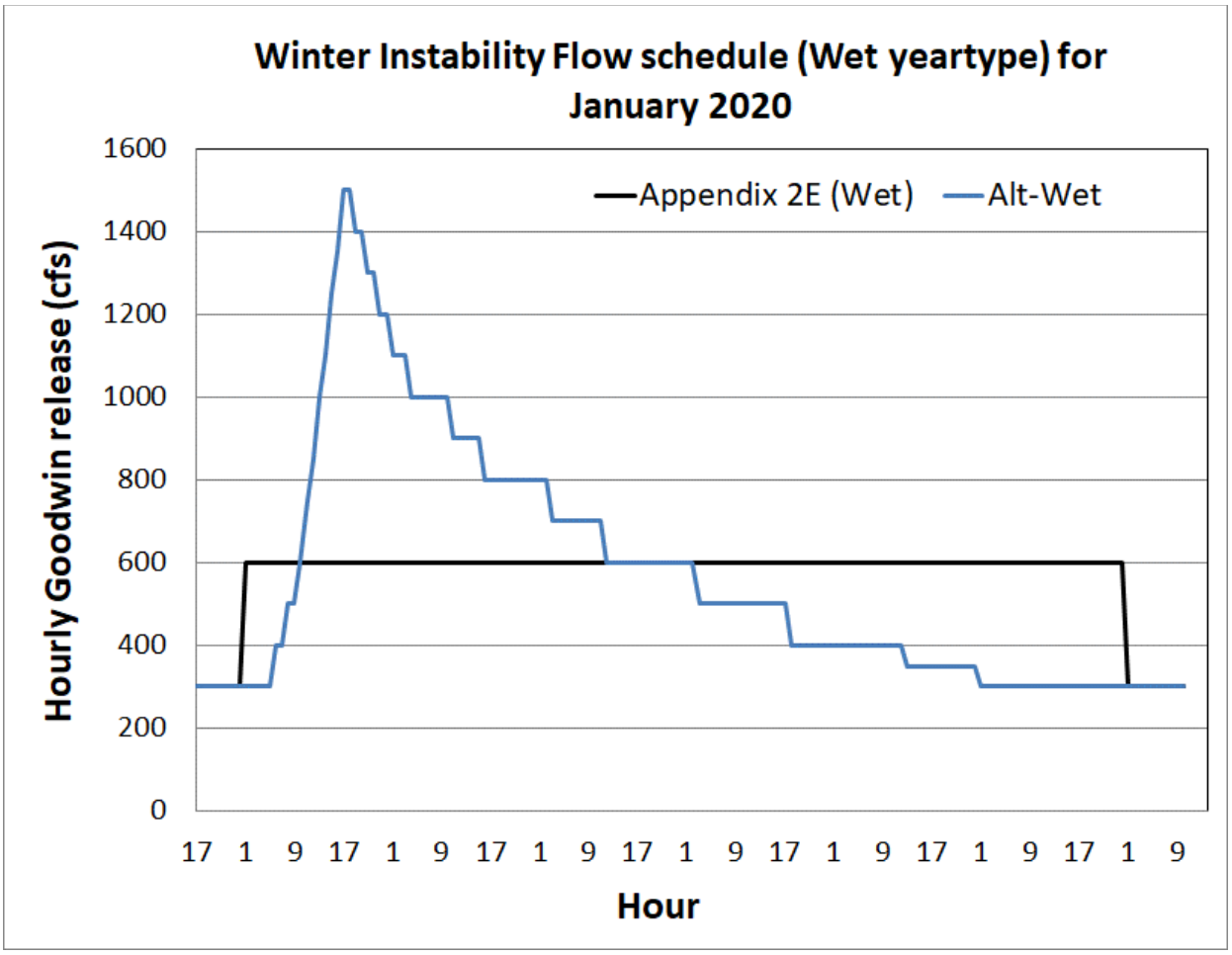
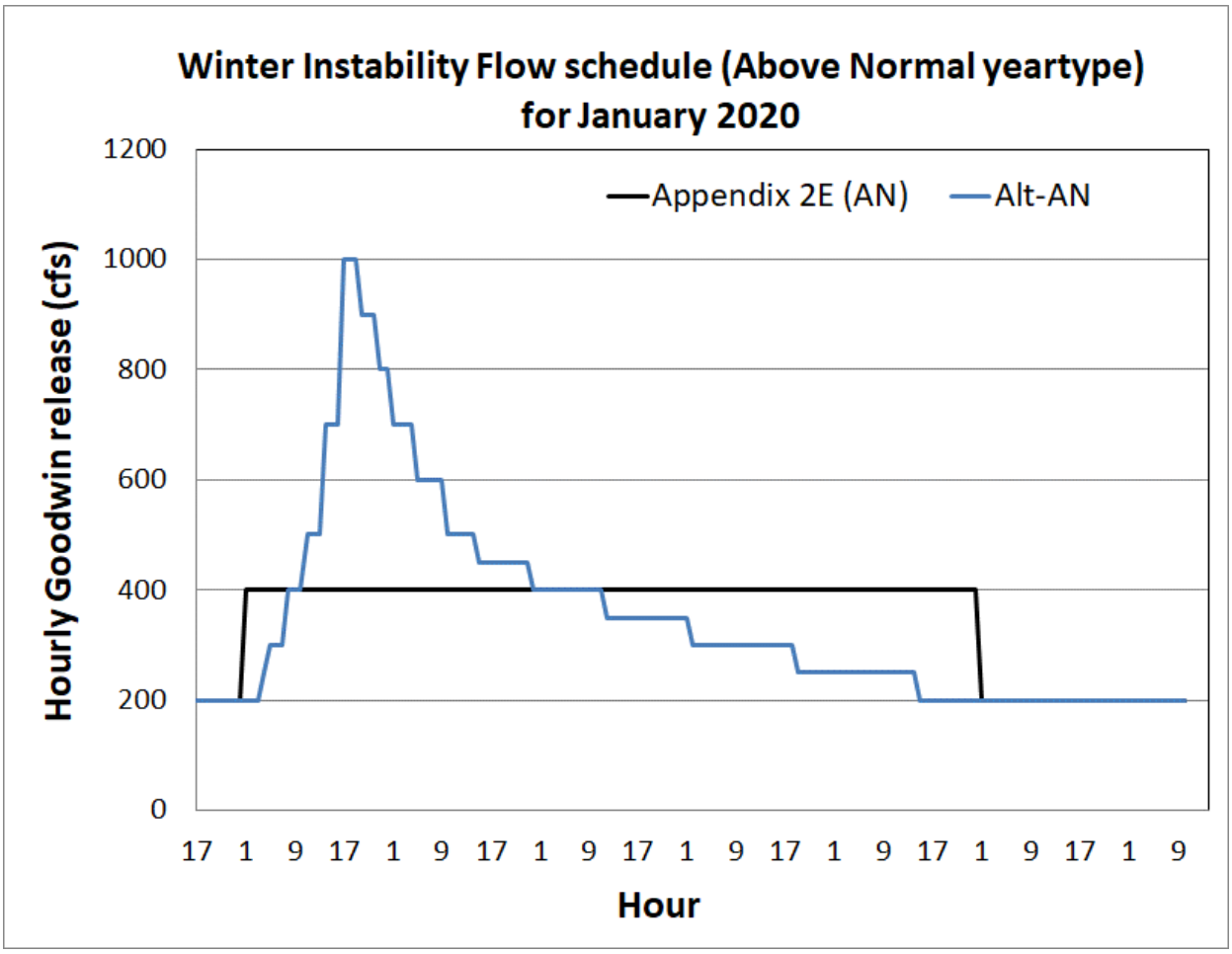


Figure 2: Plot of winter instability flow shapes from Table 1 for an Above Normal water year type. Note that the horizontal "Hour" axis is not intended to imply any particular date since the advice is to implement the pulse, if possible, coincident with a natural storm event rather than on a specific calendar date.



Appendix C. February Winter Instability Flows

NMFS determination: SOG Advice, Request for Concurrence - February 2020 Winter Instability Flows

1 message

Garwin Yip - NOAA Federal <garwin.yip@noaa.gov> Fri, Jan 31, 2020 at 7:48 PM
To: Levi Johnson <lejohnson@usbr.gov>
Cc: "Washburn, Thuy T" <TWashburn@usbr.gov>, Zarela Guerrero <zguerrero@usbr.gov>, Barbara Byrne <Barbara.Byrne@noaa.gov>, "Perrin, Sarah" <sperrin@usbr.gov>, Evan Sawyer - NOAA Affiliate <evan.sawyer@noaa.gov>, "womt@water.ca.gov" <womt@water.ca.gov>

Levi,

Thank you for your email transmitting Reclamation's request for NMFS concurrence on the minor modifications to the February 2020 winter instability flows (WIF), as advised by the Stanislaus Operations Group (SOG). As you have pointed out, the WIF is a component of the Appendix 2-E flow schedule of the NMFS 2009 Biological Opinion, which may be adaptively managed per RPA Action III.1.3 (page 49 of the 2011 RPA Amendments to the NMFS Biological Opinion). Specifically, "…based upon the advice of SOG and the concurrence by NMFS, the flows may be implemented with minor modifications to the timing, magnitude, and/or duration, as long as NMFS concurs that the rationale for the shift in timing, magnitude, and/or duration is deemed by NMFS to be consistent with the intent of the action." (page 50 of the 2011 RPA Amendments to the NMFS Biological Opinion). In this case, the intent of RPA Action III.1.3 is "to maintain minimum base flows to optimize CV steelhead habitat for all life history stages and to incorporate habitat maintaining geomorphic flows in a flow pattern that will provide migratory cues to smolts and facilitate out-migrant smolt movement on declining limb of pulse" (page 50 of the 2011 RPA Amendments to the NMFS Biological Opinion).

After review, NMFS agrees that for February 2020, the winter instability flow and a late February spring pulse flow may be reshaped according to the attached SOG advice relevant to the current water year type. As it pertains to the shifting in time of WIF, the rationale provided by the SOG advice is that in doing so, an early-February WIF will provide outmigration cues for juvenile steelhead as well as to provide enhanced mobilization of juvenile fall-run Chinook salmon. Likewise, the rationale for reshaping the early spring pulse flow is to provide an outmigration cue for salmonids and to provide some stable flows that support conditions for monitoring juvenile salmonid use of habitat in recently restored areas. NMFS understands that the WIF may be shifted in timing to coincide with a natural storm event, but with the additional constraint that it will be scheduled no later than mid-February if no rainfall event occurs. The mid-February operational constraint is imposed so as not to interfere with the late February flow schedule, for which specific monitoring studies are planned. Until the February WIF is implemented, Goodwin releases must not be less than the minimum base flow in the Appendix 2-E schedule for February (200 cfs for all water year types other than Wet). However, NMFS acknowledges that actual Goodwin releases might be higher than the reshaped flow schedule on some days due to reservoir management needs.

Based on this review, NMFS concurs that the proposed changes in the shaping and timing of the minimum flows on the Stanislaus River during February 2020 are consistent with ESA obligations and the intent of RPA Action III.1.3.

WOMT--In the interest of following the process provided in NMFS' 2009 Opinion section 11.2.1.1, this e-mail is to inform WOMT of NMFS' determination, and to provide WOMT with an opportunity to discuss the proposal. If anyone wants to discuss the SOG advice or NMFS determination, please initiate a WOMT meeting or bring it up during the next WOMT call.

-Garwin-

Garwin Yip
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---------- Forwarded message ---------
From: **Johnson, Levi E** <lejohnson@usbr.gov>
Date: Wed, Jan 29, 2020 at 3:04 PM
Subject: SOG Advice, Request for Concurrence - February 2020 Winter Instability Flows
To: evan.sawyer@noaa.gov <evan.sawyer@noaa.gov>
Cc: WASHBURN, THUY T <TWashburn@usbr.gov>, Guerrero, Zarela R <zguerrero@usbr.gov>, Barb Byrne <barbara.byrne@noaa.gov>, Garwin yip <garwin.yip@noaa.gov>, Perrin, Sarah M <sperrin@usbr.gov>

Hi Evan,
Levi Johnson here from Reclamation's Folsom Office. The Stanislaus Operations Group (SOG) met on January 15, 2020 to discuss advice for February 2020 winter instability flows (WIF), a component of the Appendix 2-E flow schedule (per Action III.1.3) in the 2009 NMFS Biological Opinion (2011 RPA Amendments). SOG advises a modified February 2020 WIF regime that we believe is consistent with the intent of the RPA action (see attached). Different reshaped pulse flows and a shift in their timing are proposed to accommodate a change in water year type. SOG expects to provide separate advice for the Spring Pulse Flow.

To summarize, the proposed February 2020 WIF would be reshaped to include a higher peak flow early in the month, to better provide variability in the winter hydrograph by simulating a small storm pulse. Early portions of the pulse will inundate a greater portion of restoration areas where short-term inundation of shallow water habitat can provide benefits to rearing salmonids. In addition, the advice calls for a reshaping of a spring pulse flow, moving this pulse to being in late February. This additional pulse may serve as an outmigration cue for salmonids and will include a shift in water from the spring pulse volume.

In addition, SOG recommends that the early February WIF be shifted to coincide with a natural storm event (if possible). Regardless, a February WIF pulse will be initiated no later than mid-February.

With that, Reclamation requests concurrence from NMFS on the proposed February 2020 WIF SOG advice. Please let me know if you have any questions or concerns. Thank y ou, Evan and looking forward to working with you.

Sincerely,

Levi

Levi Johnson

Water Resources/RPA Branch Chief
Interior Region 10, California-Great Basin
USBR Central California Area Office
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SOG WIF for February advice 01292020.docx
594K

SOG ADVICE RE: IMPLEMENTATION OF THE STANISLAUS RPA ACTIONS DURING FEBRUARY 2020
1/28/2020

Background

Winter instability flows (WIF) in January and February are a component of the daily flow schedule in Appendix 2-E of the NMFS BiOp[1] required per Action III.1.3 of the Reasonable and Prudent Alternative (RPA). As noted in the 2011 RPA Amendments[2] (p. 50), the WIFs are intended "…to simulate natural variability in the winter hydrograph and to enhance access to varied rearing habitats." The RPA further notes (p. 50) that "…based upon the advice of SOG and the concurrence by NMFS, the flows may be implemented with minor modifications to the timing, magnitude, and/or duration, as long as NMFS concurs that the rationale for the shift in timing, magnitude, and/or duration is deemed by NMFS to be consistent with the intent of the action."

On December 19, 2019, SOG advised a modified January WIF consistent with the intent of the RPA action. Because the latest hydrology forecast at that time indicated that the water year type might change in February, SOG provided an alternative WIF schedule for both Wet and Above Normal water year types based on the water volume available in each water year type. Reclamation submitted the advice to NMFS and NMFS approved it. At its January 15, 2020 meeting, SOG discussed alternative designs for the February 2020 WIF and the preliminary spring pulse flow and is providing this advice to NMFS for concurrence. Based on the January forecast, the water year type has shifted to Below Normal.

SOG notes that reservoir management releases in February onward may be sufficient to satisfy or exceed the reshaped flow schedule. If reservoir management releases beyond the reshaped flow volumes are needed, SOG encourages that, to the extent possible and within the ramping rates in the 2009 NMFS BiOp, those releases to be shaped to mimic a storm hydrograph in early February, and, in coordination with SOG, support the Cramer Fish Sciences studies at the restoration areas in February and throughout the spring.

SOG advice

Flow per RPA Action III.1.3

For February 2020, SOG considered the potential for the water year type to change. At the time of this advice, the water year type based on the January forecast has shifted to Below Normal. However, the water year type may shift again based on the February forecast, so multiple water year type options are included here. SOG advises that February flows be reshaped according to Table 1 and the graphs in Figures 1 – 4 depending on the water year type forecasted. The WIFs will be implemented by mid-February (in coordination with a storm event, if possible) and in a manner that facilitates Cramer Fish Science to conduct a flow study in the river at several restoration areas (Lancaster Road, Buttonbush, Rodden Road), if feasible.

a) SHIFTING in time of WIF: The February WIF hydrograph will have a pulse flow at the beginning of the month (coordinated with a storm event, if possible, but with implementation to be completed no later than mid-February) in order to provide outmigration cues for juvenile steelhead as well as to provide enhanced mobilization of

juvenile fall-run Chinook (see Sturrock *et al* 2019). The February WIF in the Below Normal flow schedule in Appendix 2-E is four days at 400 cfs. Current releases at Goodwin are at 800 cfs for upstream reservoir management. SOG encourages Reclamation to mimic a storm pulse to the extent possible. The reservoir management flows of 800 cfs will inundate a greater portion of the Honolulu Bar, Lancaster Road, and Buttonbush restoration sites compared to the minimum flows in the Appendix 2-E schedule. Inundation of shallow water habitat can provide benefits to rearing salmonids such as providing temporary spatial refuges from large predators and increased allochthonous input to the main channel.

b) RESHAPING of early spring pulse flow: The SOG-advised flows in late February represent the reshaping of some of the spring pulse volume in Appendix 2-E. These late-February flows represent an additional pulse that may serve as an outmigration cue for salmonids (both steelhead and fall-run Chinook salmon) and also represent some stable flows that support conditions for monitoring juvenile salmonid use of habitat in recently restored areas at Lancaster Road, Buttonbush, and Rodden Road. For the month of February (the period covered by this advice), the reshaped flow volumes exceed the Appendix 2-E volumes, but additional water in late February is being shifted from the spring pulse volume.

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[1] The BiOp and all appendices are available online at:
http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocap.html

[2] Available online at:
http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/040711_ocap_opinion_2011_amendments.pdf

Table 1. Winter instability flow shape advised by SOG, in comparison to the Appendix 2-E flows. For the month of February (the period covered by this advice), the reshaped flow volumes exceed the Appendix 2-E volumes, but additional water is being shifted from the spring pulse volume. Because the water year type may change based on the February forecast, flow schedules for multiple year types are provided.

Day	Appendix 2E (Wet)	Alternative Flows	Appendix 2E (Above Normal)	Alternative Flows	Appendix 2E (Below Normal)	Alternative Flows	Appendix 2E (Dry)	Alternative Flows
30- Jan	300	300	200	200	200	200	200	200
31-Jan	300	1000	200	200	200	200	200	200
1-Feb	300	2000	200	200	200	200	200	200
2-Feb	300	3000	200	200	200	200	200	200
3-Feb	300	2250	200	200	200	200	200	200
4-Feb	300	1650	200	200	200	200	200	200
5-Feb	600	1250	400	400	400	400	400	400
6-Feb	600	950	400	400	400	400	400	400
7-Feb	600	800	400	2000	400	400	400	400
8-Feb	600	800	400	1000	400	400	200	200
9-Feb	600	800	400	400	200	250	200	200
10-Feb	600	800	200	200	200	250	200	200
11-Feb	300	800	200	200	200	250	200	200
12-Feb	300	800	200	200	200	250	200	200
13-Feb	300	800	200	200	200	250	200	200
14-Feb	300	800	200	200	200	250	200	200
15-Feb	300	800	200	200	200	250	200	200
16-Feb	300	800	200	200	200	250	200	200
17-Feb	300	800	200	200	200	250	200	200
18-Feb	300	800	200	200	200	250	200	200
19-Feb	300	800	200	200	200	250	200	200
20-Feb	300	800	200	200	200	250	200	200
21-Feb	300	800	200	200	200	250	200	200
22-Feb	300	800	200	200	200	200	200	200
23-Feb	300	1400	200	1000	200	1100	200	1000
24-Feb	300	2000	200	1800	200	1100	200	1000
25-Feb	300	2000	200	1800	200	1100	200	1000
26-Feb	300	2000	200	1800	200	1100	200	1000
27-Feb	300	2000	200	1800	200	1100	200	1000
28-Feb	300	2000	200	1800	200	1100	200	1000
29-Feb	300	2000	200	1800	200	1100	200	1000

Figure 1. Plot of February flows for a wet water year type.

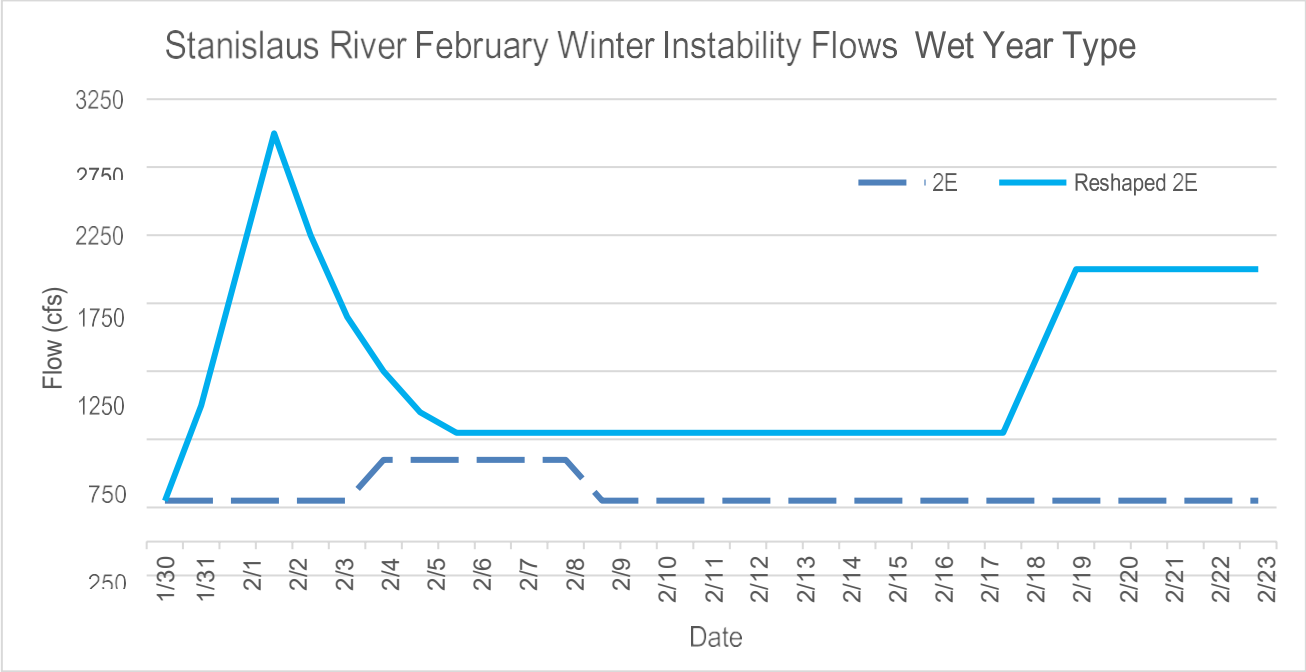


Figure 2. Plot of February flows for an above normal water year type.

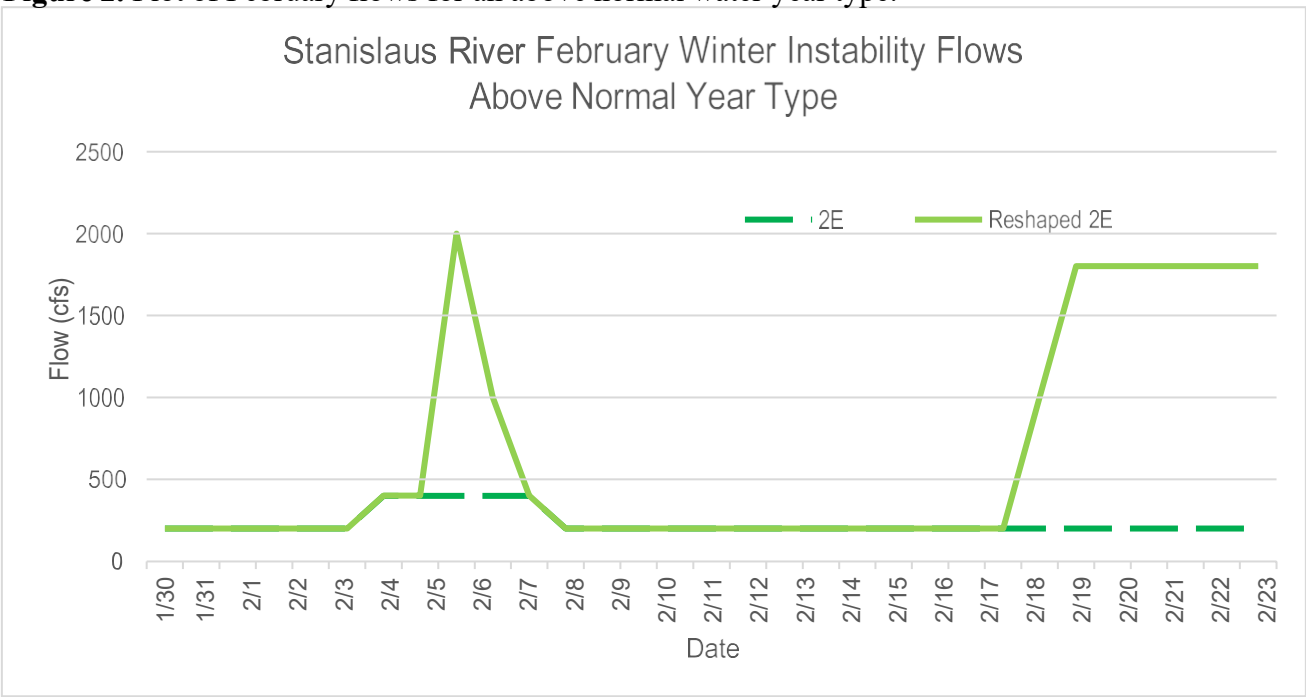


Figure 3. Plot of February flows for a below normal water year type.

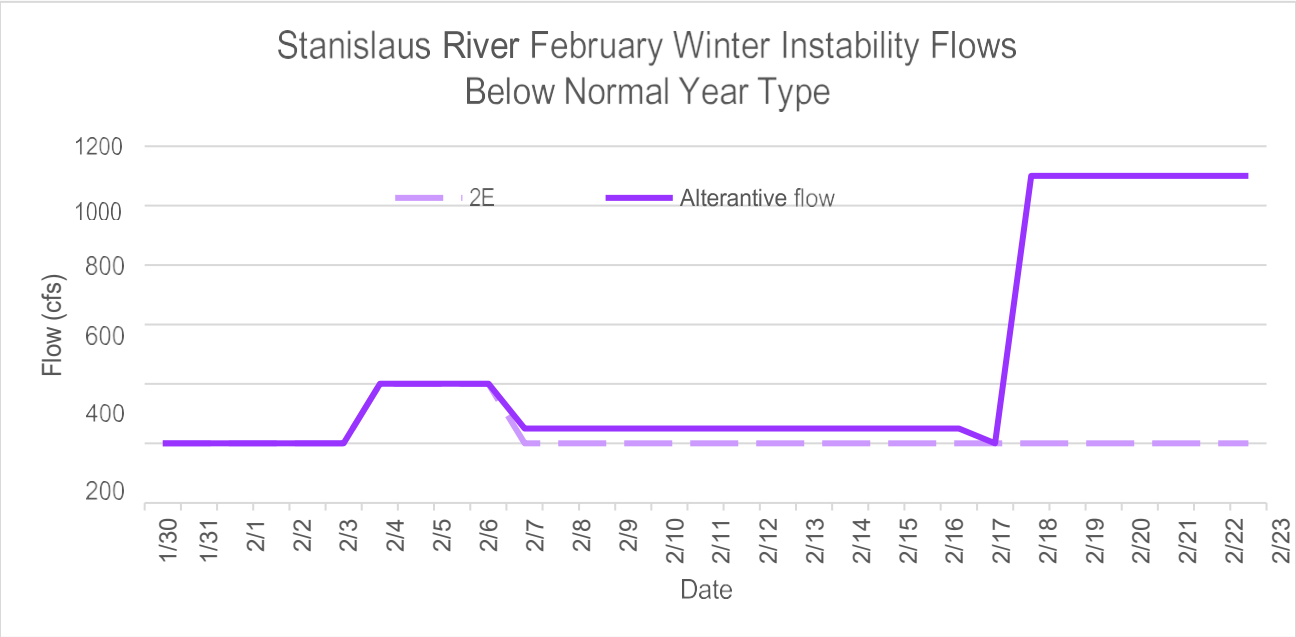
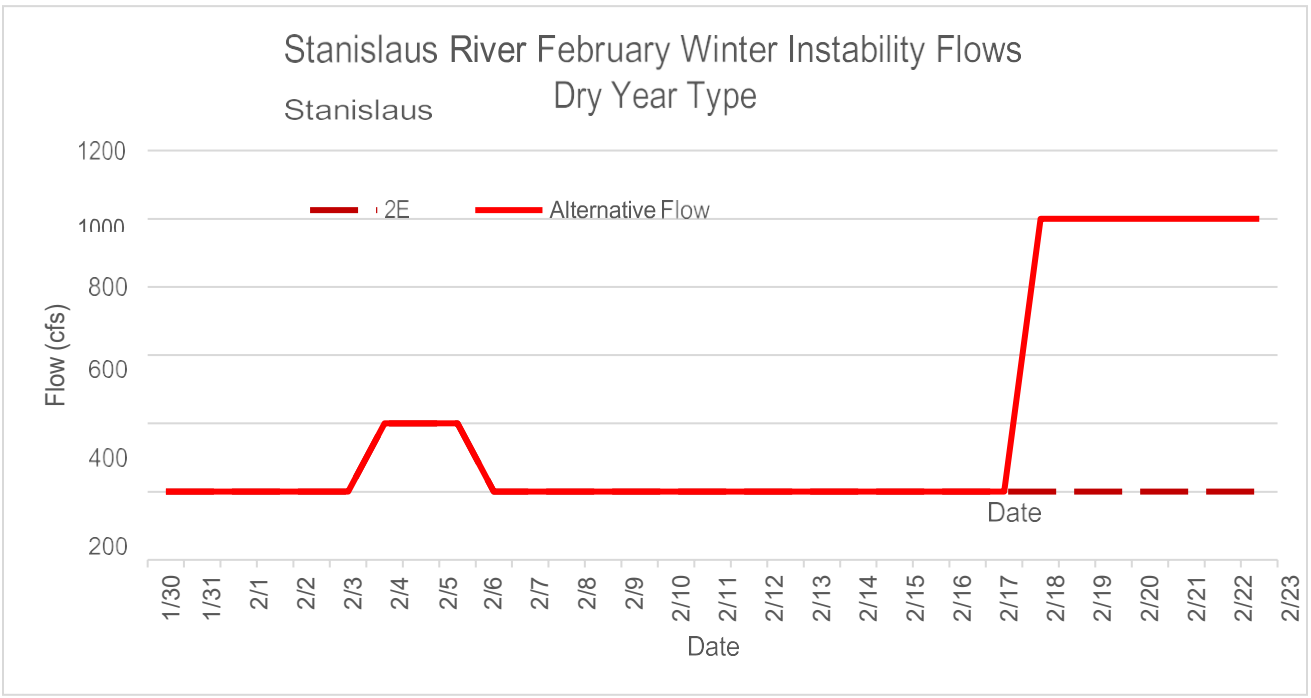


Figure 4. Plot of February flows for a dry normal water year type.



REFERENCES

Anna M. Sturrock, Stephanie M. Carlson, John D. Wikert, Tim Heyne, Sébastien Nusslé, Joseph E. Merz, Hugh J. W. Sturrock, Rachel C. Johnson. **Unnatural selection of salmon life histories in a modified riverscape**. *Global Change Biology*, 2019. https://doi.org/10.1111/gcb.14896

Appendix D. New Melones Step Release Plan

New Melones Stepped Release Plan Daily Hydrographs for Critical, Dry, Below Normal, Above Normal and Wet Year Types

New Melones Stepped Release Plan Daily Hydrographs for Critical Year Types

OCT	CFS	NOV	CFS	DEC	CFS	JAN	CFS	FEB	CFS	MAR	CFS	APR	CFS	MAY	CFS	JUN	CFS	JUL	CFS	AUG	CFS	SEP	CFS
1	200	1	200	1	200	1	200	1	200	1	200	1	200	1	725	1	150	1	150	1	150	1	150
2	200	2	200	2	200	2	200	2	200	2	200	2	200	2	725	2	150	2	150	2	150	2	150
3	200	3	200	3	200	3	400	3	200	3	200	3	200	3	725	3	150	3	150	3	150	3	150
4	200	4	200	4	200	4	400	4	200	4	200	4	200	4	725	4	150	4	150	4	150	4	150
5	200	5	200	5	200	5	200	5	400	5	200	5	200	5	725	5	150	5	150	5	150	5	150
6	200	6	200	6	200	6	200	6	400	6	200	6	200	6	725	6	150	6	150	6	150	6	150
7	200	7	200	7	200	7	200	7	200	7	200	7	200	7	725	7	150	7	150	7	150	7	150
8	200	8	200	8	200	8	200	8	200	8	200	8	200	8	725	8	150	8	150	8	150	8	150
9	200	9	200	9	200	9	200	9	200	9	200	9	200	9	725	9	150	9	150	9	150	9	150
10	200	10	200	10	200	10	200	10	200	10	200	10	200	10	725	10	150	10	150	10	150	10	150
11	200	11	200	11	200	11	200	11	200	11	200	11	200	11	725	11	150	11	150	11	150	11	150
12	200	12	200	12	200	12	200	12	200	12	200	12	200	12	725	12	150	12	150	12	150	12	150
13	200	13	200	13	200	13	200	13	200	13	200	13	200	13	550	13	150	13	150	13	150	13	150
14	200	14	200	14	200	14	200	14	200	14	200	14	200	14	450	14	150	14	150	14	150	14	150
15	500	15	200	15	200	15	200	15	200	15	200	15	350	15	300	15	150	15	150	15	150	15	150
16	750	16	200	16	200	16	200	16	200	16	200	16	500	16	150	16	150	16	150	16	150	16	150
17	1000	17	200	17	200	17	200	17	200	17	200	17	725	17	150	17	150	17	150	17	150	17	150
18	1250	18	200	18	200	18	200	18	200	18	200	18	725	18	150	18	150	18	150	18	150	18	150
19	1250	19	200	19	200	19	200	19	200	19	200	19	725	19	150	19	150	19	150	19	150	19	150
20	1250	20	200	20	200	20	200	20	200	20	200	20	725	20	150	20	150	20	150	20	150	20	150
21	1250	21	200	21	200	21	200	21	200	21	200	21	725	21	150	21	150	21	150	21	150	21	150
22	1250	22	200	22	200	22	200	22	200	22	200	22	725	22	150	22	150	22	150	22	150	22	150
23	1250	23	200	23	200	23	200	23	200	23	200	23	725	23	150	23	150	23	150	23	150	23	150
24	1250	24	200	24	200	24	200	24	200	24	200	24	725	24	150	24	150	24	150	24	150	24	150
25	1250	25	200	25	200	25	200	25	200	25	200	25	725	25	150	25	150	25	150	25	150	25	150
26	1000	26	200	26	200	26	200	26	200	26	200	26	725	26	150	26	150	26	150	26	150	26	150
27	750	27	200	27	200	27	200	27	200	27	200	27	725	27	150	27	150	27	150	27	150	27	150
28	500	28	200	28	200	28	200	28	200	28	200	28	725	28	150	28	150	28	150	28	150	28	150
29	200	29	200	29	200	29	200			29	200	29	725	29	150	29	150	29	150	29	150	29	150
30	200	30	200	30	200	30	200			30	200	30	725	30	150	30	150	30	150	30	150	30	150
31	200			31	200	31	200			31	200			31	150			31	150	31	150		
mo cfs	17900		6000		6200		6600		6000		6200		13800		12400		4500		4650		4650		4500
conv factor	1.984																						
mo af	35505	0	11901	0	12298	0	13091	0	11901	0	12298	0	27372	0	24595	0	8926	0	9223	0	9223	0	8926
yr af	2E+05																						

New Melones Stepped Release Plan Daily Hydrographs for Dry Year Types

OCT	CFS	NOV	CFS	DEC	CFS	JAN	CFS	FEB	CFS	MAR	CFS	APR	CFS	MAY	CFS	JUN	CFS	JUL	CFS	AUG	CFS	SEP	CFS
1	200	1	200	1	200	1	200	1	200	1	200	1	200	1	1000	1	200	1	200	1	200	1	200
2	200	2	200	2	200	2	200	2	200	2	200	2	200	2	1000	2	200	2	200	2	200	2	200
3	200	3	200	3	200	3	400	3	200	3	200	3	200	3	1000	3	200	3	200	3	200	3	200
4	200	4	200	4	200	4	400	4	200	4	200	4	200	4	1000	4	200	4	200	4	200	4	200
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16	750	16	200	16	200	16	200	16	200	16	200	16	1000	16	800	16	200	16	200	16	200	16	200
17	1000	17	200	17	200	17	200	17	200	17	200	17	1000	17	600	17	200	17	200	17	200	17	200
18	1250	18	200	18	200	18	200	18	200	18	200	18	1000	18	450	18	200	18	200	18	200	18	200
19	1250	19	200	19	200	19	200	19	200	19	200	19	1000	19	300	19	200	19	200	19	200	19	200
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29	500	29	200	29	200	29	200			29	200	29	1000	29	200	29	200	29	200	29	200	29	200
30	200	30	200	30	200	30	200			30	200	30	1000	30	200	30	200	30	200	30	200	30	200
31	200			31	200	31	200			31	200			31	200			31	200	31	200		
mo cfs	19700		6000		6200		6800		6200		6200		23000		19550		6000		6200		6200		6000
conv factor	1.9835																						
mo af	39075	0		0	12298	0	13488	0	12298	0	12298	0	45621	0	38777	0	11901	0	12298	0	12298	0	11901

New Melones Stepped Release Plan Daily Hydrographs for Below Normal Year Types

OCT	CFS	NOV	CFS	DEC	CFS	JAN	CFS	FEB	CFS	MAR	CFS	APR	CFS	MAY	CFS	JUN	CFS	JUL	CFS	AUG	CFS	SEP	CFS
1	250	1	200	1	200	1	200	1	200	1	200	1	400	1	1500	1	900	1	250	1	250	1	250
2	250	2	200	2	200	2	200	2	200	2	200	2	750	2	1500	2	600	2	250	2	250	2	250
3	250	3	200	3	200	3	400	3	200	3	200	3	1000	3	1500	3	600	3	250	3	250	3	250
4	250	4	200	4	200	4	400	4	200	4	200	4	1250	4	1500	4	600	4	250	4	250	4	250
5	250	5	200	5	200	5	400	5	400	5	200	5	1500	5	1500	5	600	5	250	5	250	5	250
6	250	6	200	6	200	6	400	6	400	6	200	6	1700	6	1500	6	600	6	250	6	250	6	250
7	250	7	200	7	200	7	200	7	400	7	200	7	2000	7	1500	7	450	7	250	7	250	7	250
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9	250	9	200	9	200	9	200	9	200	9	200	9	2000	9	1500	9	450	9	250	9	250	9	250
10	250	10	200	10	200	10	200	10	200	10	200	10	1500	10	1500	10	450	10	250	10	250	10	250
11	250	11	200	11	200	11	200	11	200	11	200	11	1500	11	1500	11	300	11	250	11	250	11	250
12	250	12	200	12	200	12	200	12	200	12	200	12	1500	12	1500	12	300	12	250	12	250	12	250
13	250	13	200	13	200	13	200	13	200	13	200	13	1500	13	1500	13	300	13	250	13	250	13	250
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15	500	15	200	15	200	15	200	15	200	15	200	15	1500	15	1250	15	250	15	250	15	250	15	250
16	750	16	200	16	200	16	200	16	200	16	200	16	1500	16	1250	16	250	16	250	16	250	16	250
17	1000	17	200	17	200	17	200	17	200	17	200	17	1500	17	1250	17	250	17	250	17	250	17	250
18	1250	18	200	18	200	18	200	18	200	18	200	18	1500	18	1250	18	250	18	250	18	250	18	250
19	1500	19	200	19	200	19	200	19	200	19	200	19	2000	19	1250	19	250	19	250	19	250	19	250
20	1500	20	200	20	200	20	200	20	200	20	200	20	2000	20	1000	20	250	20	250	20	250	20	250
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22	1500	22	200	22	200	22	200	22	200	22	200	22	2000	22	1000	22	250	22	250	22	250	22	250
23	1500	23	200	23	200	23	200	23	200	23	200	23	1500	23	1000	23	250	23	250	23	250	23	250
24	1500	24	200	24	200	24	200	24	200	24	200	24	1500	24	1000	24	250	24	250	24	250	24	250
25	1500	25	200	25	200	25	200	25	200	25	200	25	1500	25	1000	25	250	25	250	25	250	25	250
26	1500	26	200	26	200	26	200	26	200	26	200	26	1500	26	1000	26	250	26	250	26	250	26	250
27	1500	27	200	27	200	27	200	27	200	27	200	27	1500	27	900	27	250	27	250	27	250	27	250
28	1250	28	200	28	200	28	200	28	200	28	200	28	1500	28	900	28	250	28	250	28	250	28	250
29	1000	29	200	29	200	29	200			29	200	29	1500	29	900	29	250	29	250	29	250	29	250
30	750	30	200	30	200	30	200			30	200	30	1500	30	900	30	250	30	250	30	250	30	250
31	500			31	200	31	200			31	200			31	900			31	250	31	250		
mo cfs	24000		6000		6200		7000		6400		6200		46100		38500		10900		7750		7750		7500
conv factor	1.9835																						
mo af	47604	0	1190 1	0	12298	0	13885	0	12694	0	12298	0	91439	0	76365	0	21620	0	15372	0	15372	0	14876

New Melones Stepped Release Plan Daily Hydrographs for Above Normal Year Types

OCT	CFS	NOV	CFS	DEC	CFS	JAN	CFS	FEB	CFS	MAR	CFS	APR	CFS	MAY	CFS	JUN	CFS	JUL	CFS	AUG	CFS	SEP	CFS
1	250	1	200	1	200	1	200	1	200	1	200	1	400	1	1500	1	900	1	250	1	250	1	250
2	250	2	200	2	200	2	200	2	200	2	200	2	750	2	1500	2	600	2	250	2	250	2	250
3	250	3	200	3	200	3	400	3	200	3	200	3	1000	3	1500	3	600	3	250	3	250	3	250
4	250	4	200	4	200	4	400	4	200	4	200	4	1250	4	1500	4	600	4	250	4	250	4	250
5	250	5	200	5	200	5	400	5	400	5	200	5	1500	5	1500	5	600	5	250	5	250	5	250
6	250	6	200	6	200	6	400	6	400	6	200	6	1700	6	1500	6	600	6	250	6	250	6	250
7	250	7	200	7	200	7	200	7	400	7	200	7	2000	7	1500	7	450	7	250	7	250	7	250
8	250	8	200	8	200	8	200	8	400	8	200	8	2000	8	1500	8	450	8	250	8	250	8	250
9	250	9	200	9	200	9	200	9	200	9	200	9	2000	9	1500	9	450	9	250	9	250	9	250
10	250	10	200	10	200	10	200	10	200	10	200	10	1500	10	1500	10	450	10	250	10	250	10	250
11	250	11	200	11	200	11	200	11	200	11	200	11	1500	11	1500	11	300	11	250	11	250	11	250
12	250	12	200	12	200	12	200	12	200	12	200	12	1500	12	1500	12	300	12	250	12	250	12	250
13	250	13	200	13	200	13	200	13	200	13	200	13	1500	13	1500	13	300	13	250	13	250	13	250
14	250	14	200	14	200	14	200	14	200	14	200	14	1500	14	1250	14	300	14	250	14	250	14	250
15	500	15	200	15	200	15	200	15	200	15	200	15	1500	15	1250	15	250	15	250	15	250	15	250
16	750	16	200	16	200	16	200	16	200	16	200	16	1500	16	1250	16	250	16	250	16	250	16	250
17	1000	17	200	17	200	17	200	17	200	17	200	17	1500	17	1250	17	250	17	250	17	250	17	250
18	1250	18	200	18	200	18	200	18	200	18	200	18	1500	18	1250	18	250	18	250	18	250	18	250
19	1500	19	200	19	200	19	200	19	200	19	200	19	2000	19	1250	19	250	19	250	19	250	19	250
20	1500	20	200	20	200	20	200	20	200	20	200	20	2000	20	1000	20	250	20	250	20	250	20	250
21	1500	21	200	21	200	21	200	21	200	21	200	21	2000	21	1000	21	250	21	250	21	250	21	250
22	1500	22	200	22	200	22	200	22	200	22	200	22	2000	22	1000	22	250	22	250	22	250	22	250
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27	1500	27	200	27	200	27	200	27	200	27	200	27	1500	27	900	27	250	27	250	27	250	27	250
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29	1000	29	200	29	200	29	200			29	200	29	1500	29	900	29	250	29	250	29	250	29	250
30	750	30	200	30	200	30	200			30	200	30	1500	30	900	30	250	30	250	30	250	30	250
31	500			31	200	31	200			31	200			31	900			31	250	31	250		
mo cfs	24000		6000		6200		7000		6400		6200		46100		38500		10900		7750		7750		7500
conv factor	1.9835																						
mo af	47604	0	11901	0	12298	0	13885	0	12694	0	12298	0	91439	0	76365	0	21620	0	15372	0	15372	0	14876

New Melones Stepped Release Plan Daily Hydrographs for Wet Year Types

OCT	CFS	NOV	CFS	DEC	CFS	JAN	CFS	FEB	CFS	MAR	CFS	APR	CFS	MAY	CFS	JUN	CFS	JUL	CFS	AUG	CFS	SEP	CFS
1	300	1	200	1	200	1	200	1	200	1	200	1	3000	1	3000	1	1200	1	300	1	300	1	300
2	300	2	200	2	200	2	200	2	200	2	350	2	3000	2	3000	2	1200	2	300	2	300	2	300
3	300	3	200	3	200	3	400	3	200	3	700	3	3000	3	3000	3	1200	3	300	3	300	3	300
4	300	4	200	4	200	4	400	4	200	4	1200	4	3000	4	3000	4	1200	4	300	4	300	4	300
5	300	5	200	5	200	5	400	5	400	5	1800	5	2300	5	2300	5	1200	5	300	5	300	5	300
6	300	6	200	6	200	6	400	6	400	6	2300	6	1500	6	1500	6	1200	6	300	6	300	6	300
7	300	7	200	7	200	7	400	7	400	7	3000	7	1200	7	1500	7	1200	7	300	7	300	7	300
8	300	8	200	8	200	8	200	8	400	8	3000	8	800	8	1500	8	1200	8	300	8	300	8	300
9	300	9	200	9	200	9	200	9	400	9	3000	9	800	9	1500	9	1000	9	300	9	300	9	300
10	300	10	200	10	200	10	200	10	200	10	3000	10	800	10	1500	10	1000	10	300	10	300	10	300
11	300	11	200	11	200	11	200	11	200	11	3000	11	800	11	1500	11	1000	11	300	11	300	11	300
12	300	12	200	12	200	12	200	12	200	12	3000	12	800	12	1500	12	1000	12	300	12	300	12	300
13	300	13	200	13	200	13	200	13	200	13	1200	13	800	13	1500	13	1000	13	300	13	300	13	300
14	300	14	200	14	200	14	200	14	200	14	800	14	800	14	1500	14	1000	14	300	14	300	14	300
15	500	15	200	15	200	15	200	15	200	15	800	15	800	15	1200	15	1000	15	300	15	300	15	300
16	750	16	200	16	200	16	200	16	200	16	800	16	800	16	1200	16	1000	16	300	16	300	16	300
17	1000	17	200	17	200	17	200	17	200	17	800	17	800	17	1200	17	1000	17	300	17	300	17	300
18	1250	18	200	18	200	18	200	18	200	18	800	18	800	18	1200	18	1000	18	300	18	300	18	300
19	1500	19	200	19	200	19	200	19	200	19	800	19	800	19	1200	19	1000	19	300	19	300	19	300
20	1500	20	200	20	200	20	200	20	200	20	800	20	800	20	1200	20	1000	20	300	20	300	20	300
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24	1500	24	200	24	200	24	200	24	200	24	800	24	800	24	1200	24	750	24	300	24	300	24	300
25	1500	25	200	25	200	25	200	25	200	25	800	25	800	25	1200	25	750	25	300	25	300	25	300
26	1500	26	200	26	200	26	200	26	200	26	800	26	800	26	1200	26	500	26	300	26	300	26	300
27	1500	27	200	27	200	27	200	27	200	27	1200	27	1500	27	1200	27	500	27	300	27	300	27	300
28	1250	28	200	28	200	28	200	28	200	28	1500	28	2300	28	1200	28	500	28	300	28	300	28	300
29	1000	29	200	29	200	29	200			29	2300	29	3000	29	1200	29	300	29	300	29	300	29	300
30	750	30	200	30	200	30	200			30	3000	30	3000	30	1200	30	300	30	300	30	300	30	300
31	500			31	200	31	200			31	3000			31	1200			31	300	31	300		
mo cfs	24700		6000		6200		7200		6600		47150		42000		48200		28200		9300		9300		9000
conv factor	1.9835																						
mo af	48992	0	11901	0	12298	0	14281	0	13091	0	93522	0	83307	0	95605	0	55935	0	18447	0	18447	0	17852

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Appendix E. Spring Pulse Flows Operations Plan

BUREAU OF RECLAMATION

Stanislaus Stepped Release Plan – Water Year 2020 Spring Pulse Flow

Final Operations Plan

April 1, 2020

This Stanislaus Stepped Release Plan (SRP) – Water Year (WY) 2020 Final Operations Plan details Reclamation's plan for operating the Stanislaus River to meet WY 2020 spring pulse flow requirements. The Final Operations Plan incorporates feedback from the Stanislaus Watershed Team (SWT) who convened March 18, 2020 to discuss a spring pulse flow Draft Operations Plan.

Background

A spring pulse flow is one component of the daily flow schedule in the Stanislaus River Stepped Release Plan (SRP) pursuant to Section 4.10.6.1 of the U.S. Bureau of Reclamation's (Reclamation) and California Department of Water Resources' (DWR) Proposed Action for the coordinated long term operation (LTO) of the Central Valley Project (CVP) and the State Water Project (SWP), dated October 2019 (Proposed Action, PA), and the corresponding Biological Opinion (BiOp) issued pursuant to section 7 of the federal Endangered Species Act (ESA) by NOAA's National Marine Fisheries Service (NMFS), dated October 21, 2019.. As noted on page 4-81 of the Biological Assessment, "the New Melones SRP will be implemented similarly to current operations under the 2009 biological opinion with a default daily hydrograph, and the ability to shape monthly and seasonal flow volumes to meet specific biological objectives." On page 4-82 of the Biological Assessment, it is further described that "The Stanislaus Watershed Team will also provide input on the shaping and timing of monthly or seasonal flow volumes to optimize biological benefits."

Water Volume Accounting for WY

Reclamation intends to use the water accounting framework (which accommodates water year type changes in the winter and spring) used by the Stanislaus Operations Group (precursor to the SWT) to implement the SRP. Because the water year type is generally updated mid-month based on the snow surveys completed early in the month, the framework calculates the total required instream flow volume for the spring pulse flow period based on the default flow schedule in the SRP from the 16th of Month A to the 15th of Month B, based on the water year type determined by the Month A forecast.

The 60-20-20 San Joaquin Index (the index used to determine the water year type for SRP implementation) was "Critical" based on the March 2020 forecast. Assuming the water year type does not change based on future forecasts, the total required instream flow volume pursuant to the SRP for the March 16-June 30, 2020 period is detailed below:

Date range	Water Year Type (Month of forecast)	Total water volume in default schedule in SRP (acre-feet)
3/16/20-4/15/20	Critical (March)	12,595
4/16/20-5/15/20	Critical* (April)	40,959
5/16/20-6/15/20	Critical* (May)	9,223
6/16/20-6/30/20	Critical* (May)	4,463

**Assumes the water year type does not change based on future forecasts. If the water year type per the 60-20-20 San Joaquin Index changes from Critical based on the April or May forecasts, Reclamation will recalculate the volume requirement and seek input from the SWT on an updated flow schedule if needed.*

Reshaped SRP flows

For WY 2020, Reclamation intends to implement a reshaped spring pulse flow according to the flow schedule described in Alt-Critical 4 (see details in Attachment 1).

At the March 18, 2020 SWT meeting, the technical team discussed various alternatives for the spring pulse flow schedule, given the change in water year type from Dry to Critical based on the March forecast. In the meeting handouts, Reclamation presented a Draft Operations Plan that offered two options (Alt-Critical 1 and Alt-Critical 2) for WY 2020 spring pulse flows (see Attachment 1). Based on discussion, and in order to (a) move a higher volume of water into the default April 15-May 15 Vernalis pulse flow period, and (b) accommodate flows needed for important predation studies[1] on the Stanislaus River in May 2002, the SWT provided feedback on these options. SWT discussions led to the design of Alt-Critical 3. Upon further analysis of Alt-Critical 3, Reclamation determined that the proposed Alt-Critical 3 recommended pulse flow volumes do not ideally align with a 31-day Vernalis pulse flow period. Reclamation, and the SWT, then designed Alt-Critical 4 (see flow schedule alternatives, including the default schedule in the SRP, in the figure in Attachment 2).

The Alt-Critical 4 schedule has the same total volume (67,240 AF, including base flows) for the March 16-June 30 period as the default SRP Critical schedule, as described in Section I of this plan. Reclamation, and the SWT, believe that the Alt-Critical 4 reshaping optimizes biological benefits by providing a spring pulse flow that may cue anadromy and improve migratory habitat in both the Stanislaus River and in the mainstem San Joaquin River and southern delta. In the Stanislaus River, higher flows are expected to reduce water temperature (or at least buffer daily maximum water temperature) and inundate some shallow water habitat which may provide juvenile salmonids with short-term growth benefits as well as potential refuge from predation. In the mainstem San Joaquin River and south delta, higher flows from the Stanislaus River (and other San Joaquin tributaries) are expected to convey out-migrating salmonids more rapidly along their migratory pathway, which may improve outmigration success.

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[1] The predation studies have since been cancelled because of COVID-19 considerations but SWT still supports this flow schedule.

Some key features of the Alt-Critical 4 spring pulse include:

- As in the default schedule, **higher spring flows** (compared to winter base flows) are intended to cue outmigration and improve migratory habitat downstream.
- Reshaping the single pulse identified in the default SRP schedule into **an extended six-peaks pulse period increases flow variability within the season.** This variability is expected to provide opportunities for a broader range of salmonid outmigration timing since outmigration may be cued by variability as well as flow magnitude (Zeug et al. 2014).
- The **time frame** of the Alt-Critical 4 pulse (which is similar in duration, though a bit earlier in timing, compared to the default SRP schedule) is expected to provide some inundation of shallow-water habitat and temperature buffering from April through early-May; the extent of such benefits will vary with flow throughout the spring pulse period. The timing of Alt-Critical 4 puts most of the pulse volume in a 31-day window which aligns better with Vernalis pulse flow period.
- **Shifting much of the pulse volume into an earlier release** in early April is to address concerns about relatively low Stanislaus and San Joaquin flows (due to Critical water year type and limited pulse flow volumes under the SRP as well as relatively low expected pulse flow volumes for other San Joaquin River tributaries) and the potential for progressively more unsuitable water temperatures for migration later in spring.
- Other considerations for in-basin interests:
    - No flows >1,500 cfs are scheduled in consideration of concerns regarding agricultural seepage[2].

References

Zeug, S.C., Sellheim, K., Watry, C., Wikert, J.D. and Merz, J. (2014), Response of juvenile Chinook salmon to managed flow: lessons learned from a population at the southern extent of their range in North America. Fish Manag Ecol, 21: 155-168. doi:10.1111/fme.12063

[2] Note that in wetter years, flows >1,500 cfs cannot be avoided entirely, but may be limited in duration.

Attachment 1

Reshaped alternatives 1 and 2 for the WY 2020 spring pulse flow schedule for March 16 – June 30, 2020.

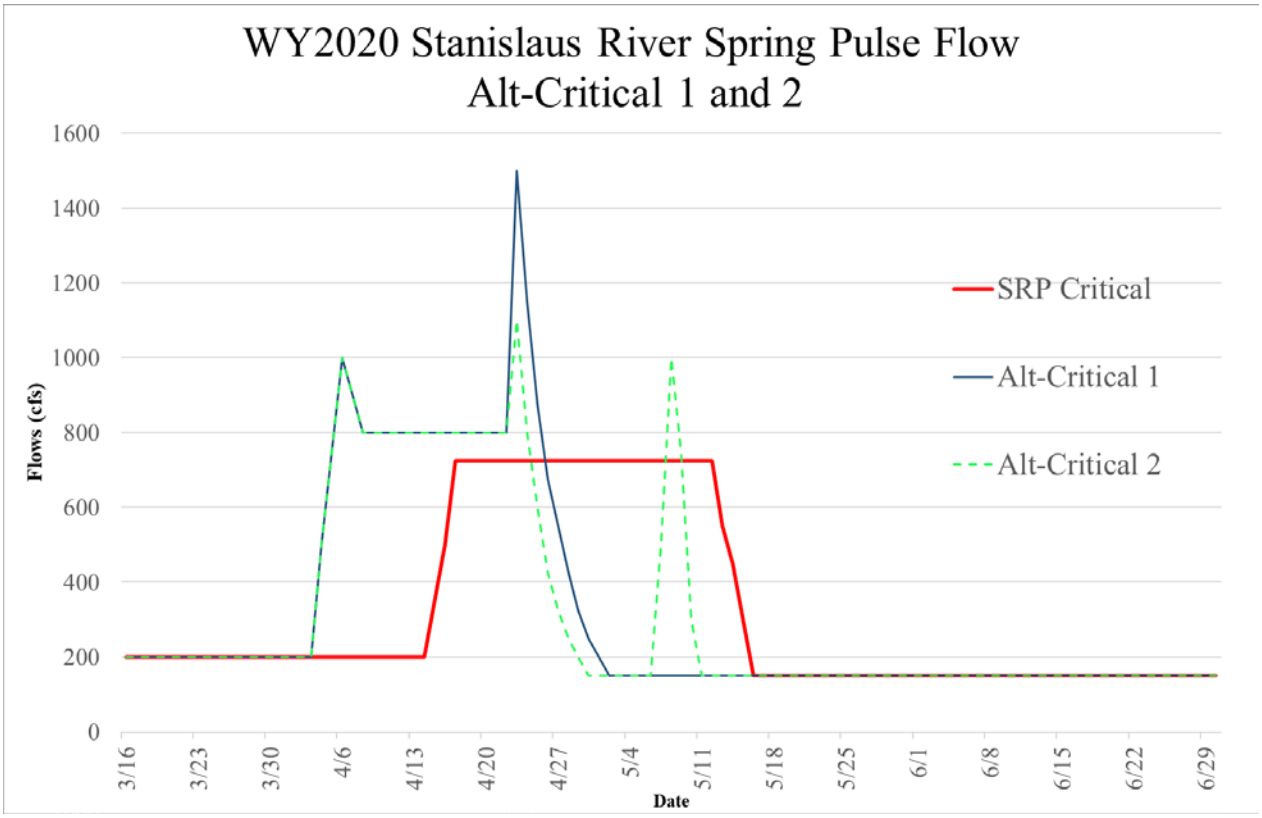

Figure 1.Figure showing daily flows from March 10 to June 10 in both the default SRP-Critical schedule and three Alternative-Critical 1 and 2 schedules.

Table 1.Daily Flows under the SRP Critical and alternatives 1 and 2 for March - June 2020

Schedules		SRP Critical	Alt Critical 1	Alt Critical 2
Day	**Date**	**Daily flow (cfs)**	**Daily flow (cfs)**	**Daily flow (cfs)**
S	3/16	200	200	200
M	3/17	200	200	200
T	3/18	200	200	200
W	3/19	200	200	200
T	3/20	200	200	200
F	3/21	200	200	200
S	3/22	200	200	200
S	3/23	200	200	200
M	3/24	200	200	200
T	3/25	200	200	200
W	3/26	200	200	200
T	3/27	200	200	200
F	3/28	200	200	200
S	3/29	200	200	200
S	3/30	200	200	200
M	3/31	200	200	200
T	4/1	200	200	200
W	4/2	200	200	200
T	4/3	200	200	200
F	4/4	200	500	500
S	4/5	200	750	750
S	4/6	200	1000	1000
M	4/7	200	900	900
T	4/8	200	800	800
W	4/9	200	800	800
T	4/10	200	800	800
F	4/11	200	800	800
S	4/12	200	800	800
S	4/13	200	800	800
M	4/14	200	800	800
T	4/15	350	800	800
W	4/16	500	800	800
T	4/17	725	800	800
F	4/18	725	800	800
S	4/19	725	800	800
S	4/20	725	800	800
M	4/21	725	800	800
T	4/22	725	800	800
W	4/23	725	1500	1100
T	4/24	725	1150	800
F	4/25	725	875	600
S	4/26	725	675	425
S	4/27	725	550	325
M	4/28	725	425	250
T	4/29	725	325	200
W	4/30	725	250	150
T	5/1	725	200	150
F	5/2	725	150	150
S	5/3	725	150	150
S	5/4	725	150	150
M	5/5	725	150	150
T	5/6	725	150	150
W	5/7	725	150	500
T	5/8	725	150	1000
F	5/9	725	150	750
S	5/10	725	150	300
S	5/11	725	150	150
M	5/12	725	150	150
T	5/13	550	150	150
W	5/14	450	150	150
T	5/15	300	150	150
F	5/16	150	150	150
S	5/17	150	150	150
S	5/18	150	150	150
M	5/19	150	150	150
T	5/20	150	150	150
W	5/21	150	150	150
T	5/22	150	150	150
F	5/23	150	150	150
S	5/24	150	150	150
S	5/25	150	150	150
M	5/26	150	150	150
T	5/27	150	150	150
W	5/28	150	150	150
T	5/29	150	150	150
F	5/30	150	150	150
S	5/31	150	150	150
S	6/1	150	150	150
M	6/2	150	150	150
T	6/3	150	150	150
W	6/4	150	150	150
T	6/5	150	150	150
F	6/6	150	150	150
S	6/7	150	150	150
S	6/8	150	150	150
M	6/9	150	150	150
T	6/10	150	150	150
W	6/11	150	150	150
T	6/12	150	150	150

Schedules		SRP Critical	Alt Critical 1	Alt Critical 2
Day	Date	Daily flow (cfs)	Daily flow (cfs)	Daily flow (cfs)
F	6/13	150	150	150
S	6/14	150	150	150
S	6/15	150	150	150
M	6/16	150	150	150
T	6/17	150	150	150
W	6/18	150	150	150
T	6/19	150	150	150
F	6/20	150	150	150
S	6/21	150	150	150
S	6/22	150	150	150
M	6/23	150	150	150
T	6/24	150	150	150
W	6/25	150	150	150
T	6/26	150	150	150
F	6/27	150	150	150
S	6/28	150	150	150
S	6/29	150	150	150
M	6/30	150	150	150

Table 2. Comparison of water volumes and flows between SRP Critical, Alt-Critical 1 and Alt-Critical 2 from March 16 and June 30

Schedules	SRP Critical	Alt-Critical 1	Alt-Critical 2
Total cfs (Mar 16 - June 30)	33,900	33,900	33,900
Total acre-feet (Mar 16 - June 30)	67,240	67,240	67,240

Attachment 2

Reshaped alternatives 3 and 4 for the WY 2020 spring pulse flow schedule for March 16 – June 30, 2020.

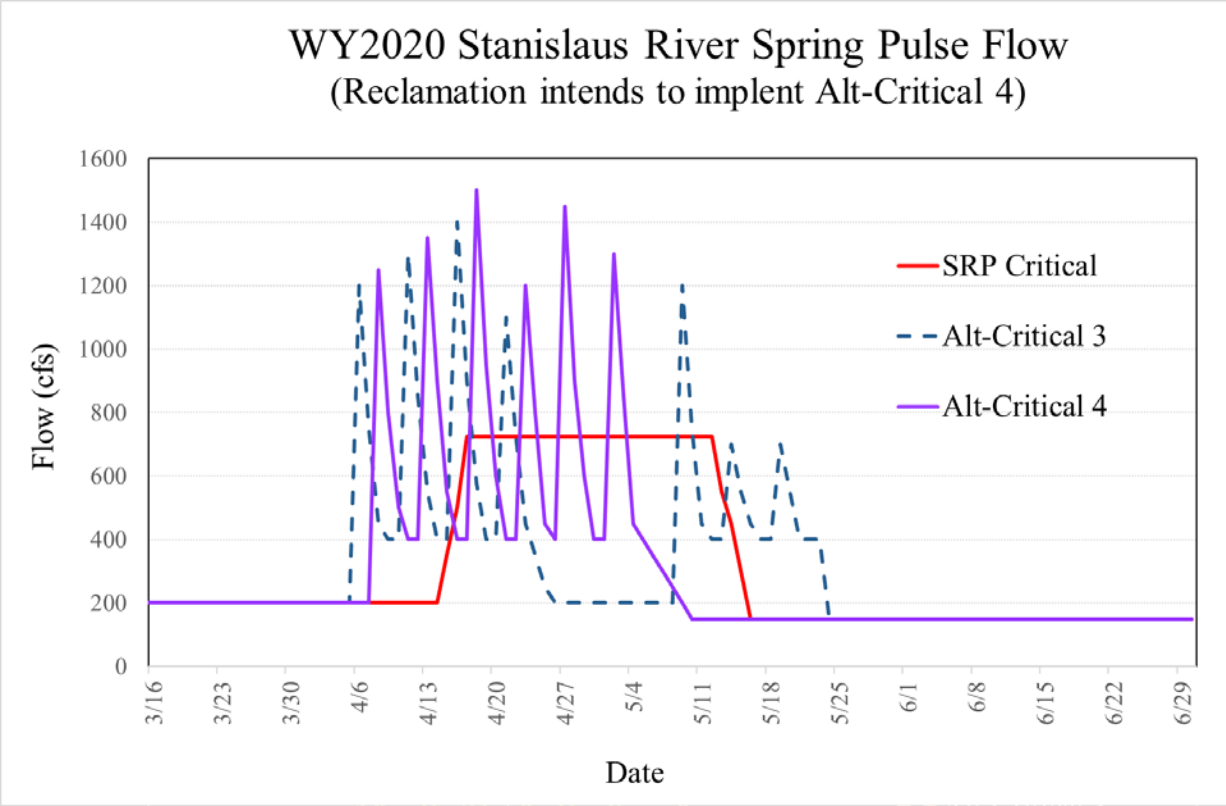

Figure 2. Daily flows from March 10 to June 10 in both the default SRP-Critical schedule and Alternative-Critical 3 and 4 schedules.

Table 3. Daily Flows under the SRP Critical and alternatives 3 and 4 for March - June 2020

Schedules		SRP Critical	Alt Critical 3	Alt Critical 4
Day	Date	Daily flow (cfs)	Daily flow (cfs)	Daily flow (cfs)
S	3/16	200	200	200
M	3/17	200	200	200
T	3/18	200	200	200
W	3/19	200	200	200
T	3/20	200	200	200
F	3/21	200	200	200
S	3/22	200	200	200
S	3/23	200	200	200
M	3/24	200	200	200
T	3/25	200	200	200
W	3/26	200	200	200
T	3/27	200	200	200
F	3/28	200	200	200
S	3/29	200	200	200
S	3/30	200	200	200
M	3/31	200	200	200
T	4/1	200	200	200
W	4/2	200	200	200
T	4/3	200	200	200
F	4/4	200	200	200
S	4/5	200	200	200
S	4/6	200	1200	200
M	4/7	200	750	200
T	4/8	200	450	1250
W	4/9	200	400	800
T	4/10	200	400	500
F	4/11	200	1300	400
S	4/12	200	850	400
S	4/13	200	550	1350
M	4/14	200	400	900
T	4/15	350	400	550
W	4/16	500	1400	400
T	4/17	725	900	400
F	4/18	725	575	1500
S	4/19	725	400	950
S	4/20	725	400	600
M	4/21	725	1100	400
T	4/22	725	725	400
W	4/23	725	450	1200
T	4/24	725	350	800
F	4/25	725	250	450
S	4/26	725	200	400
S	4/27	725	200	1450
M	4/28	725	200	900
T	4/29	725	200	600
W	4/30	725	200	400
T	5/1	725	200	400
F	5/2	725	200	1300
S	5/3	725	200	850
S	5/4	725	200	450
M	5/5	725	200	400
T	5/6	725	200	350
W	5/7	725	200	300
T	5/8	725	200	250
F	5/9	725	1200	200
S	5/10	725	750	150
S	5/11	725	450	150
M	5/12	725	400	150
T	5/13	550	400	150
W	5/14	450	700	150
T	5/15	300	550	150
F	5/16	150	450	150
S	5/17	150	400	150
S	5/18	150	400	150
M	5/19	150	700	150
T	5/20	150	550	150
W	5/21	150	400	150
T	5/22	150	400	150
F	5/23	150	400	150
S	5/24	150	150	150
S	5/25	150	150	150
M	5/26	150	150	150
T	5/27	150	150	150
W	5/28	150	150	150
T	5/29	150	150	150

Schedules		SRP Critical	Alt Critical 3	Alt Critical 4
Day	**Date**	**Daily flow (cfs)**	**Daily flow (cfs)**	**Daily flow (cfs)**
F	5/30	150	150	150
S	5/31	150	150	150
S	6/1	150	150	150
M	6/2	150	150	150
T	6/3	150	150	150
W	6/4	150	150	150
T	6/5	150	150	150
F	6/6	150	150	150
S	6/7	150	150	150
S	6/8	150	150	150
M	6/9	150	150	150
T	6/10	150	150	150
W	6/11	150	150	150
T	6/12	150	150	150
F	6/13	150	150	150
S	6/14	150	150	150
S	6/15	150	150	150
M	6/16	150	150	150
T	6/17	150	150	150
W	6/18	150	150	150
T	6/19	150	150	150
F	6/20	150	150	150
S	6/21	150	150	150
S	6/22	150	150	150
M	6/23	150	150	150
T	6/24	150	150	150
W	6/25	150	150	150
T	6/26	150	150	150
F	6/27	150	150	150
S	6/28	150	150	150
S	6/29	150	150	150
M	6/30	150	150	150

Table 4. Comparison of water volumes and flows between SRP Critical, Alt-Critical 3 and Alt-Critical 4 from March 16 and June 30

Schedules	Period	SRP Critical	Alt-Critical 3	Alt-Critical 4
Total cfs	March 16 – June 30	33,900	33,900	33,900
Total acre-feet	March 16 – June 30	67,240	67,240	67,240