

Annual Report of Activities Water Year 2017



Stanislaus Operations Group (SOG)
October 2017

Cover Photo: *Looking towards New Melones Reservoir from the emergency spillway. May 2017.*

Credit: *Reclamation*

Acronyms and Abbreviations

Term	Definition
7DADM	Seven-Day-Average Daily Maximum Temperature
BiOp	Biological Opinion
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CDEC	California Data Exchange Center
CDFW	California Department of Fish & Wildlife
CWT	Coded Wire Tag
CDWR	California Department of Water Resources
D-1422	Water Rights Decision 1422
ESA	Endangered Species Act
GDW	Stanislaus River at Goodwin Dam (CDEC gauge)
KF	Knights Ferry
NMFS	National Marine Fisheries Service
OBB	Stanislaus River at Orange Blossom Bridge (CDEC gauge)
OID	Oakdale Irrigation District
Reclamation	U.S. Bureau of Reclamation
RPA	Reasonable and Prudent Alternative
RPN	Stanislaus River at Ripon (CDEC gauge for dissolved oxygen)
SOG	Stanislaus Operations Group
SSJID	South San Joaquin Irrigation District
SWP	State Water Project
SWRCB	State Water Resources Control Board
TUCP	Temporary Urgency Change Petition
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish & Wildlife Service
WOMT	Water Operations Management Team
WY	Water Year

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CHAPTER 1 INTRODUCTION AND BACKGROUND

1.1 Introduction

This report summarizes the activities and actions of the Stanislaus Operations Group (SOG) for Water Year (WY) 2017¹ in compliance with the NOAA's National Marine Fisheries Service (NMFS) 2009 Biological Opinion and Conference Opinion on the Long Term Operations of the Central Valley Project (CVP) and State Water Project (SWP; NMFS BiOp). Table 1-1 lists the Reasonable and Prudent Alternative (RPA) actions from the NMFS BiOp. These RPAs establish the requirements related to Stanislaus operations.

Table 1-1. NMFS BiOp Reasonable and Prudent Alternative (RPA) actions, description, and page references in the 2009 BiOp with 2011 amendments² related to Stanislaus operations:

ACTION ID	Page #	RPA Action Name
Section 11.2.1.2	9	Research and Adaptive Management (Annual Review)
Section 11.2.1.3	10	Monitoring and Reporting: (e) Adult escapement and juvenile monitoring for steelhead on the Stanislaus River.
Action III.1.1	7-9, 47	Establish Stanislaus Operational Group (SOG) for Real-Time Operational Decision-Making.
Action III.1.2	47-48	Provide Cold Water Releases to Maintain Suitable Steelhead Temperatures.
Action III.1.3	49-53, Appendix 2-E ³	Operate the East Side Division Dams to Meet the Minimum Flows, as Measured at Goodwin Dam.
Action III.2.1	53-54	Increase and Improve Quality of Spawning Habitat with addition of 50,000 Cubic Yards of Gravel by 2014 and with a Minimum Addition of 8,000 Cubic Yards per Year for the Duration of the Project Actions.
Action III.2.2	54	Conduct Floodplain Restoration and Inundation in Winter or Spring to Inundate Steelhead Juvenile Rearing Habitat on One-to Three-Year Schedule.
Action III.2.3	54-55	Restore Freshwater Migratory Habitat for Juvenile Steelhead by Implementing Projects to Increase Floodplain Connectivity and to Reduce Predation Risk During Migration.

¹ WY 2017 started on 10/1/16 and ended on 9/30/17.

² The 2011 NMFS RPA adjustments are available online at:

http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/040711_ocap_opinion_2011_amendments.pdf

³ Appendix 2-E is available at:

http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/appendix_2-rpa_supporting_documents_compiled.pdf

ACTION ID	Page #	RPA Action Name
Action III.2.4	55	Evaluate Fish Passage at New Melones, Tulloch, and Goodwin Dams.

1.2 Background

The Stanislaus River is of considerable interest to fishery management agencies, the public, and the U.S. Bureau of Reclamation (Reclamation). The agencies with trust responsibilities for fishery and water resources in the Stanislaus River include the U.S. Fish and Wildlife Service (USFWS), NMFS, California Department of Fish and Wildlife (CDFW), and State Water Resource Control Board (SWRCB). 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 enhancement⁴. A partnership between the Oakdale Irrigation District and the South San Joaquin Irrigation District (collectively, the Districts), known as the Tri Dam Project, own and operate multiple features on the Stanislaus River. These include Donnell's 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.

On June 4, 2009, NMFS issued its NMFS BiOp⁵. On April 7, 2011, NMFS issued adjustments⁶ to the RPAs of the NMFS BiOp. Unless noted otherwise, references to page numbers in this document refer to page numbers in the 2011 NMFS RPA Adjustments. References to the NMFS BiOp should be considered to include the 2011 NMFS RPA Adjustments. The NMFS BiOp required that Reclamation create the Stanislaus Operations Group (SOG). The SOG is 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 Adjustments, pp. 8-9).

The SOG mission is “to gather and analyze information, and make recommendations, regarding adjustments to water operations within the range of flexibility prescribed in the implementation procedures”⁷ for the Stanislaus River and for the operation of the East Side Division as a unit of the overall CVP which is consistent with all relevant laws, regulations, and standards, including the NMFS BiOp. Reclamation maintains its authority and responsibility for operations of the East Side Division complex. The SOG provides operational advice to NMFS and WOMT but has no authority in operational decisions. NMFS considers advice from SOG when making a final determination as to whether or not a proposed operational action is consistent with obligations to the NMFS BiOp and Endangered Species Act.

⁴ PL 78–534 and PL 87-874

⁵ The NMFS BiOp is 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

⁶ The 2011 NMFS RPA adjustments are available online at:

http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/040711_ocap_opinion_2011_amendments.pdf

⁷ 2011 NMFS RPA Adjustments at p. 7.

1.3 Membership

The SOG member agencies during WY 2017 included:

- Reclamation
- USFWS
- NMFS
- CDFW
- California Department of Water Resources (CDWR)
- SWRCB

CHAPTER 2 SUMMARY OF ACTIONS AND SOG DISCUSSIONS

SOG monthly meetings for WY 2017 consisted of:

2.1 Monthly Discussion Topics

- Water operations at Goodwin Dam;
- Water quality [temperatures at Orange Blossom Bridge (OBB) and Knights Ferry (KF), occasionally dissolved oxygen (DO) at Ripon];
- Stanislaus RPA Actions (2011 NMFS RPA Adjustments at pages 46-55);
- Stanislaus River Forum update;
- Fish monitoring; and
- Restoration.

2.2 Other Discussion Topics

Additional substantive issues reviewed by SOG during WY 2016 include:

2.2.1 Advice on implementation of the pulse flows in Action III.1.3

- Fall Attraction Flows – see details in advice provided in Appendix A.
- Winter Instability Flows – see details in advice provided in Appendix B.
- Spring Pulse Flow – see details in advice provided in Appendix C.

2.2.2 Storage Management and Flood Control Releases

In January and February of 2017, Reclamation increased releases from Goodwin on multiple occasions to manage the storage at Tulloch Reservoir. Releases during this period peaked at 2,465 cfs on January 12, 2017. In March and April, releases were increased to manage storage at New Melones. On April 26, 2017, New Melones entered flood control operations, with releases peaking at 5,000 cfs from May 11-27th. Storage management releases in excess of the BiOp Appendix 2-E flows continued throughout the summer. On September 6, 2017, flows were reduced to 400 cfs to allow in-water work at the Buttonbush restoration site and to complete maintenance of the weir near Riverbank. The flows remained at 400 cfs until the fall pulse started in early October.

2.3 Implementation of RPA Actions in WY2016

2.3.1 RPA Action III.1.2 - Temperature Management

This RPA action requires 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.

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- **October 17⁸ to December 31: 7 day average daily maximum (7DADM) not to exceed 56°F at Orange Blossom Bridge (OBB)** (measured at CDEC station OBB). The 56°F temperature criterion at OBB in the fall is intended to provide temperatures suitable for adult CV steelhead migration and holding. The NMFS BiOp states, “This criterion shall apply as of October 1 or as of initiation date of fall pulse flow as agreed to by NMFS.” Based on SOG’s final decision to implement the “Alternative B” fall pulse flow schedule for WY 2017 (as modified with augmented releases by the local irrigation districts), the associated initiation date of the fall temperature criterion was October 17, 2017 (see details in Appendix A).
 - **January 1 to May 31: 7DADM not to exceed 55°F at Orange Blossom Bridge** (measured at CDEC station OBB) **or 52°F at Knights Ferry (KF).** The 55°F temperature criterion at OBB is for steelhead spawning and incubation. The 52°F at KF is for steelhead smoltification
 - **June 1-September 30: 7DADM not to exceed 65°F at OBB** (measured at CDEC station OBB). The 65°F temperature criterion at OBB is for steelhead juvenile rearing.

Temperature criteria and water temperatures during WY 2017 are summarized in Chapter 4 Figures 3-3 and 3-4.

2.3.2 RPA Action III.1.3 - Flow Management

This RPA action requires Reclamation to provide minimum instream flows in the Stanislaus River according to the New Melones year type specific minimum flow schedules in Appendix 2-E of the NMFS BiOp.

2.3.2.1 Fall Pulse Flow

The fall attraction flow is one component of the daily flow schedule required. As stated in the 2011 RPA Adjustments, the fall attraction flow is intended “...to improve in-stream conditions sufficiently to attract CV steelhead to the Stanislaus River.” The RPA action further notes that “...based upon the advice of SOG and 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.”

⁸The NMFS BiOp states, “This criterion shall apply as of October 1 or as of initiation date of fall pulse flow as agreed to by NMFS.” SOG recommended a start date of October 17th for WY 2017; see details in Appendix A.

At the September SOG meeting, SOG members reviewed the three-peak flow schedule implemented in fall of 2015 and agreed to implement a similar three-peak schedule in 2016. All reshaped flow schedules (Figure 2-1) have the same volume (23,207 AF) as the Critical fall pulse in Appendix 2-E. All of the schedules reshape the fall pulse volume into a three-peak release that provides 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 of 1,200 cfs for “Alternative A” and “Alternative B” and 1,300 cfs for “Alternative C” were comparable to the peak sustained flow of 1,250 cfs in the default 2-E flow schedule. The technical team believed all of the schedules met the intent of the RPA action, namely, improving instream conditions and providing an attraction cue for adult salmonids returning to spawn.

SOG members also agreed to design three timing alternatives – one with the first major peak in early October, one with the first major peak in mid-October (similar to the initiation timing of the Appendix 2-E schedule), and another with the first major peak in late October. All alternatives extended the pulse flow into November; SOG expected that the higher-than-base flows would help to buffer water temperatures during the seasonal transition to cooler air temperatures.

NMFS approved the Fall Pulse Advice on September 30, 2017, and allowed SOG to choose the preferred alternative that best fit real-time conditions (weather forecasts, water temperatures, and weir counts). On October 11, 2017, SOG chose to implement Alternative B, with the schedule slightly modified to incorporate an additional 16 TAF of releases (above the 2-E volume) by Oakdale Irrigation District and South San Joaquin Irrigation District (Figure 2-2).

The full rationale for the shaping and timing of the fall pulse flow and augmented releases, including a discussion of stakeholder input received at the Stanislaus River Forum, are provided in Appendix A. Actual fall pulse flow implementation is shown in Figure 3-2 in Chapter 3.

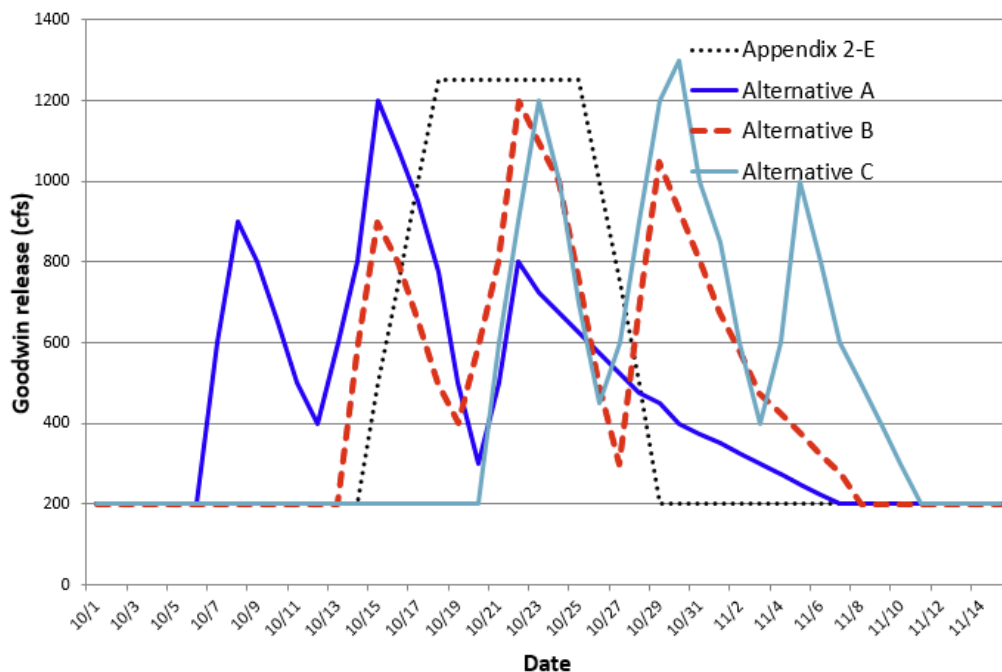


Figure 2-1. Stanislaus fall pulse flow schedules considered by SOG for October - November 2016. SOG advised, and NMFS approved, implementation of the “Alternative B” pulse flow schedule, which was later modified to incorporate an additional 16 TAF of water from the local irrigation districts.

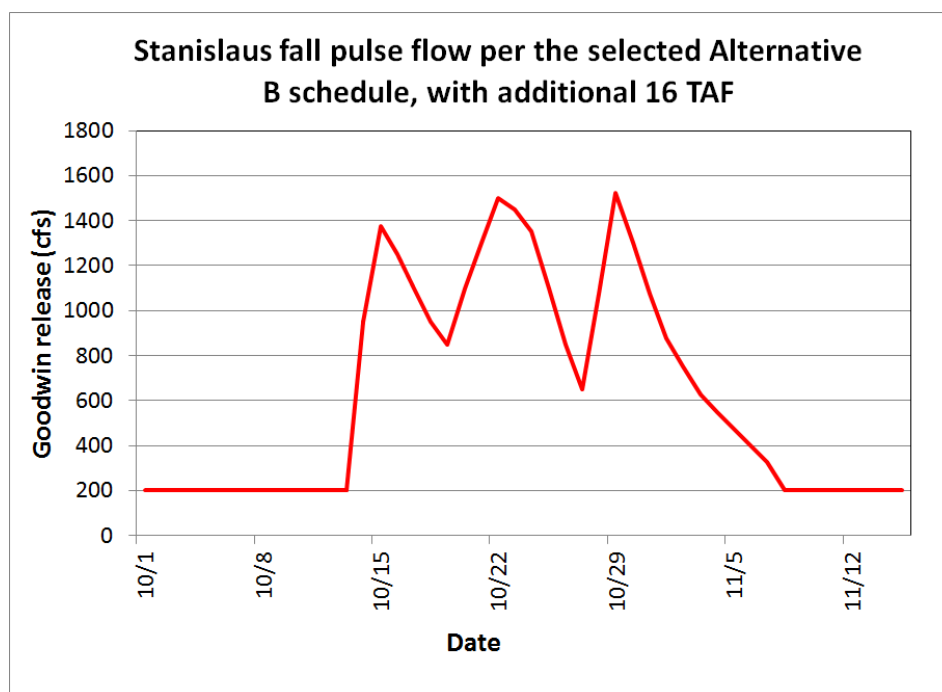


Figure 2-2. Stanislaus fall pulse flow per the selected Alternative B schedule modified to include the 16 TAF of augmented releases.

2.3.2.2 Winter Instability Flows

Winter instability flows in January and February are another component of the daily flow schedule in Appendix 2-E required per Action III.1.3 of the RPA in the NMFS BiOp. The winter instability flows are intended "...to simulate natural variability in the winter hydrograph and to enhance access to varied rearing habitats" (2011 RPA Amendments p. 50). The RPA further states (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."

For January and February 2017, SOG advised, and NMFS approved, that the winter instability flows be reshaped to mimic a natural storm pulse(including a higher peak) and be moved to coincide with a natural storm event (or scheduled to be initiated by the end of each calendar month if no rainfall event occurs). Both the January and February WIFs (based on the Critical yeartype schedule, 793 AF in addition to the 200 cfs base flow) were satisfied by Goodwin flood releases to manage side flows into Tulloch Reservoir. Full details are provided in Appendix B.

2.3.2.3 Spring Pulse Flow

The spring pulse flows identified in Action III.1.3 are intended to serve multiple purposes. Spring pulse flows provide outmigration flow cues to enhance likelihood of anadromy. The late spring flows help with conveyance and maintenance of downstream migratory habitat quality. The 2011 NMFS BiOp Amendments further note (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."

In WY 2017, SOG advised that the spring pulse flow be reshaped into "Alt-A" which includes multiple smaller pulses to maximize opportunities for a broader range of salmonid outmigration and provides inundation of shallow-water habitat and temperature buffering into June (see Figure 2-3; details in Appendix C).

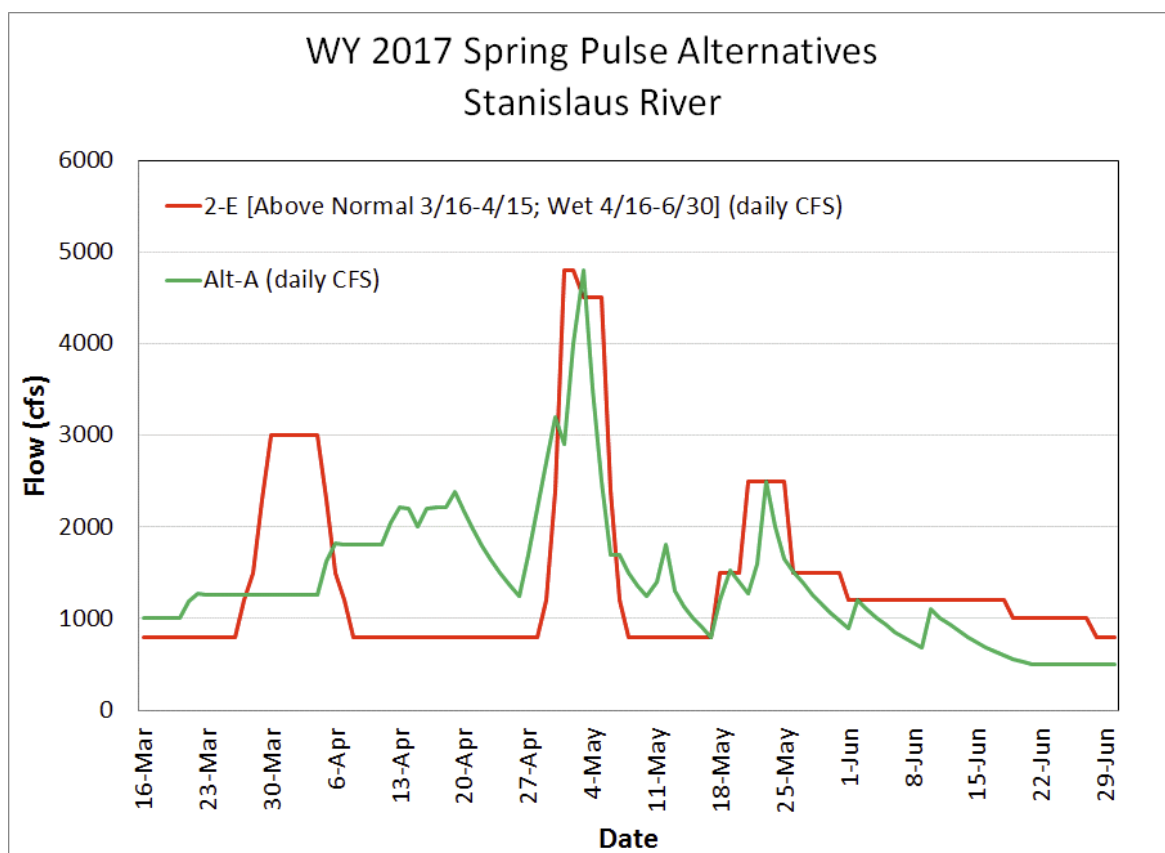


Figure 2-3. Spring pulse flow schedule considered by SOG. SOG advised and NMFS approved the “Alt A” shaping. The Alt-A schedule was advised by SOG in late April, so most of the April flows in Alt-A represent actual Goodwin releases.

During WY 2017, the Stanislaus year type, based on the New Melones Index, changed to Above Normal based on the March forecast, and to Wet based on the April forecast. Given the changing year type during the spring pulse flow period, SOG needed a water accounting framework to determine the water volume required by Appendix 2-E. Because the year type is generally updated mid-month based on the snow surveys completed early in the month, SOG calculated the total required instream flow volume for the March 16-June 30 period based on the default flow schedule in Appendix 2-E from the 16th of Month A to the 15th of Month B, based on the yeartype determined by the Month A forecast, as follows:

Date range	Stanislaus yeartype (Month of forecast)	Water volume in default schedule in Appendix 2-E (acre-feet)
3/16/17-4/15/17	Above Normal (March)	85,683
4/16/17-5/15/17	Wet (April)	93,418
5/16/17-6/15/17	Wet (May)	90,443
6/15/17-6/30/17	Wet (June)	29,751
	Total:	299,295

Flows during the spring pulse did not match the SOG shaping due to flood control conditions (described above in section 2.2.1 *Storage Management and Flood Control Releases*; see Figure 2-4). Since the flows were above the Appendix 2-E flow schedule, this release was technically not under SOG’s purview, but SOG did provide comments to Reclamation on SOG’s preferred shaping of the release in its April advice (Appendix C).

WY 2017 Spring Pulse Stanislaus River

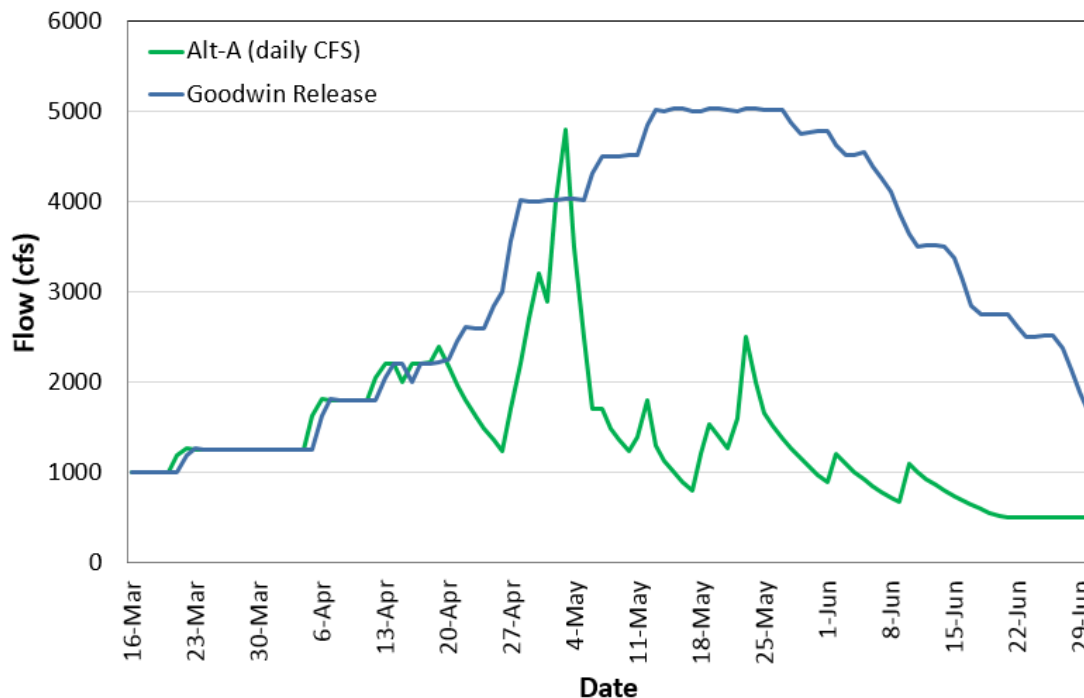


Figure 2-4. Comparison of the SOG-advised Alt-A spring pulse flow schedule and actual Goodwin releases in WY 2017.

2.3.3 RPA Action Suite III.2 - Habitat Restoration

The NMFS BiOp includes a suite of four habitat restoration RPA actions⁹ to improve habitat for spawning, rearing, and migrating CV steelhead:

- **RPA Action III.2.1** -- Gravel augmentation
- **RPA Action III.2.2** -- Conduct Floodplain Restoration and Inundation Flows
- **RPA Action III.2.3** -- Restore Freshwater Migratory Habitat for Juvenile Steelhead by Implementing Projects to Increase Floodplain Connectivity and to Reduce Predation Risk During Migration
- **RPA Action III.2.4** -- Evaluate Fish Passage at New Melones, Tulloch, and Goodwin Dams

⁹ 2011 NMFS RPA Adjustments at pages 53-55. The 2011 NMFS RPA Adjustments are available online at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Operations,%20Criteria%20and%20Plan/040711_ocap_opinion_2011_amendments.pdf

A summary of completed (since 2009) and potential habitat restoration projects relevant for the objectives of RPA Actions III.2.1, III.2.2, and III.2.3 is provided in Table 2-1. SOG expects that RPA Action III.2.4, which calls for an evaluation of fish passage at New Melones, Tulloch, and Goodwin Dams, is being addressed by the Interagency Fish Passage Steering Committee.

Table 2-1. Completed (since 2009) and potential habitat restoration actions on the Stanislaus River relevant for the objectives of RPA Actions III.2.1, III.2.2, and III.2.3

Recovery action	Project extent
COMPLETED gravel augmentation projects (for spawning habitat at all locations; some gravel placed at the cable crossing in Goodwin Canyon intended for mobilization and downstream placement by river flows)	
Goodwin Canyon at cable crossing – 2011	3,333 cubic yards
Goodwin Canyon at float tube pool – 2012	2,000 cubic yards
Goodwin Canyon at cable crossing – 2015	5,333 cubic yards
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
COMPLETED floodplain & side-channel restoration (for improved rearing habitat, improved migratory habitat, improved connectivity to avoid stranding)	
Lancaster Road side-channel -- 2011	640 linear feet of side-channel and 2 acres of floodplain habitat
Side-channel improvement at Honolulu Bar to reduce stranding risk – 2012	
Floodplain at Honolulu Bar, including clearing on non-native vegetation and planting of native riparian vegetation – 2012	2.4 acres
Buttonbush	4.4 acres of side-channel and floodplain habitat and 2,400 linear feet of side-channel habitat.
POTENTIAL Projects	
Two Mile Bar	<i>Anticipated gravel:</i> 6,000 cubic yards.
Horseshoe Recreation Area	<i>Anticipated gravel:</i> 6,000 cubic yards
Valley Oak Recreation Area	<i>Anticipated gravel:</i> 3,000 cubic yards
Rodden Road	<i>Anticipated habitat and gravel:</i> Acres of habitat and volumes of gravel are yet to be determined.

Goodwin Canyon	<i>Anticipated gravel:</i> The 2009 NMFS BiOp requires 50,000 cubic yards by 2014 (extension has been granted; including the 2015 augmentation in Goodwin Canyon, total augmentation through 2017 is 21,504 cy), and 8,000 cubic yards per year thereafter. The 8,000 cubic yards /year rate was achieved in 2012 during the Honolulu Bar restoration work.
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CHAPTER 3 WATER OPERATIONS SUMMARY

This chapter describes Stanislaus River operations for water year 2017, pertaining to RPA Actions III.1.2 and III.1.3. These actions are presented in reverse order for clarity.

3.1 Action III.1.3 – Flow Management

Figure 3-1 summarizes New Melones Reservoir operations during WY 2017.

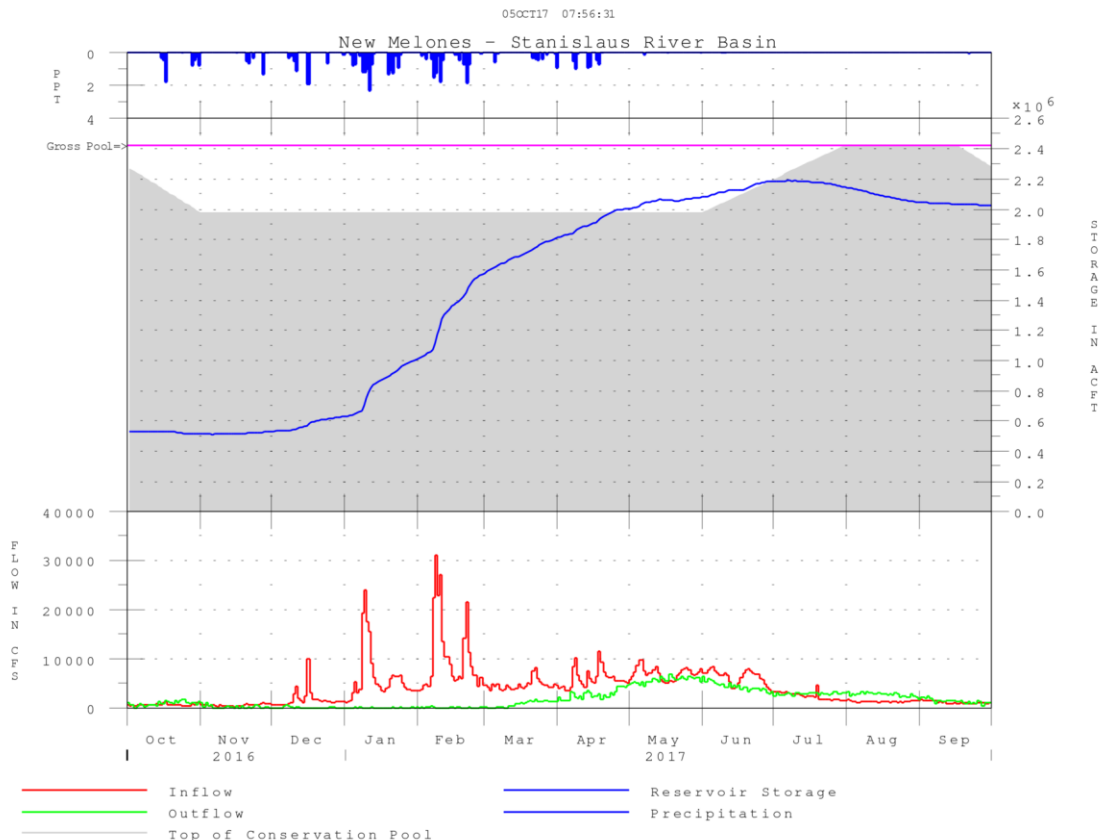


Figure 3-1. Summary of New Melones Reservoir Operations during the 2017 water year.

The 2017 WY classifications for determining Appendix 2-E minimum flows, based on the New Melones Index, were as follows in Table 3-1 (the New Melones Index is the sum of end-of-February storage and forecasted inflows for March through September). Per agreement (SOG meeting notes from February 17, 2010), the New Melones Index was calculated by using the Interim Plan of Operations methodology which uses the 90% exceedance forecast for any forecasted elements of the index¹⁰.

¹⁰ For more information on this methodology, see Appendix C of the WY 2010 SOG Annual Report, available at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/Stanislaus%20Operations%20Grop/2010_sog_annual_report.pdf

Table 3-1. Water Year Classification by Month during WY 2017

Month	Water Year Classification
October	Critically Dry
November	Critically Dry
December	Critically Dry
January	Critically Dry
February	Below Normal
March	Above Normal
April	Wet
May	Wet
June	Wet
July	Wet
August	Wet
September	Wet

3.2 Stanislaus River Operations:

In October and November, releases were made based on the Fall Pulse flow, which was implemented according to the September SOG advice (Appendix A). In January and February of 2017, Reclamation increased releases from Goodwin on multiple occasions to manage the storage at Tulloch Reservoir. Releases peaked at 2,750 cfs on January 11, 2017. In March and April, releases were made to manage storage at New Melones. On April 26, 2017, New Melones entered flood control operations, where releases peaked at 5,000 cfs from May 11-27th. Storage management releases in excess of the BiOp Appendix 2-E flows continued throughout the summer. On September 6, 2017, flows were reduced to 400 cfs to allow in-water work at the Buttonbush restoration site and maintenance of the weir near Riverbank. The flows remained at 400 cfs until the fall pulse started in early October.

Goodwin Reservoir releases to the Stanislaus River are shown in Figure 3-2, including the primary reasons for those releases. Appendix D contains a summary of release changes from Goodwin Reservoir indicating the purpose of the operational change.

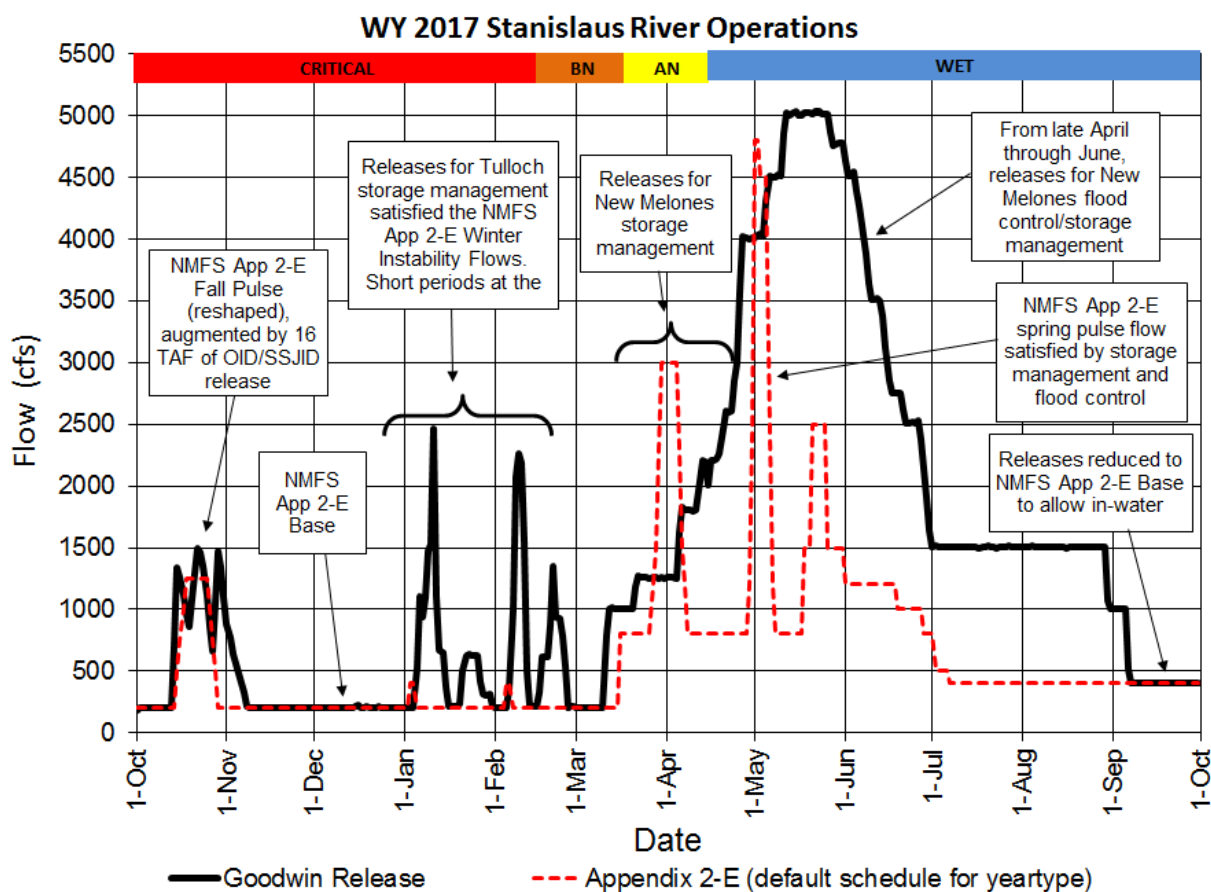


Figure 3-2. Summary of Stanislaus River releases at Goodwin Dam during WY 2017. Boxes identify the controlling requirements, the band at the top indicates the changes in yeartype (based on the New Melones Index) throughout the year from Critical, to Below Normal, to Above Normal, to Wet.

3.3 Action III.1.2 - Temperature Management

Figure 3-3 is a summary of temperature operations from October 2016 through September 2017. Figure 3-4 is the same summary with average air temperature at Modesto, CA added to the graph¹¹.

¹¹ The summary with air temperature was plotted on a separate graph since the increased range of the temperature axis made the Orange Blossom Bridge and Knights Ferry water temperature data more difficult to distinguish.

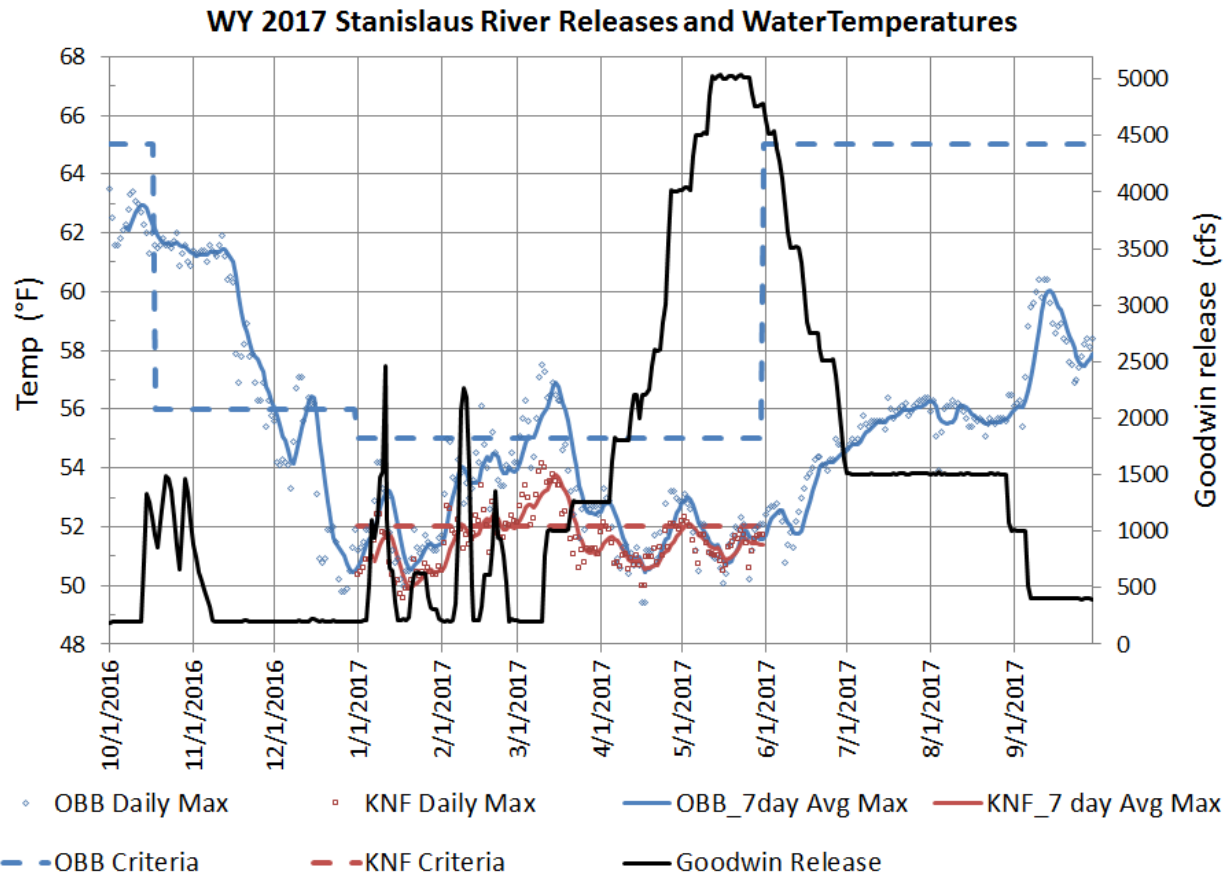


Figure 3-3. Summary of releases at Goodwin Dam and water temperatures at Orange Blossom Bridge (measured) and Knights Ferry (estimated) during WY 2017. The 7DADM targets are per Action III.1.2 in the NMFS BiOp. Goodwin Dam release data from CDEC station “GDW”. Orange Blossom Bridge temperatures from CDEC station “OBB”.

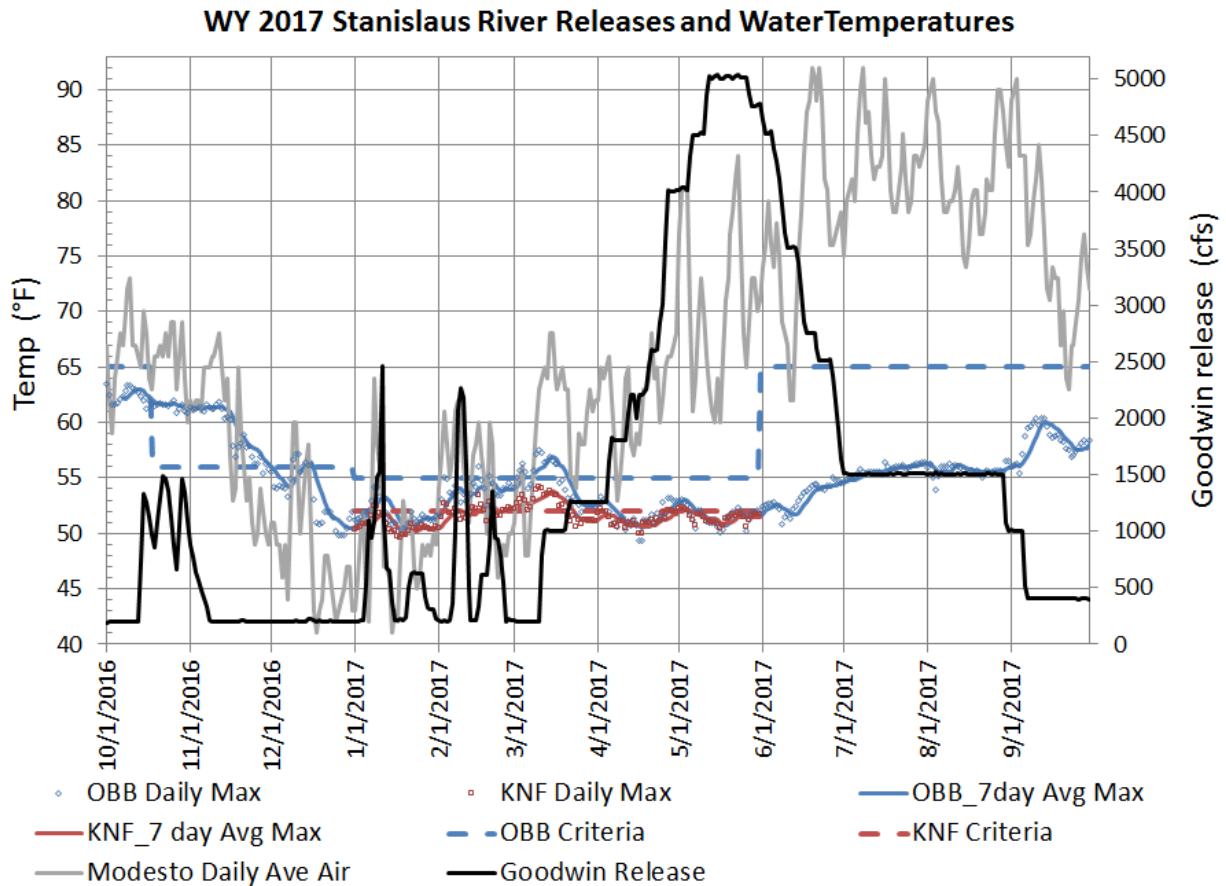


Figure 3-4. Summary of releases at Goodwin Dam, water temperatures at Orange Blossom Bridge (measured) and Knights Ferry (estimated), and average daily air temperature at Modesto, CA during WY 2017. The 7DADM targets are per Action III.1.2 in the NMFS BiOp. Goodwin Dam release data from CDEC station “GDW”. Orange Blossom Bridge temperatures from CDEC station “OBB”. Average daily air temperature at Modesto from KMOD station at www.wunderground.com.

3.4 Summary of Water Year 2017 NMFS BiOp RPA Action III.1.2 Exceptions

RPA Action III.1.2 describes suitable temperatures for CV steelhead life stages on the Stanislaus River. The temperature criteria, measured at both OBB and Knights Ferry, are based on a 7-day average daily maximum temperature (7DADM). 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 blending 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 conflicts with Reclamation's obligations served by New Melones Reservoir storage and the desire to preserve cold water for fishery purposes later in the year.

The NMFS RPA provides a temperature exception procedure which requires Reclamation to notify NMFS if the temperature requirement is expected to be exceeded based on a three-day average daily maximum. Reclamation is also required to provide an evaluation of the conditions and identify conflicts with Reclamation's nondiscretionary requirements. The temperature exceptions in WY 2017 (see

Figure 3-3) were noted and discussed within SOG. In spite of elevated flows for a fishery pulse, temperatures exceeded the OBB criterion in the fall. The Knights Ferry temperature criterion had some minor exceedances in February (less than half a degree), and was exceeded for most of March (the maximum 7DADM was 53.8°F on March 15, 2017). The OBB temperature criterion was exceeded for 10 days in mid-March.

CHAPTER 4 SUMMARY OF SELECTED STANISLAUS FISH MONITORING DATA

Monitoring data from the Stanislaus River are summarized below for both fall-run Chinook salmon (*Oncorhynchus tshawytscha*) and *O. mykiss* (when data is present). The location of monitoring sites is shown in Figure 4-1.

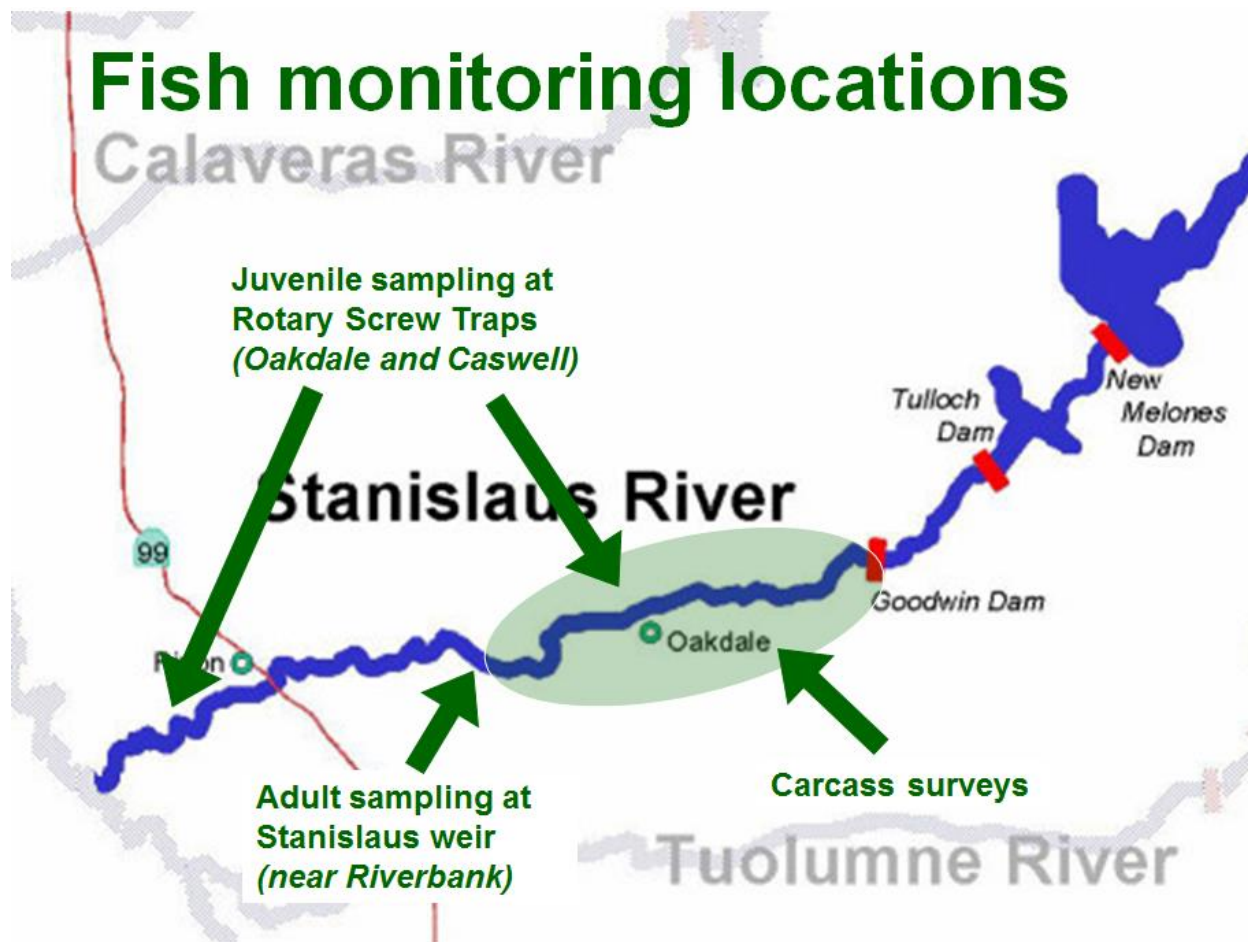


Figure 4-1. Location of fish monitoring efforts on the Stanislaus River

The California Department of Fish & Wildlife (CDFW) began conducting fall-run Chinook carcass and redd surveys the week of 10/3/16 and completed surveys in early January. Through the week of 1/2/17, CDFW observed 5538 redds on the Stanislaus River. The preliminary Stanislaus River escapement estimate for brood year 2016 fall-run Chinook salmon based on the CDFW carcass survey (reported in the 4/7/17 GrandTab) was 9,330.

The Districts' and Tri-Dam Project fund Fishbio to conduct adult weir monitoring near Riverbank (approximately river mile 31) and juvenile rotary screw trap monitoring near Oakdale (approximately river mile 40). Monitoring at the weir near Riverbank (for upstream passage of adult salmonids) began for the season on 9/8/16. The net upstream passage of Chinook salmon through 1/5/17 was 14,382 (26% were ad-clipped, indicating a hatchery origin). The net upstream passage through 1/5/17 of *Oncorhynchus mykiss* was 25. Seventeen of the 25 *O. mykiss* were greater than 16 inches (indicating that are likely anadromous rather than resident adults); fourteen of the 25 (56%) had a clipped adipose fin (indicating that are of hatchery origin).

The weir operations were suspended on 1/5/17 in expectation of flows higher than the operational limits of the weir, resumed on 3/1/17, and were again suspended after 3/17/17 in expectation of high flows. Two Chinook salmon and one *O. mykiss* were observed passing upstream between 3/1/1 and 3/17/17. Seasonal totals for the 9/8/16 through 3/17/17 period (with sampling gap 1/6/17-2/29/17 due to high flows) were 14,385 fall-run Chinook salmon (26% were ad-clipped) and 26 *O. mykiss* (18 of which were greater than 16 inches, fourteen of which (54%) had a clipped adipose fin). Figure 4-4 and 4-5 show daily net upstream passage of Chinook and *O. mykiss* over the sampling period. The Chinook return of 14,385 was the highest passage observed since the weir sampling began in 2003 (Table 4-1).

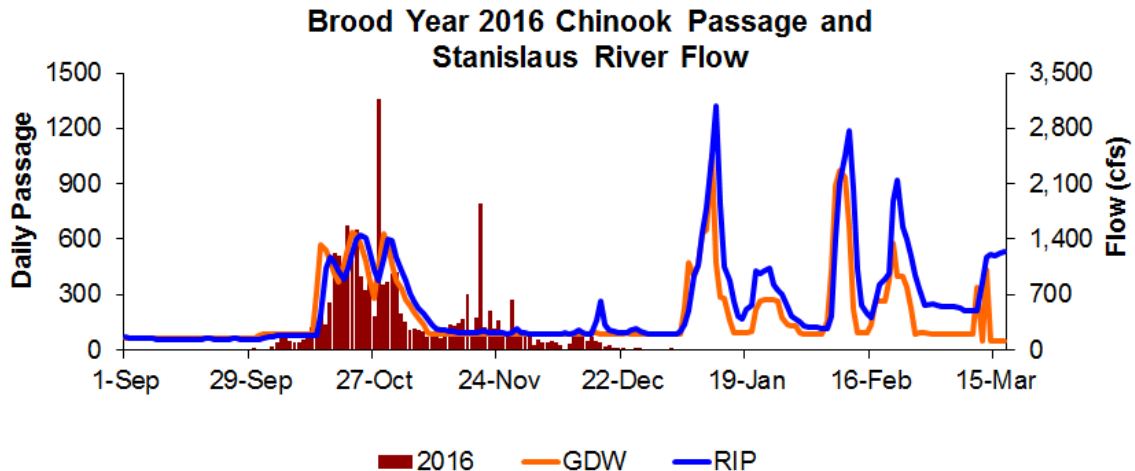


Figure 4-2. Daily upstream passage of adult Chinook salmon at the Stanislaus River Weir and flow at Goodwin Dam (GDW) and Ripon (RIP) from 9/8/16 to 3/17/16 (with sampling gap 1/6/17-2/29/17 due to high flows). Figure provided by FISHBIO in their 3/23/17 Stanislaus weir update.

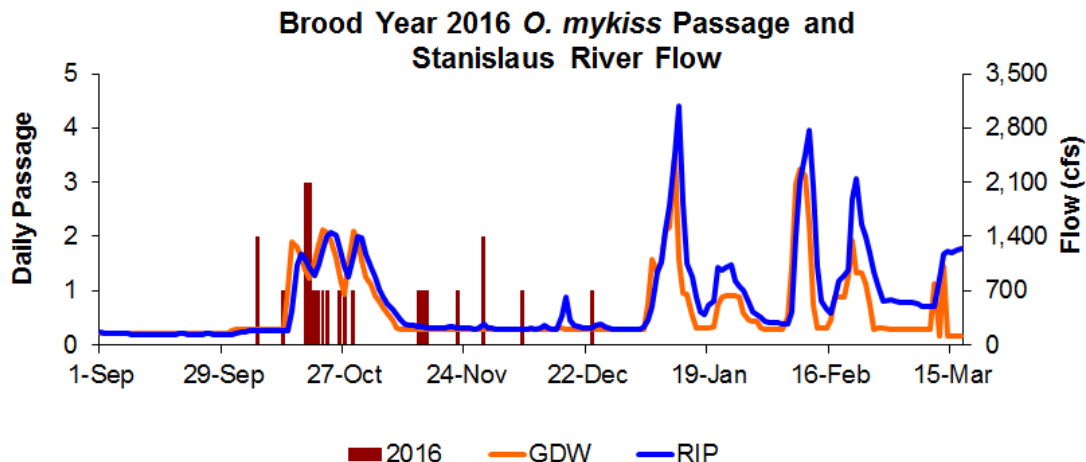


Figure 4-3. Daily upstream passage of *O. mykiss* at the Stanislaus River Weir and flow at Goodwin Dam (GDW) and Ripon (RIP) from 9/8/16 to 3/17/16 (with sampling gap 1/6/17-2/29/17 due to high flows). Data provided by FISHBIO in their 3/23/17 Stanislaus weir update.

Table 4-1: Cumulative net upstream passage of Chinook salmon at the Stanislaus weir near Riverbank (~ river mile 31) through early January since the weir was first installed in 2003. Data courtesy of Fishbio.

Brood Year	Monitoring Start date	Net Passage (Start date to 1/5)	Seasonal Total
2016	9/8/2016	14383	14385
2015	9/15/2015	12658	12703
2014	9/5/2014	5424	5436
2013	9/3/2013	5439	5460
2012	9/11/2012	7133	7248
2011	11/8/2011	761	818
2010	9/7/2010	1361	1363
2009	9/9/2009	1259	1303
2008	9/9/2008	923	923
2007	9/22/2007	408	408
2006	9/8/2006	3039	3056
2005	9/8/2005	4121	4121
2004	9/10/2004	4407	4408
2003	9/5/2003	4840	4848

Rotary screw trap monitoring of outmigrating juvenile salmonids began at Oakdale (~river mile 40, monitoring conducted by Fishbio) in early January and at Caswell (~ river mile 9, monitoring conducted by the Pacific States Marine Fisheries Commission) in early February. Chinook catch at these sampling locations through June 12 is summarized in Figures 4-4 and 4-5.

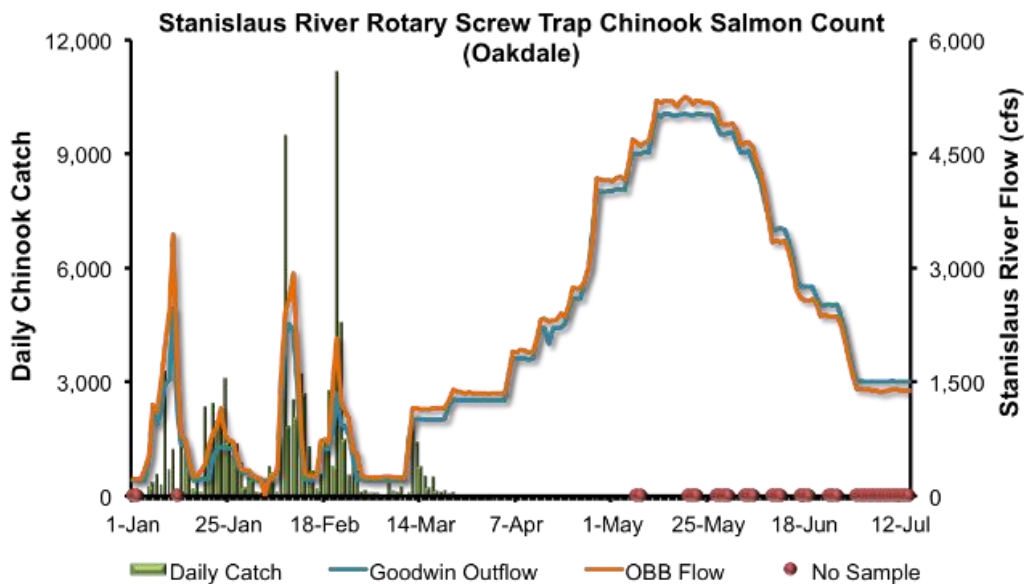


Figure 4-4. Daily catch of outmigrating juvenile Chinook salmon at the Stanislaus River rotary screw trap at Oakdale and flow at Goodwin Dam (GDW) and Orange Blossom Bridge (OBB) for January to June 2017. Figure provided by FISHBIO in their 6/13/17 San Joaquin Basin Update.

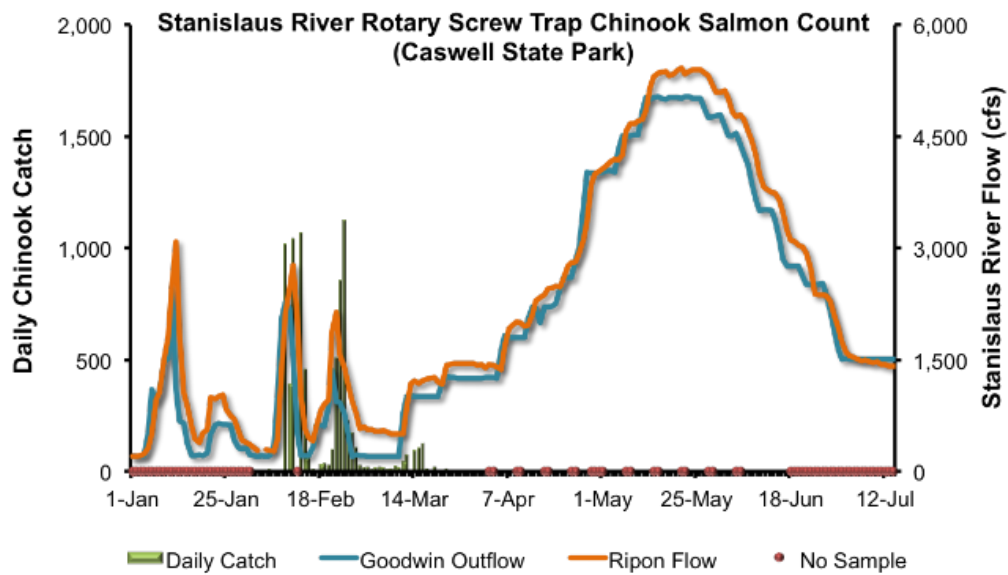


Figure 4-5. Daily catch of outmigrating juvenile Chinook salmon at Caswell and daily average flow (cfs) at Goodwin Dam (GDW) and Ripon (RIP) for February to June 2017. Figure provided by FISHBIO in their 6/13/17 San Joaquin Basin Update.

CHAPTER 5 REFERENCES

- 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. 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. April 7.
http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocap.html

Appendix A—SOG advice on fall pulse flow

Revised Alternative B flow schedule: A-4

Original SOG advice: A-5 to A-12



Barbara Byrne - NOAA Federal <barbara.byrne@noaa.gov>

Re: NMFS determination RE: SOG Advice - Fall Pulse Flow and Temperature

1 message

White, Kristin <knwhite@usbr.gov>

Tue, Oct 11, 2016 at 12:00 PM

To: Garwin Yip - NOAA Federal <garwin.yip@noaa.gov>

Cc: Elizabeth G' Kiteck <EKiteck@usbr.gov>, "Milligan, Ronald E" <RMilligan@usbr.gov>, Jeffrey Rieker <jrieker@usbr.gov>, DREW LESSARD <dlessard@usbr.gov>, Lee Mao <Imao@usbr.gov>, "Mary (Catherine) Blackwell" <mblackwell@usbr.gov>, Barbara Byrne <Barbara.Byrne@noaa.gov>, Thomas Patton <tpatton@usbr.gov>, "Washburn, Thuy T" <TWashburn@usbr.gov>, "Brycen.Swart@noaa.gov" <Brycen.Swart@noaa.gov>, "Bahls, Amanda" <abahls@usbr.gov>

Garwin -

The Stanislaus Operation Group (SOG) has chosen to implement the Alternative B schedule for the Stanislaus fall pulse flow. The pulse flow in Alternative B begins October 14th. In addition, SOG has recommended a flow schedule to implement an additional 16 TAF that will be released from OID and SSJID in the same time frame. This 16 TAF is above the 2-E schedule, but is incorporated into the final flow schedule (attached).

Due to the selection of the Alternative B flow schedule with the augmented release, the temperature criterion at Orange Blossom Bridge of 56°F will begin on the 17th of October. Please let me know if there are any questions regarding this decision.

Kristin White, PE*

Water Resources Branch Chief

U.S. Bureau of Reclamation, Mid-Pacific Region

Ph: [916-989-7226](tel:916-989-7226) (Central California Area Office)

*Inactive

On Fri, Sep 30, 2016 at 12:41 PM, Garwin Yip - NOAA Federal <garwin.yip@noaa.gov> wrote:

Kristin,

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 2016, the fall attraction flow may be reshaped according to any of the three alternative flow schedules (A, B or C) 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 understands that because of uncertainty about temperature conditions and migration timing in October, SOG expects to advise implementation of the Alternative B schedule but requests the flexibility to instead advise the Alternative A or Alternative C schedule. This flexibility is granted. NMFS requests that SOG report back to NMFS and WOMT via e-mail on the specific pulse schedule as soon as determined, at least three days before a change in flow, and no later than October 18,

NMFS also concurs with the advice to shift the initiation date for the fall temperature criterion at Orange Blossom Bridge to the third day after the reshaped fall pulse flow reaches 800 cfs (October 11, 18, or 25, depending on whether SOG advises implementation of Alternative A, B, or C) and determines that the proposed initiation window for the fall temperature criterion is consistent with 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

Water Operations and Delta Consultations Branch Chief
NOAA Fisheries West Coast Region
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----- Forwarded message -----

From: **White, Kristin** <knwhite@usbr.gov>

Date: Thu, Sep 29, 2016 at 10:25 AM

Subject: SOG Advice - Fall Pulse Flow and Temperature

To: Garwin Yip <Garwin.Yip@noaa.gov>

Cc: ELIZABETH KITECK <ekiteck@usbr.gov>, Ronald Milligan <rmilligan@usbr.gov>, Jeffrey Rieker <jriecker@usbr.gov>, DREW LESSARD <dlessard@usbr.gov>, Leeyan Mao <lmiao@usbr.gov>, "Mary (Catherine) Blackwell" <mblackwell@usbr.gov>, Barbara Byrne - NOAA Federal <barbara.byrne@noaa.gov>, Thomas Patton <tpatton@usbr.gov>, Thuy Washburn <twashburn@usbr.gov>, Brycen Swart <brycen.swart@noaa.gov>, Amanda Bahls <abahls@usbr.gov>

Garwin -

Attached is the Stanislaus Operations Group (SOG) advice for implementing the fall pulse flows. As a summary, SOG advises three alternatives to be considered to satisfy the fall pulse flow (Critically Dry year type) in the Appendix 2-E flow schedule with a default of Alternative B.

SOG also advises that the 56°F fall temperature criterion at Orange Blossom Bridge (OBB) required per Action III.1.2 apply on the third day after the reshaped fall pulse flow reaches over 800 cfs.

Reclamation requests concurrence from NMFS on all three pulse alternatives so that SOG may choose the alternative that best fits real-time conditions (weather forecasts and weir counts). NMFS will be notified at least three days before a change in flow. Reclamation also requests concurrence on the initiation date of the fall temperature criterion.

Kristin White, PE*

Water Resources Branch Chief

U.S. Bureau of Reclamation, Mid-Pacific Region

Ph: 916-989-7226 (Central California Area Office)

*Inactive



SOG_FallPulse2016.docx

55K

Alternative B - revised (1500 cap)									
Stanislaus River Minimum Fish Flow Schedule									
Water Year Type: Critically Dry									
		Daily						Cumulative	Cumulative
		Total CFS	Base CFS	Pulse CFS	District CFS	Pulse AF	District AF	Pulse AF	District AF
OCT	10/1	200	200	0		0		0	0
	10/2	200	200	0		0		0	0
	10/3	200	200	0		0		0	0
	10/4	200	200	0		0		0	0
	10/5	200	200	0		0		0	0
	10/6	200	200	0		0		0	0
	10/7	200	200	0		0		0	0
	10/8	200	200	0		0		0	0
	10/9	200	200	0		0		0	0
	10/10	200	200	0		0		0	0
	10/11	200	200	0		0		0	0
	10/12	200	200	0		0		0	0
	10/13	200	200	0		0		0	0
	10/14	950	200	400	350	793	694	793	694
	10/15	1375	200	700	475	1388	942	2182	1636
	10/16	1250	200	600	450	1190	893	3372	2529
	10/17	1100	200	450	450	893	893	4264	3421
	10/18	950	200	300	450	595	893	4860	4314
	10/19	850	200	200	450	397	893	5256	5207
	10/20	1100	200	400	500	793	992	6050	6198
	10/21	1300	200	600	500	1190	992	7240	7190
	10/22	1500	200	1000	300	1983	595	9223	7785
	10/23	1450	200	900	350	1785	694	11008	8479
	10/24	1350	200	800	350	1587	694	12595	9174
	10/25	1100	200	550	350	1091	694	13686	9868
	10/26	850	200	300	350	595	694	14281	10562
	10/27	650	200	100	350	198	694	14479	11256
	10/28	1075	200	500	375	992	744	15471	12000
	10/29	1525	200	850	475	1686	942	17157	12942
	10/30	1300	200	725	375	1438	744	18595	13686
	10/31	1075	200	600	275	1190	545	19785	14231
NOV	11/1	875	200	475	200	942	397	20727	14628
	11/2	750	200	375	175	744	347	21471	14975
	11/3	625	200	275	150	545	298	22017	15273
	11/4	550	200	225	125	446	248	22463	15521
	11/5	475	200	175	100	347	198	22810	15719
	11/6	400	200	125	75	248	149	23058	15868
	11/7	325	200	75	50	149	99	23207	15967
	11/8	200	200	0		0		23207	15967
	11/9	200	200	0		0		23207	15967
	11/10	200	200	0		0		23207	15967
	11/11	200	200	0		0		23207	15967
	11/12	200	200	0		0		23207	15967
	11/13	200	200	0		0		23207	15967
	11/14	200	200	0		0		23207	15967
	11/15	200	200	0		0		23207	15967

**SOG ADVICE RE: IMPLEMENTATION OF THE STANISLAUS RPA ACTIONS
DURING OCTOBER AND NOVEMBER
9/29/2016**

Background

Flow

The fall attraction flow is one component of the daily flow schedule in Appendix 2-E of the NMFS BiOp¹ required per Action III.1.3 of the Reasonable and Prudent Alternative (RPA). As noted in the 2011 RPA Amendments² (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."

Input from stakeholders on preferred rafting conditions

The SOG considered the following preferred rafting conditions and tried to accommodate if doing so was not detrimental to the fishery benefits of the fall pulse flow:

- Preferred rafting flows: 800-1200 cfs, high end of the range preferred. 600-800 cfs is raftable, but not desirable.
- Timing of rafting flows: 10am-4pm on weekends, preferably in October rather than November
- Location of rafting flows: Between Goodwin Dam and Knights Ferry

Coordination with other San Joaquin tributaries

SOG's scope is limited to implementation of the Stanislaus actions in the NMFS BiOp, but SOG does consider other expected flows in the San Joaquin basin when providing advice on BiOp implementation. The final fall pulse schedules for the Tuolumne and Merced were not available for the 9/21/16 SOG meeting, but the pulse flows in those watersheds are expected to be implemented in the mid-October to mid-November time-frame and are likely to at least partially overlap with any of the three fall pulse alternatives in this advice. SOG plans to select a pulse alternative based on Stanislaus conditions (for example, upstream fish passage through the weir

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

near Riverbank, water temperature) and not on the specific Tuolumne and Merced plans for releasing a fall pulse flow.

Coordination regarding potential augmented flows

As this advice was being finalized, Reclamation reported that releases above and beyond the flow requirements in Appendix 2-E might be implemented during October or November. Because the volume and timeframe for the potential augmented flows is not yet certain, SOG did not revise the proposed pulse alternatives to include any augmented flows. If flow augmentation does become a certainty, SOG is willing to provide feedback on how to shape the augmented flow volume.

Below, SOG advises three options for a modified fall attraction flow schedule (for initiation in either early-, mid- or late-October) that we believe are consistent with the intent of RPA actions III.1.3. The proposed flow schedules do accommodate the preferred flows for rafters on at least one October weekend.

SOG advice

Flow

For 2016, SOG advises that the fall attraction flow (Critical yeartype) be reshaped according to the “Alternative A” or “Alternative B” or “Alternative C” flow schedule, with “Alternative B” being the default. “Alternative A” may be selected if temperatures cool off quickly, and “Alternative C” may be selected if temperatures remain warm. SOG will review the weather forecast and weir counts weekly and will notify NMFS and Reclamation of a change in alternative (i.e., a schedule other than Alternative B) at least three days before a change in flow. The alternatives are described in Table 1 and Figure 1 of Attachment 1.

Pulse shaping:

At the 9/21/16 SOG meeting, SOG members reviewed the three-peak flow schedule implemented in fall of 2015 and agreed to implement a similar three-peak schedule in 2016. All reshaped flow schedules have the same volume (23,207 AF) as the Critical fall pulse in Appendix 2-E. All of the schedules reshape the fall pulse volume into a three-peak release that provides flow variability expected to deter spawning at the higher flows that won't be sustained through egg incubation and fry emergence. The maximum daily release of 1,200 cfs for “Alternative A” and “Alternative B” and 1,300 cfs for “Alternative C” are comparable to the peak sustained flow of 1,250 cfs in the default 2-E flow schedule. The technical team believes all of the schedules meet the intent of the RPA action, namely, improving instream conditions and providing an attraction cue for adult salmonids returning to spawn.

Pulse timing:

At the 9/21/16 SOG meeting, SOG members agreed to design three alternatives – one with the first major peak in early October, one with the first major peak in mid-October (similar to the initiation timing of the Appendix 2-E schedule), and another with the first major peak in late October. All alternatives extend the pulse flow into November; SOG

expects that the higher-than-base flows will help to buffer water temperatures during the seasonal transition to cooler air temperatures.

However, because of uncertainty about temperature conditions in October, SOG requests that NMFS approve implementation of any of the schedules, with the choice of alternative to be made by SOG in early or mid-October, based on early or mid-October water quality conditions (*e.g.*, water temperatures and dissolved oxygen) and fish monitoring data (*e.g.*, observed salmonid passage at the weir, carcass survey data). SOG did not identify specific conditions for implementation of either alternative, but discussed some qualitative considerations. For example, SOG is unlikely to choose implementation of the earlier “Alternative A” schedule unless water temperatures cool considerably, or fish passage through the weir increases considerably, during the beginning of October.

Because of scheduling at New Melones, Reclamation needs advance notice to implement the selected schedule. Flow increases for a Friday (all pulse alternatives begin on a Friday) must be scheduled by Reclamation no later than 10am on Wednesday of the same week. To allow Reclamation time to prepare the schedule, SOG would need to advise the “Alternative A” schedule no later than 10/4/15 (for a 10/7/16 start), the “Alternative B” schedule no later than 10/11/15 (for a 10/14/16 start), or the “Alternative C” schedule not later than 10/18/16 (for a 10/21/16 start).

The full list of considerations discussed by SOG at the 9/21/16 meeting is summarized in Table 2 of Attachment 1.

Temperature

For 2016, SOG advises that the fall temperature criterion of 56°F at Orange Blossom Bridge (OBB) apply on the third day after the reshaped fall pulse flow reaches 800 cfs.

Using this approach, the fall temperature criterion initiation date would be 10/11/16 (Alternative A), 10/18/16 (Alternative B), or 10/25/16 (Alternative C). 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. The net upstream cumulative count of fall-run Chinook counted at the Stanislaus Weir from 9/8/2016 through 9/25/2016 is just 5 fish, and no CV steelhead have yet been observed this fall at the weir. These data provide no clear indication of “early migration” of salmonids into the watershed which might require temperature management to begin on October 1.

From 9/15/16 to 9/25/16, daily maximum temperatures measured at OBB³ have ranged between 63.6°F and 67.2°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 9/25/2016 was 65.5°F. Because of progressively shorter day length and cooler night temperatures, SOG expects that water temperatures will start 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 attraction flow schedule advised
by SOG for October-November 2016

Table 1. Stanislaus fall pulse flow schedules considered by SOG for October-November 2016. SOG advised that “Alternative A” or “Alternative B” or “Alternative C” pulse be implemented rather than the Appendix 2-E schedule, with the alternative to be selected by SOG in early or mid-October based on observed conditions. The pulse volume was calculated against a base flow of 200 cfs. The darker blue cells indicate weekend days.

Appendix 2-E							Alternative A						
Stanislaus River Minimum Fish Flow Schedule							Stanislaus River Minimum Fish Flow Schedule						
Water Year Type: Critically Dry							Water Year Type: Critically Dry						
		Daily				Cumulative			Daily				Cumulative
		Total CFS	Base CFS	Pulse CFS	Pulse AF				Total CFS	Base CFS	Pulse CFS	Pulse AF	
OCT	10/1	200	200	0	0	0	OCT	10/1	200	200	0	0	0
	10/2	200	200	0	0	0		10/2	200	200	0	0	0
	10/3	200	200	0	0	0		10/3	200	200	0	0	0
	10/4	200	200	0	0	0		10/4	200	200	0	0	0
	10/5	200	200	0	0	0		10/5	200	200	0	0	0
	10/6	200	200	0	0	0		10/6	200	200	0	0	0
	10/7	200	200	0	0	0		10/7	600	200	400	793	793
	10/8	200	200	0	0	0		10/8	900	200	700	1388	2182
	10/9	200	200	0	0	0		10/9	800	200	600	1190	3372
	10/10	200	200	0	0	0		10/10	650	200	450	893	4264
	10/11	200	200	0	0	0		10/11	500	200	300	595	4860
	10/12	200	200	0	0	0		10/12	400	200	200	397	5256
	10/13	200	200	0	0	0		10/13	600	200	400	793	6050
	10/14	200	200	0	0	0		10/14	800	200	600	1190	7240
	10/15	500	200	300	595	595		10/15	1200	200	1000	1983	9223
	10/16	750	200	550	1091	1686		10/16	1075	200	875	1736	10959
	10/17	1000	200	800	1587	3273		10/17	950	200	750	1488	12446
	10/18	1250	200	1050	2083	5355		10/18	775	200	575	1140	13587
	10/19	1250	200	1050	2083	7438		10/19	500	200	300	595	14182
	10/20	1250	200	1050	2083	9521		10/20	300	200	100	198	14380
	10/21	1250	200	1050	2083	11603		10/21	500	200	300	595	14975
NOV	10/22	1250	200	1050	2083	13686		10/22	800	200	600	1190	16165
	10/23	1250	200	1050	2083	15769		10/23	725	200	525	1041	17207
	10/24	1250	200	1050	2083	17851		10/24	675	200	475	942	18149
	10/25	1250	200	1050	2083	19934		10/25	625	200	425	843	18992
	10/26	1000	200	800	1587	21521		10/26	575	200	375	744	19736
	10/27	750	200	550	1091	22612		10/27	525	200	325	645	20380
	10/28	500	200	300	595	23207		10/28	475	200	275	545	20926
	10/29	200	200	0	0	23207		10/29	450	200	250	496	21421
	10/30	200	200	0	0	23207		10/30	400	200	200	397	21818
	10/31	200	200	0	0	23207		10/31	375	200	175	347	22165
	11/1	200	200	0	0	23207	NOV	11/1	350	200	150	298	22463
	11/2	200	200	0	0	23207		11/2	325	200	125	248	22711
	11/3	200	200	0	0	23207		11/3	300	200	100	198	22909
	11/4	200	200	0	0	23207		11/4	275	200	75	149	23058
	11/5	200	200	0	0	23207		11/5	250	200	50	99	23157
	11/6	200	200	0	0	23207		11/6	225	200	25	50	23207
	11/7	200	200	0	0	23207		11/7	200	200	0	0	23207
	11/8	200	200	0	0	23207		11/8	200	200	0	0	23207
	11/9	200	200	0	0	23207		11/9	200	200	0	0	23207
	11/10	200	200	0	0	23207		11/10	200	200	0	0	23207
	11/11	200	200	0	0	23207		11/11	200	200	0	0	23207
	11/12	200	200	0	0	23207		11/12	200	200	0	0	23207
	11/13	200	200	0	0	23207		11/13	200	200	0	0	23207
	11/14	200	200	0	0	23207		11/14	200	200	0	0	23207
	11/15	200	200	0	0	23207		11/15	200	200	0	0	23207

Alternative B							Alternative C						
Stanislaus River Minimum Fish Flow Schedule							Stanislaus River Minimum Fish Flow Schedule						
Water Year Type: Critically Dry							Water Year Type: Critically Dry						
		Daily				Cumulative			Daily				Cumulative
		Total CFS	Base CFS	Pulse CFS	Pulse AF	Pulse AF			Total CFS	Base CFS	Pulse CFS	Pulse AF	Pulse AF
OCT	10/1	200	200	0	0	0	OCT	10/1	200	200	0	0	0
	10/2	200	200	0	0	0		10/2	200	200	0	0	0
	10/3	200	200	0	0	0		10/3	200	200	0	0	0
	10/4	200	200	0	0	0		10/4	200	200	0	0	0
	10/5	200	200	0	0	0		10/5	200	200	0	0	0
	10/6	200	200	0	0	0		10/6	200	200	0	0	0
	10/7	200	200	0	0	0		10/7	200	200	0	0	0
	10/8	200	200	0	0	0		10/8	200	200	0	0	0
	10/9	200	200	0	0	0		10/9	200	200	0	0	0
	10/10	200	200	0	0	0		10/10	200	200	0	0	0
	10/11	200	200	0	0	0		10/11	200	200	0	0	0
	10/12	200	200	0	0	0		10/12	200	200	0	0	0
	10/13	200	200	0	0	0		10/13	200	200	0	0	0
	10/14	600	200	400	793	793		10/14	200	200	0	0	0
	10/15	900	200	700	1388	2182		10/15	200	200	0	0	0
	10/16	800	200	600	1190	3372		10/16	200	200	0	0	0
	10/17	650	200	450	893	4264		10/17	200	200	0	0	0
	10/18	500	200	300	595	4860		10/18	200	200	0	0	0
	10/19	400	200	200	397	5256		10/19	200	200	0	0	0
	10/20	600	200	400	793	6050		10/20	200	200	0	0	0
	10/21	800	200	600	1190	7240		10/21	600	200	400	793	793
	10/22	1200	200	1000	1983	9223		10/22	900	200	700	1388	2182
	10/23	1100	200	900	1785	11008		10/23	1200	200	1000	1983	4165
	10/24	1000	200	800	1587	12595		10/24	1000	200	800	1587	5752
	10/25	750	200	550	1091	13686		10/25	700	200	500	992	6744
	10/26	500	200	300	595	14281		10/26	450	200	250	496	7240
	10/27	300	200	100	198	14479		10/27	600	200	400	793	8033
	10/28	700	200	500	992	15471		10/28	900	200	700	1388	9421
	10/29	1050	200	850	1686	17157		10/29	1200	200	1000	1983	11405
	10/30	925	200	725	1438	18595		10/30	1300	200	1100	2182	13587
	10/31	800	200	600	1190	19785		10/31	1000	200	800	1587	15174
NOV	11/1	675	200	475	942	20727	NOV	11/1	850	200	650	1289	16463
	11/2	575	200	375	744	21471		11/2	600	200	400	793	17256
	11/3	475	200	275	545	22017		11/3	400	200	200	397	17653
	11/4	425	200	225	446	22463		11/4	600	200	400	793	18446
	11/5	375	200	175	347	22810		11/5	1000	200	800	1587	20033
	11/6	325	200	125	248	23058		11/6	800	200	600	1190	21223
	11/7	275	200	75	149	23207		11/7	600	200	400	793	22017
	11/8	200	200	0	0	23207		11/8	500	200	300	595	22612
	11/9	200	200	0	0	23207		11/9	400	200	200	397	23008
	11/10	200	200	0	0	23207		11/10	300	200	100	198	23207
	11/11	200	200	0	0	23207		11/11	200	200	0	0	23207
	11/12	200	200	0	0	23207		11/12	200	200	0	0	23207
	11/13	200	200	0	0	23207		11/13	200	200	0	0	23207
	11/14	200	200	0	0	23207		11/14	200	200	0	0	23207
	11/15	200	200	0	0	23207		11/15	200	200	0	0	23207

Figure 1. Stanislaus fall pulse flow schedules considered by SOG for October-November 2016. SOG advised that “Alternative A” “Alternative B” or “Alternative C” pulse be implemented rather than the Appendix 2-E schedule (with the default being Alternative B), with the alternative to be selected by SOG in early or mid-October based on observed conditions.

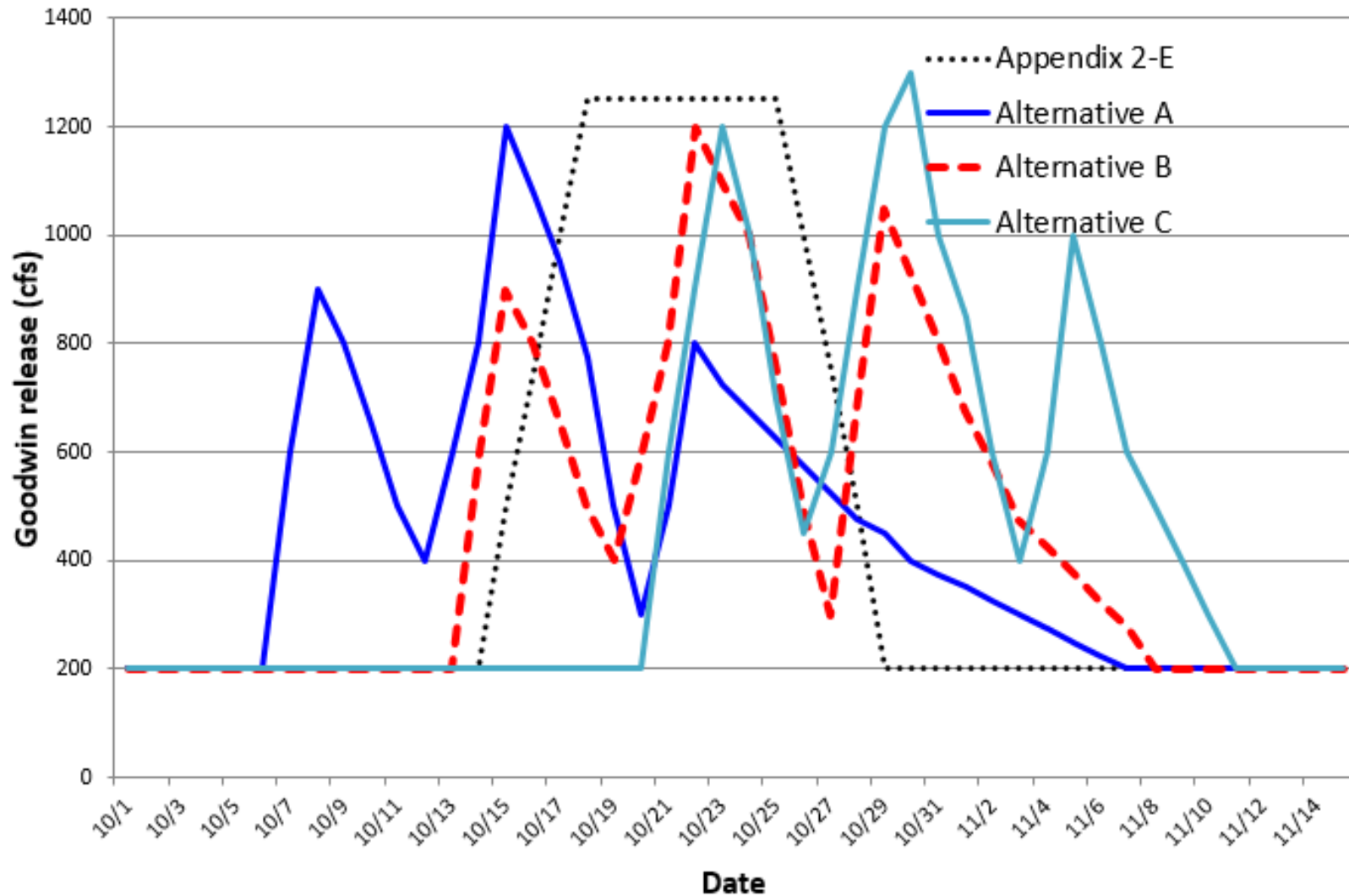


Table 2. Factors considered in the design of the SOG-advised fall pulse flow.

Driver	Location	Lifestage	Notes
Migration Window	Vernalis	Adult	Provide temperature/D.O. suitable for upmigration for at least several weeks.
Redd Scour/Stranding	Trib/spawning area	redd/eggs/fry	The main pulse should occur before a significant number of the season's redds are created. Historically, few redds are built before the 4th week of October, though in some years redd activity picks up in mid-October.
Redd Stranding	Trib/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	Trib/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 800-1200 cfs between 10am and 4pm on weekend days during October.

Appendix B— SOG advice on winter instability flows



Barbara Byrne - NOAA Federal <barbara.byrne@noaa.gov>

NMFS determination on SOG Advice for Jan and Feb WIF

1 message

Garwin Yip - NOAA Federal <garwin.yip@noaa.gov>

Thu, Dec 15, 2016 at 2:17 PM

To: "knwhite@usbr.gov" <knwhite@usbr.gov>

Cc: ELIZABETH KITECK <ekiteck@usbr.gov>, RONALD MILLIGAN <rmilligan@usbr.gov>, "Rieker, Jeffrey" <jrieker@usbr.gov>, "LESSARD, DREW" <dlessard@usbr.gov>, LEEYAN MAO <lmao@usbr.gov>, "Mary (Catherine) Blackwell" <mblackwell@usbr.gov>, Barbara Byrne - NOAA Federal <barbara.byrne@noaa.gov>, THUY WASHBURN <twashburn@usbr.gov>, Thomas Patton <tpatton@usbr.gov>, "Bahls, Amanda" <abahls@usbr.gov>, "womt@water.ca.gov" <womt@water.ca.gov>

Kristin--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 and February 2017, the winter instability flows may be (1) reshaped according to the attached SOG advice (specifically, the "Alt-A" column in Table 1 and shape in Figure 1), and (2) shifted in timing to coincide with a natural storm event, or, in the event of no rainfall, be initiated no later than the last day of the month in which it was scheduled per Appendix 2-E. Until each winter instability flow is implemented, Goodwin releases must not be less than the minimum base flow in the Appendix 2-E schedule for January and February (200 cfs in all yeartypes but Wet).

NMFS determines that the proposed changes in the shaping and timing of the January and February winter instability flows are 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. 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

Office: 916-930-3611

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----- Forwarded message -----

From: **White, Kristin** <knwhite@usbr.gov>

Date: Thu, Dec 15, 2016 at 10:09 AM

Subject: SOG Advice for Jan and Feb WIF

To: Garwin Yip <Garwin.Yip@noaa.gov>

Cc: ELIZABETH KITECK <ekiteck@usbr.gov>, RONALD MILLIGAN <rmilligan@usbr.gov>, "Rieker, Jeffrey" <jrieker@usbr.gov>, "LESSARD, DREW" <dlessard@usbr.gov>, LEEYAN MAO <lmao@usbr.gov>, "Mary (Catherine) Blackwell" <mblackwell@usbr.gov>, Barbara Byrne - NOAA Federal <barbara.byrne@noaa.gov>, THUY WASHBURN <twashburn@usbr.gov>, Thomas Patton <tpatton@usbr.gov>, Brycen Swart <brycen.swart@noaa.gov>, "Bahls, Amanda" <abahls@usbr.gov>

Garwin -

Attached is the Stanislaus Operations Group (SOG) advice for implementing the winter instability pulse flows in both January and February. As a summary, SOG advises that the winter instability flow (a) be reshaped to simulate a small storm pulse, and (b) be 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).

Reclamation requests concurrence from NMFS on the reshaping and the flexibility of timing for the winter instability flows for both January and February.

Kristin White, PE*

Water Resources Branch Chief

U.S. Bureau of Reclamation, Mid-Pacific Region

Ph: [916-989-7226](tel:916-989-7226) (Central California Area Office)

*Inactive



2017.12.12_DRAFT_SOG winter pulse advice.pdf

120K

**SOG ADVICE RE: IMPLEMENTATION OF THE STANISLAUS RPA ACTIONS
DURING JANUARY & FEBRUARY 2017
12.14.2016**

Background

Winter instability flows in January and February are a component of the daily flow schedule in Appendix 2-E of the NMFS BiOp¹ required per Action III.1.3 of the Reasonable and Prudent Alternative (RPA). As noted in the 2011 RPA Amendments² (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 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 winter instability flow for implementation in both January and February that we believe is consistent with the intent of the RPA action.

SOG advice

Flow per RPA Action III.1.3

For January and February 2017, SOG advises that the winter instability flow (Critically Dry yeartype) (a) be reshaped according to the "Alt-A" flow schedule described in Table 1 and Figure 1, and (b) be 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:** This alternate pulse shaping has the same volume (793 AF in addition to the 200 cfs base flow) as the Critically Dry winter instability pulse in Appendix 2-E but has been reshaped to include a higher peak flow. The technical team believes it meets the intent of the RPA action, namely, it provides variability in the winter hydrograph by simulating a small storm pulse. The shape of the "Alt-A" pulse, with its more rapidly rising limb and more slowly descending limb, is more typical of the flow pattern associated with storm events. Reshaping the subdaily flow pattern to increase the peak flow to 750 cfs for part of the first day of the pulse will inundate a greater portion of the Honolulu Bar restoration area and will likely allow at least partial inundation of the Lancaster Road restoration area. 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. It was the opinion of SOG members

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

familiar with those areas that, since the restoration at Honolulu Bar, there are minimal stranding concerns for juvenile salmonids for flow changes between 200 and 750 cfs.

If the yeartype based on the New Melones water supply parameter changes in February (the first month in which an official forecast is available), SOG will provide new advice on how to reshape the water volume of the winter instability flow for that new yeartype.

- b) SHIFT IN TIME:** According to the flow schedule in Appendix 2-E, the January and February winter instability flows are scheduled to begin on January 3rd and February 5th, respectively. Allowing the winter instability flow to be shifted in time to coincide with a natural storm event (if applicable) within each month is expected to better capture the characteristics of a natural hydrograph, as the runoff, turbidity, meteorological conditions, etc. associated with a natural storm event will co-occur with the pulse of regulated flow.

Flow variability could cue outmigration in juvenile *Oncorhynchus mykiss* throughout January, but few fall-run Chinook fry will have emerged in early January. SOG would prefer the January winter instability flow 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.

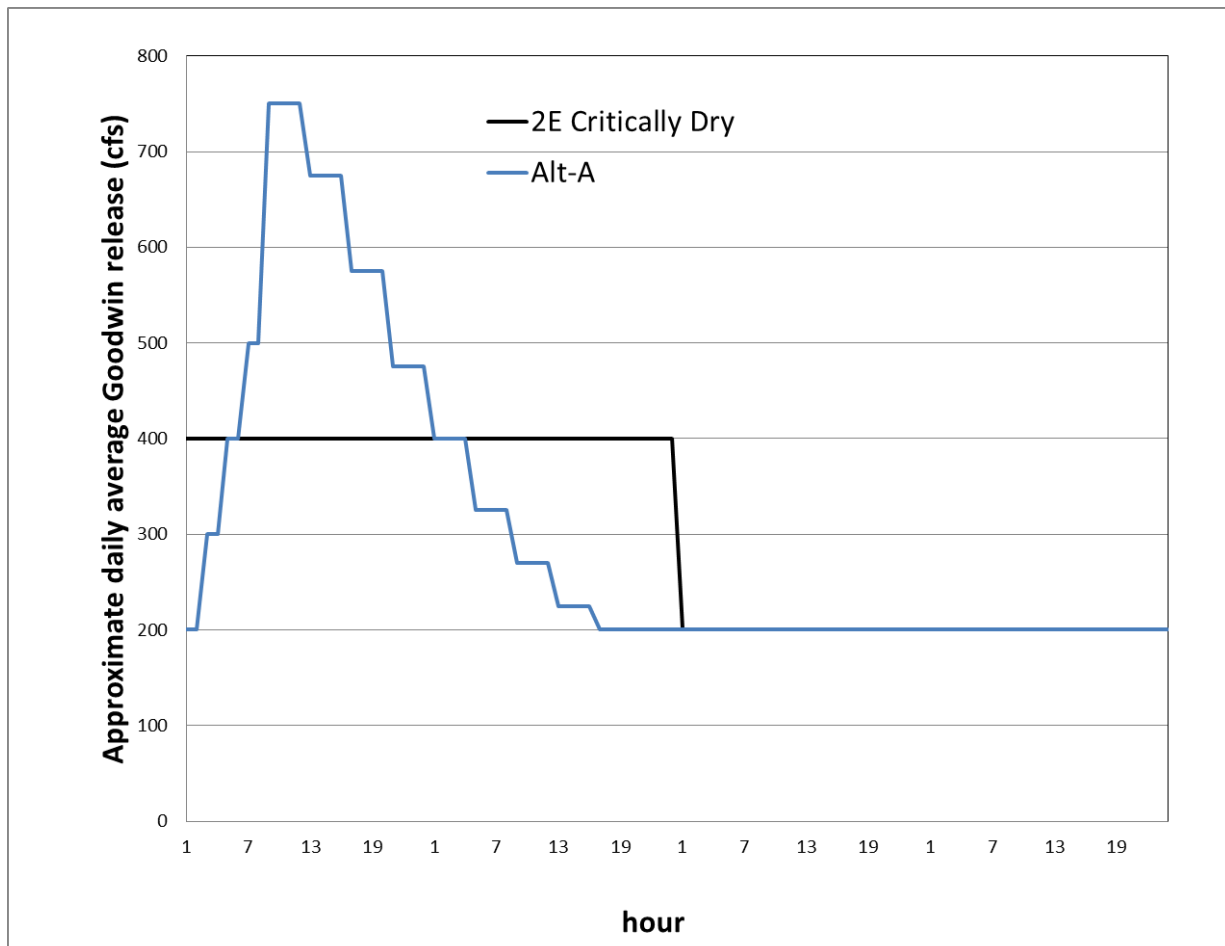
Reclamation will monitor the forecasted precipitation and will solicit SOG input on scheduling the January winter instability pulse. If the pulse has not been scheduled by January 18th, then SOG will discuss scheduling at the January 18th SOG meeting to ensure a pulse is initiated no later than January 31st.

Reclamation will also monitor the forecasted precipitation in February and will solicit SOG input on scheduling the February winter instability pulse. If the pulse has not been scheduled by February 15th, then SOG will discuss scheduling at the February 15th SOG meeting to ensure a pulse is initiated no later than February 28th.

Table 1 Winter instability flow shape advised by SOG (Alt-A, highlighted in yellow), in comparison to the pulse as described in Appendix 2-E..

Day	Time	Appendix 2E (Critically Dry)	Alt-A
1	1	400	200
1	2	400	200
1	3	400	300
1	4	400	300
1	5	400	400
1	6	400	400
1	7	400	500
1	8	400	500
1	9	400	750
1	10	400	750
1	11	400	750
1	12	400	750
1	13	400	675
1	14	400	675
1	15	400	675
1	16	400	675
1	17	400	575
1	18	400	575
1	19	400	575
1	20	400	575
1	21	400	475
1	22	400	475
1	23	400	475
1	0	400	475
2	1	400	400
2	2	400	400
2	3	400	400
2	4	400	400
2	5	400	325
2	6	400	325
2	7	400	325
2	8	400	325
2	9	400	270
2	10	400	270
2	11	400	270
2	12	400	270
2	13	400	225
2	14	400	225
2	15	400	225
2	16	400	225
2	17	400	200
2	18	400	200
2	19	400	200
2	20	400	200
2	21	400	200
2	22	400	200
2	23	400	200
2	0	400	200
avg hourly cfs:		400.0	399.6

Figure 1: Plot of winter instability flow shapes from Table 1. 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—SOG advice on spring pulse flow



Barbara Byrne - NOAA Federal <barbara.byrne@noaa.gov>

Re: NMFS determination on SOG advice for spring pulse flow

1 message

Garwin Yip - NOAA Federal <garwin.yip@noaa.gov>

Mon, May 1, 2017 at 10:07 PM

To: "knwhite@usbr.gov" <knwhite@usbr.gov>

Cc: Elizabeth G' Kiteck <EKiteck@usbr.gov>, "Milligan, Ronald E" <RMilligan@usbr.gov>, Jeffrey Rieker <jrieker@usbr.gov>, DREW LESSARD <dlessard@usbr.gov>, Lee Mao <lmoo@usbr.gov>, "Mary (Catherine) Blackwell" <mblackwell@usbr.gov>, "Washburn, Thuy T" <TWashburn@usbr.gov>, "Bahls, Amanda" <abahls@usbr.gov>, Barbara Byrne <Barbara.Byrne@noaa.gov>, "womt@water.ca.gov" <womt@water.ca.gov>

Kristin,

As you know, Action III.1.3 (pages 49-50 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."

NMFS determinations on the three issues in the April 28, 2017, SOG advice are provided below.

I. Water Volume Accounting for WY 2017: The water accounting framework described in Section I of the SOG advice is a reasonable and practicable method for defining instream flow requirements when an updated inflow forecast causes a change in yeartype. NMFS agrees with this methodology for WY 2017. *[NMFS understands the WY 2017 spring pulse window to be March 15-June 30; we assume that the "July" in element 1 of your e-mail is meant to be "June"]*

II. Flood Management Constraints: Section II of the SOG advice defers to Reclamation to manage Stanislaus flows within all flood management constraints and acknowledges that the Alt. A schedule will likely not be implemented as designed. While there is not an explicit flood exception described in the NMFS Biological Opinion, NMFS did not intend for the minimum instream flows to cause flood risks downstream in the San Joaquin River and determines that whenever the daily flow listed in the Alt. A schedule is not necessary for upstream reservoir management and may unacceptably exacerbate flooding risk downstream, Goodwin releases may be reduced to as low as 400 cfs, the minimum summer base flow in Wet years.

III. Reshaped Flow Schedule: NMFS concurs that the Alt A flow schedule described in Section III of the SOG advice meets the objective of RPA Action III.1.3 "...to incorporate habitat maintaining geomorphic flows in a flow pattern that will provide migratory cues to smolts and facilitate out-migrant smolt movement..." and acknowledges that implementation of this schedule may be modified as described in item II, above.

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 bring it up during tomorrow afternoon's WOMT meeting.

Thanks.

-Garwin-

Garwin Yip

Water Operations and Delta Consultations Branch Chief
NOAA Fisheries West Coast Region
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----- Forwarded message -----

From: **Kristin White** <knwhite@usbr.gov>

Date: Fri, Apr 28, 2017 at 3:27 PM

Subject: Spring Advice

To: Garwin yip <garwin.yip@noaa.gov>

Cc: Barb Byrne <barbara.byrne@noaa.gov>, Elizabeth Kiteck <ekiteck@usbr.gov>, rmilligan@usbr.gov, Jeffrey Rieker <jriecker@usbr.gov>, DREW LESSARD <dlessard@usbr.gov>, Lee Mao <lmiao@usbr.gov>, "Mary (Catherine) Blackwell" <mblackwell@usbr.gov>, THUY WASHBURN <TWASHBURN@usbr.gov>, Amanda Bahls <abahls@usbr.gov>

Garwin,

Attached is the Stanislaus Operations Group (SOG) advice for implementing the Spring pulse flow. As a summary, the SOG advice includes three elements:

1. SOG's accounting of water volume accounting for WY2017 due to the changing Stanislaus yeartype. SOG calculates the total volume for mid-March through the end of July as 299,295 AF.
2. Recognition that the SOG-advised schedule is likely to be constrained by upstream reservoir management and downstream water level constraints, and recommendations to achieve fish-related objectives within flood management constraints.
3. SOG advice for a modified spring outmigration pulse flow schedule that SOG believes is consistent with the intent of RPA Action III.1.3. However, SOG defers to Reclamation to manage Stanislaus flows within all flood management constraints even if that (as expected) precludes implementation of the reshaped spring pulse flow.

SOG notes in the attached advice that operations under flood management are not expected to achieve the flow shaping advised by SOG. Reclamation does expect, however, that operations will meet or exceed the flow volume required by Appendix 2-E. The Goodwin releases from March 16-April 27 total 153,410 AF, which is 51% of the 299,295 AF required under Appendix 2-E of the NMFS BiOp despite just being 40% of the way through the March 15-June 30 pulse flow period for WY 2017. If unforeseen flood management constraints mean that the Appendix 2-E volume are not met by June 30, 2017, Reclamation will report that to NMFS.

11/3/2017

National Oceanic and Atmospheric Administration Mail - Re: NMFS determination on SOG advice for spring pulse flow

If you have any questions, please feel free to contact me or Amanda Bahls (CC'd). Thank you!

Kristin White
Water Resources Branch Chief
Central California Area Office
Bureau of Reclamation - MP Region



2017.04.28_SOG Advice_Spring Pulse.pdf

258K

**Stanislaus Operations Group Advice Re:
Stanislaus River Spring 2017 Outmigration Pulse flow**
April 28, 2017

Background

Spring outmigration pulse flows are one component of the daily flow schedule in Appendix 2-E of the NMFS BiOp¹ required per Action III.1.3 of the Reasonable and Prudent Alternative (RPA). As noted in the 2011 BiOp Amendments², spring pulse flows are intended to provide “outmigration flow cues to enhance likelihood of anadromy” and “late spring flows for conveyance and maintenance of downstream migratory habitat quality”. The 2011 BiOp Amendments further note (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.”

The SOG advice for spring 2017 includes three elements:

- I. Description of water volume accounting for WY 2017
- II. Recognition that the SOG-advised schedule provided below is likely to be constrained by upstream reservoir management and downstream water level constraints, and recommendations to achieve fish-related objectives within flood management constraints
- III. SOG advice for a modified spring outmigration pulse flow schedule that we believe is consistent with the intent of the RPA action.

I. Water Volume Accounting for WY 2017

During WY 2017, the Stanislaus yeartype, based on the New Melones Index, changed to Above Normal based on the March forecast, and to Wet based on the April forecast. Given the changing yeartype during the spring pulse flow period, SOG needed a water accounting framework to determine the water volume required by Appendix 2-E. Because the yeartype is generally updated mid-month based on the snow surveys completed early in the month, SOG calculated the total required instream flow volume for the March 16-June 30 period based on the default flow schedule in Appendix 2-E from the 16th of Month A to the 15th of Month B, based on the yeartype determined by the Month A forecast, as follows:

Date range	Stanislaus yeartype (Month of forecast)	Water volume in default schedule in Appendix 2-E (acre-feet)
3/16/17-4/15/17	Above Normal (March)	85,683
4/16/17-5/15/17	Wet (April)	93,418
5/16/17-6/15/17	Wet (May*)	90,443
6/15/17-6/30/17	Wet (June*)	29,751

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

	Total:	299,295
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* SOG assumes that the yeartype will remain Wet in the May and June forecasts.

II. Recognition of Flood Management Constraints

In a 3/28/17 e-mail to Reclamation, NMFS noted that that “current flow conditions in the San Joaquin basin are such that some of the minimum flows required in the default Appendix 2-E flow schedule under Action III.1.3 could contribute to flooding risk, e.g. by causing the river stage at Vernalis to rise above (or higher above) the flood monitor stage of 24.5 feet. While there is not an explicit flood exception described in the NMFS BiOp, NMFS did not intend for the minimum instream flows to cause flood risks downstream in the San Joaquin River. NMFS appreciates that in this year of very wet hydrology, it is a challenging task to simultaneously manage storage in the upstream reservoirs and water levels downstream.”

As of 4/28/17, flows at Vernalis remain above the flood monitor stage of 24.5 feet and releases from New Melones have increased for storage management. **SOG defers to Reclamation to manage Stanislaus flows within all flood management constraints** even if that (as expected) precludes implementation of the reshaped spring pulse flow described in Section III.

If feasible without risk to human health and safety, SOG recommends the following elements to achieve fish-related objectives within flood management constraints

Element	Benefits	Example
Introduce variability into the flow schedule	Cue for fish outmigration	A 500cfs-1000cfs variation scheduled over a day's time will introduce flow variability in the Stanislaus River but the increased flow will likely be attenuated by the time it reaches Vernalis.
Introduce variability into the flow schedule multiple times April-June	Support life history diversity in outmigration timing	Implement some flow variability every one or two weeks.
Introduce high flows	Inundation of additional shallow water habitat which can provide rearing habitat and increase allochthonous input to river Move sediment Provide 'conveyance flow' for outmigrating salmonids that might increase migration speed and reduce predation risk	Increase Goodwin releases, if possible, to the peak daily flow in the default 2-E Above Normal (3,000 cfs) or Wet (5,000 cfs) schedules.

	Buffer maximum water temperatures	
Manage storage to allow at least 30 days of <500 cfs flow during summer	Would allow planned restoration work to proceed	Release higher flows in the spring to allow lower flows in the summer.

III. SOG advice

For 2017, SOG advises that the spring outmigration pulse flow be reshaped according to the flow schedule described in Alt-A (See Attachment 1). The Alt-A schedule has the same total volume (299,295 AF, including base flows) for the March 16-June 30 period as the default Appendix 2-E schedule, as described in Section I of this advice. The technical team believes that reshaping meets the intent of the RPA action 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 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 outmigrating salmonids more rapidly along their migratory pathway, which may improve outmigration success.

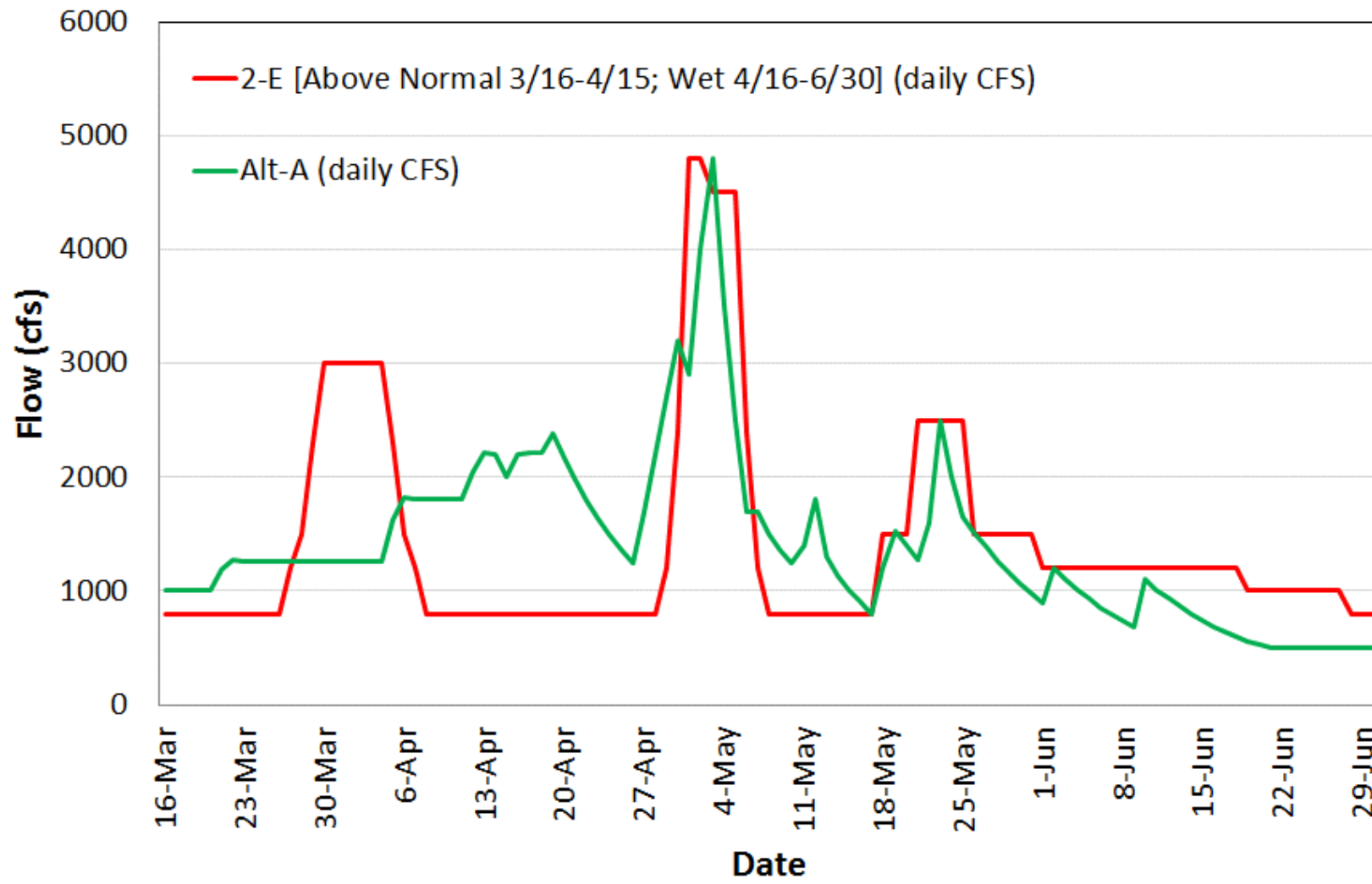
Some key features of the “**Alt-A**” pulse include:

- Reshaping the few larger pulses identified in Appendix 2-E into **multiple smaller pulses** may maximize opportunities for a broader range of salmonid outmigration timing rather than improving migratory conditions over a shorter duration. Increased flows are intended to cue outmigration and improve migratory habitat downstream.
- The **time frame** of the Alt-A pulse (comparable to that of the default 2-E schedule) is expected to provide inundation of shallow-water habitat and temperature buffering into June.
- Other considerations for in-basin interests:
 - The highest flows are scheduled on weekdays, since under the current yeartype, the highest flows are not as suitable for rafting as are the intermediate flows.
 - The limited time at flows >1,500 cfs is intended to address agricultural seepage concerns.

Attachment 1

Stanislaus spring outmigration flow
schedule advised by SOG for March 16-June
30, 2017

WY 2017 Spring Pulse Alternatives Stanislaus River



Blue highlighted cells represent actual Goodwin releases through 4/18/17.

		2-E default			Alt-A		
Day	Date	2-E [Above Normal 3/16-4/15; Wet 4/16-6/30] (daily CFS)	2-E [Above Normal 3/16-4/15; Wet 4/16-6/30] (daily AF)	2-E [Above Normal 3/16-4/15; Wet 4/16-6/30] (cumulative AF)	Alt-A (daily CFS)	Alt-B (daily AF)	Alt-B (cumulative AF)
Thurs	16-Mar	800	1587	1587	1006	1995	1995
Fri	17-Mar	800	1587	3173	1007	1997	3993
Sat	18-Mar	800	1587	4760	1007	1997	5990
Sun	19-Mar	800	1587	6347	1007	1997	7987
Mon	20-Mar	800	1587	7934	1009	2001	9988
Tues	21-Mar	800	1587	9520	1188	2356	12345
Weds	22-Mar	800	1587	11107	1271	2521	14866
Thurs	23-Mar	800	1587	12694	1262	2503	17369
Fri	24-Mar	800	1587	14280	1258	2495	19864
Sat	25-Mar	800	1587	15867	1256	2491	22355
Sun	26-Mar	800	1587	17454	1255	2489	24844
Mon	27-Mar	1200	2380	19834	1256	2491	27335
Tues	28-Mar	1500	2975	22809	1256	2491	29826
Weds	29-Mar	2300	4562	27371	1254	2487	32314
Thurs	30-Mar	3000	5950	33321	1256	2491	34805
Fri	31-Mar	3000	5950	39271	1255	2489	37294
Sat	1-Apr	3000	5950	45221	1257	2493	39787
Sun	2-Apr	3000	5950	51172	1257	2493	42280
Mon	3-Apr	3000	5950	57122	1257	2493	44773
Tues	4-Apr	3000	5950	63072	1255	2489	47262
Weds	5-Apr	2300	4562	67634	1628	3229	50491
Thurs	6-Apr	1500	2975	70609	1824	3618	54109
Fri	7-Apr	1200	2380	72989	1803	3576	57685
Sat	8-Apr	800	1587	74576	1804	3578	61263
Sun	9-Apr	800	1587	76162	1803	3576	64839
Mon	10-Apr	800	1587	77749	1801	3572	68411
Tues	11-Apr	800	1587	79336	1802	3574	71985
Weds	12-Apr	800	1587	80923	2044	4054	76040
Thurs	13-Apr	800	1587	82509	2211	4385	80425
Fri	14-Apr	800	1587	84096	2201	4365	84790
Sat	15-Apr	800	1587	85683	2002	3971	88761
Sun	16-Apr	800	1587	87270	2205	4373	93134
Mon	17-Apr	800	1587	88856	2209	4381	97516
Tues	18-Apr	800	1587	90443	2217	4397	101913
Weds	19-Apr	800	1587	92030	2387	4734	106647
Thurs	20-Apr	800	1587	93616	2168	4301	110948
Fri	21-Apr	800	1587	95203	1971	3910	114858
Sat	22-Apr	800	1587	96790	1794	3559	118417
Sun	23-Apr	800	1587	98377	1635	3243	121660
Mon	24-Apr	800	1587	99963	1491	2958	124618
Tues	25-Apr	800	1587	101550	1362	2702	127320
Weds	26-Apr	800	1587	103137	1246	2471	129791
Thurs	27-Apr	800	1587	104723	1700	3372	133163
Fri	28-Apr	800	1587	106310	2200	4363	137526
Sat	29-Apr	1200	2380	108690	2700	5355	142881
Sun	30-Apr	2400	4760	113450	3200	6347	149228

		2-E default			Alt-A		
Day	Date	2-E [Above Normal 3/16-4/15; Wet 4/16-6/30] (daily CFS)	2-E [Above Normal 3/16-4/15; Wet 4/16-6/30] (daily AF)	2-E [Above Normal 3/16-4/15; Wet 4/16-6/30] (cumulative AF)	Alt-A (daily CFS)	Alt-B (daily AF)	Alt-B (cumulative AF)
Mon	1-May	4800	9520	122971	2900	5752	154980
Tues	2-May	4800	9520	132491	4000	7934	162914
Weds	3-May	4500	8925	141416	4800	9520	172434
Thurs	4-May	4500	8925	150342	3500	6942	179376
Fri	5-May	4500	8925	159267	2500	4958	184334
Sat	6-May	2400	4760	164027	1700	3372	187706
Sun	7-May	1200	2380	166407	1700	3372	191078
Mon	8-May	800	1587	167994	1491	2958	194036
Tues	9-May	800	1587	169581	1362	2702	196738
Weds	10-May	800	1587	171167	1246	2471	199209
Thurs	11-May	800	1587	172754	1400	2777	201986
Fri	12-May	800	1587	174341	1800	3570	205556
Sat	13-May	800	1587	175927	1300	2578	208135
Sun	14-May	800	1587	177514	1125	2231	210366
Mon	15-May	800	1587	179101	1000	1983	212349
Tues	16-May	800	1587	180688	900	1785	214134
Weds	17-May	800	1587	182274	800	1587	215721
Thurs	18-May	1500	2975	185249	1200	2380	218101
Fri	19-May	1500	2975	188225	1529	3032	221133
Sat	20-May	1500	2975	191200	1396	2768	223901
Sun	21-May	2500	4958	196158	1276	2531	226432
Mon	22-May	2500	4958	201117	1600	3173	229606
Tues	23-May	2500	4958	206075	2499	4957	234562
Weds	24-May	2500	4958	211034	2000	3967	238529
Thurs	25-May	2500	4958	215992	1658	3288	241818
Fri	26-May	1500	2975	218967	1512	2999	244817
Sat	27-May	1500	2975	221942	1381	2739	247556
Sun	28-May	1500	2975	224917	1263	2505	250061
Mon	29-May	1500	2975	227892	1157	2294	252355
Tues	30-May	1500	2975	230868	1061	2104	254459
Weds	31-May	1500	2975	233843	975	1933	256393

		2-E default			Alt-A		
Day	Date	2-E [Above Normal 3/16-4/15; Wet 4/16-6/30] (daily CFS)	2-E [Above Normal 3/16-4/15; Wet 4/16-6/30] (daily AF)	2-E [Above Normal 3/16-4/15; Wet 4/16-6/30] (cumulative AF)	Alt-A (daily CFS)	Alt-B (daily AF)	Alt-B (cumulative AF)
Thurs	1-Jun	1200	2380	236223	897	1780	258172
Fri	2-Jun	1200	2380	238603	1200	2380	260552
Sat	3-Jun	1200	2380	240983	1100	2182	262734
Sun	4-Jun	1200	2380	243363	1010	2003	264737
Mon	5-Jun	1200	2380	245743	929	1843	266580
Tues	6-Jun	1200	2380	248123	856	1698	268278
Weds	7-Jun	1200	2380	250503	790	1568	269846
Thurs	8-Jun	1200	2380	252883	731	1451	271297
Fri	9-Jun	1200	2380	255263	678	1345	272642
Sat	10-Jun	1200	2380	257643	1100	2182	274824
Sun	11-Jun	1200	2380	260024	1012	2007	276831
Mon	12-Jun	1200	2380	262404	933	1850	278681
Tues	13-Jun	1200	2380	264784	861	1708	280389
Weds	14-Jun	1200	2380	267164	796	1580	281969
Thurs	15-Jun	1200	2380	269544	738	1464	283433
Fri	16-Jun	1200	2380	271924	686	1360	284793
Sat	17-Jun	1200	2380	274304	638	1266	286058
Sun	18-Jun	1200	2380	276684	595	1181	287239
Mon	19-Jun	1000	1983	278667	557	1104	288343
Tues	20-Jun	1000	1983	280651	522	1035	289378
Weds	21-Jun	1000	1983	282634	500	992	290370
Thurs	22-Jun	1000	1983	284618	500	992	291362
Fri	23-Jun	1000	1983	286601	500	992	292353
Sat	24-Jun	1000	1983	288584	500	992	293345
Sun	25-Jun	1000	1983	290568	500	992	294337
Mon	26-Jun	1000	1983	292551	500	992	295328
Tues	27-Jun	1000	1983	294535	500	992	296320
Weds	28-Jun	800	1587	296121	500	992	297312
Thurs	29-Jun	800	1587	297708	500	992	298304
Fri	30-Jun	800	1587	299295	500	992	299295

Appendix D—Summary of release changes at Goodwin Dam in WY 2017

NEW MELONES LAKE OPERATIONS - WY 2017 GOODWIN RELEASE LOG				
Date	Time of Change	Increase or Decrease	Flow (cfs)	Comment/Reason
10/1/2016			200	2-E Base
10/14/2016	0100	Increase	275	Fall Pulse Flow
10/14/2016	0300	Increase	350	Fall Pulse Flow
10/14/2016	0500	Increase	450	Fall Pulse Flow
10/14/2016	0700	Increase	550	Fall Pulse Flow
10/14/2016	0900	Increase	800	Fall Pulse Flow
10/14/2016	1100	Increase	950	Fall Pulse Flow
10/15/2016	0100	Increase	1200	Fall Pulse Flow
10/15/2016	0300	Increase	1375	Fall Pulse Flow
10/16/2016	0100	Decrease	1250	Fall Pulse Flow
10/17/2016	0100	Decrease	1100	Fall Pulse Flow
10/18/2016	0100	Decrease	950	Fall Pulse Flow
10/19/2016	0100	Decrease	850	Fall Pulse Flow
10/20/2016	0100	Increase	1100	Fall Pulse Flow
10/21/2016	0100	Increase	1300	Fall Pulse Flow
10/22/2016	0100	Increase	1500	Fall Pulse Flow
10/23/2016	0100	Decrease	1450	Fall Pulse Flow
10/24/2016	0100	Decrease	1350	Fall Pulse Flow
10/25/2016	0100	Decrease	1100	Fall Pulse Flow
10/26/2016	0100	Decrease	850	Fall Pulse Flow
10/27/2016	0100	Decrease	650	Fall Pulse Flow
10/28/2016	0100	Increase	900	Fall Pulse Flow
10/28/2016	0300	Increase	1075	Fall Pulse Flow
10/29/2016	0100	Increase	1300	Fall Pulse Flow
10/29/2016	0300	Increase	1500	Fall Pulse Flow
10/30/2016	0100	Decrease	1325	Fall Pulse Flow
10/31/2016	0100	Decrease	1075	Fall Pulse Flow
11/1/2016	0100	Decrease	875	Fall Pulse Flow
11/2/2016	0100	Decrease	750	Fall Pulse Flow
11/3/2016	0100	Decrease	625	Fall Pulse Flow
11/4/2016	0100	Decrease	550	Fall Pulse Flow
11/5/2016	0100	Decrease	475	Fall Pulse Flow
11/6/2016	0100	Decrease	400	Fall Pulse Flow
11/7/2016	0100	Decrease	325	Fall Pulse Flow
11/8/2016	0100	Decrease	200	2-E Base

NEW MELONES LAKE OPERATIONS - WY 2017 GOODWIN RELEASE LOG				
Date	Time of Change	Increase or Decrease	Flow (cfs)	Comment/Reason
1/5/2017	1200	Increase	300	Tulloch Storage Management
1/5/2017	1300	Increase	400	Tulloch Storage Management
1/5/2017	1400	Increase	500	Tulloch Storage Management
1/5/2017	1500	Increase	600	Tulloch Storage Management
1/5/2017	1600	Increase	650	Tulloch Storage Management
1/5/2017	1630	Increase	1000	Tulloch Storage Management
1/7/2017	1300	Decrease	800	Tulloch Storage Management
1/7/2017	1700	Decrease	600	Tulloch Storage Management
1/8/2017	0900	Increase	850	Tulloch Storage Management
1/8/2017	1530	Increase	1100	Tulloch Storage Management
1/8/2017	1630	Increase	1600	Tulloch Storage Management
1/9/2017	1000	Decrease	1400	Tulloch Storage Management
1/9/2017	1400	Decrease	1200	Tulloch Storage Management
1/9/2017	1800	Decrease	1000	Tulloch Storage Management
1/10/2017	0900	Increase	1250	Tulloch Storage Management
1/10/2017	1100	Increase	1500	Tulloch Storage Management
1/10/2017	2000	Increase	1750	Tulloch Storage Management
1/11/2017	0030	Increase	2750	Tulloch Storage Management
1/11/2017	0900	Decrease	2250	Tulloch Storage Management
1/11/2017	1300	Decrease	2000	Tulloch Storage Management
1/11/2017	1700	Decrease	1800	Tulloch Storage Management
1/11/2017	2100	Decrease	1600	Tulloch Storage Management
1/12/2017	0100	Decrease	1400	Tulloch Storage Management
1/12/2017	0500	Decrease	1200	Tulloch Storage Management
1/12/2017	0900	Decrease	1000	Tulloch Storage Management
1/12/2017	1300	Decrease	800	Tulloch Storage Management
1/12/2017	1700	Decrease	600	Tulloch Storage Management
1/14/2017	2000	Decrease	500	Tulloch Storage Management
1/14/2017	2100	Decrease	400	Tulloch Storage Management
1/15/2017	1200	Decrease	300	Tulloch Storage Management
1/15/2017	1600	Decrease	200	Tulloch Storage Management
1/21/2017	0600	Increase	600	Tulloch Storage Management
1/26/2017	2200	Decrease	500	Tulloch Storage Management
1/27/2017	0800	Decrease	400	Tulloch Storage Management
1/27/2017	1200	Decrease	300	Tulloch Storage Management
1/30/2017	2200	Decrease	200	2-E Base

NEW MELONES LAKE OPERATIONS - WY 2017 GOODWIN RELEASE LOG				
Date	Time of Change	Increase or Decrease	Flow (cfs)	Comment/Reason
2/6/2017	1100	Increase	300	Tulloch Storage Management
2/6/2017	1300	Increase	400	Tulloch Storage Management
2/6/2017	1500	Increase	500	Tulloch Storage Management
2/6/2017	1700	Increase	600	Tulloch Storage Management
2/7/2017	1000	Increase	800	Tulloch Storage Management
2/7/2017	1200	Increase	1000	Tulloch Storage Management
2/7/2017	1700	Increase	1250	Tulloch Storage Management
2/7/2017	1900	Increase	1500	Tulloch Storage Management
2/7/2017	2100	Increase	1750	Tulloch Storage Management
2/8/2017	0900	Increase	2000	Tulloch Storage Management
2/8/2017	1100	Increase	2250	Tulloch Storage Management
2/10/2017	1400	Decrease	2050	Tulloch Storage Management
2/10/2017	1800	Decrease	1850	Tulloch Storage Management
2/11/2017	800	Decrease	1650	Tulloch Storage Management
2/11/2017	1200	Decrease	1450	Tulloch Storage Management
2/11/2017	1600	Decrease	1250	Tulloch Storage Management
2/11/2017	2000	Decrease	1050	Tulloch Storage Management
2/12/2017	0001	Decrease	850	Tulloch Storage Management
2/12/2017	0400	Decrease	650	Tulloch Storage Management
2/12/2017	0800	Decrease	450	Tulloch Storage Management
2/12/2017	1200	Decrease	350	Tulloch Storage Management
2/12/2017	1600	Decrease	250	Tulloch Storage Management
2/12/2017	2000	Decrease	200	2-E Base
2/16/2017	1500	Increase	400	Tulloch Storage Management
2/16/2017	1700	Increase	600	Tulloch Storage Management
2/20/2017	1600	Increase	1000	Tulloch Storage Management
2/20/2017	1800	Increase	1250	Tulloch Storage Management
2/20/2017	2000	Increase	1500	Tulloch Storage Management
2/21/2017	1200	Decrease	1300	Tulloch Storage Management
2/21/2017	1600	Decrease	1100	Tulloch Storage Management
2/21/2017	2000	Decrease	900	Tulloch Storage Management
2/24/2017	1300	Decrease	700	Tulloch Storage Management
2/24/2017	1700	Decrease	500	Tulloch Storage Management
2/26/2017	1400	Decrease	400	Tulloch Storage Management
2/26/2017	1800	Decrease	300	Tulloch Storage Management
2/26/2017	2200	Decrease	200	2-E Base

NEW MELONES LAKE OPERATIONS - WY 2017 GOODWIN RELEASE LOG				
Date	Time of Change	Increase or Decrease	Flow (cfs)	Comment/Reason
3/11/2017	0100	Increase	300	Storage Management
3/11/2017	0300	Increase	400	Storage Management
3/11/2017	0500	Increase	500	Storage Management
3/11/2017	0700	Increase	750	Storage Management
3/11/2017	0900	Increase	1000	Storage Management
3/21/2017	0700	Increase	1250	Storage Management
4/5/2017	0600	Increase	1500	Storage Management
4/5/2017	0800	Increase	1700	Storage Management
4/5/2017	1000	Increase	1800	Storage Management
4/12/2017	0800	Increase	2000	Storage Management
4/12/2017	1000	Increase	2200	Storage Management
4/20/2017	0800	Increase	2400	Storage Management
4/20/2017	1000	Increase	2600	Storage Management
4/24/2017	0800	Increase	2800	Storage Management
4/24/2017	1000	Increase	3000	Storage Management
4/26/2017	0800	Increase	3250	Flood Control/Storage Management
4/26/2017	1000	Increase	3500	Flood Control/Storage Management
4/26/2017	1200	Increase	3750	Flood Control/Storage Management
4/26/2017	1400	Increase	4000	Flood Control/Storage Management
5/5/2017	0800	Increase	4250	Flood Control/Storage Management
5/5/2017	1000	Increase	4500	Flood Control/Storage Management
5/11/2017	0800	Increase	4750	Flood Control/Storage Management
5/11/2017	1000	Increase	5000	Flood Control/Storage Management
5/27/2017	1000	Decrease	4800	Flood Control/Storage Management
5/27/2017	1400	Decrease	4750	Flood Control/Storage Management
6/1/2017	1000	Decrease	4600	Flood Control/Storage Management
6/1/2017	1400	Decrease	4500	Flood Control/Storage Management
6/5/2017	1000	Decrease	4300	Flood Control/Storage Management
6/5/2017	1400	Decrease	4250	Flood Control/Storage Management
6/8/2017	1000	Decrease	3850	Flood Control/Storage Management
6/8/2017	1400	Decrease	3750	Flood Control/Storage Management
6/9/2017	1000	Decrease	3600	Flood Control/Storage Management
6/9/2017	1400	Decrease	3500	Flood Control/Storage Management
6/14/2017	1000	Decrease	3350	Flood Control/Storage Management
6/14/2017	1400	Decrease	3250	Flood Control/Storage Management
6/15/2017	1000	Decrease	3100	Flood Control/Storage Management

NEW MELONES LAKE OPERATIONS - WY 2017 GOODWIN RELEASE LOG				
Date	Time of Change	Increase or Decrease	Flow (cfs)	Comment/Reason
6/15/2017	1400	Decrease	3000	Flood Control/Storage Management
6/16/2017	1000	Decrease	2850	Flood Control/Storage Management
6/16/2017	1400	Decrease	2750	Flood Control/Storage Management
6/21/2017	1000	Decrease	2600	Flood Control/Storage Management
6/21/2017	1400	Decrease	2500	Flood Control/Storage Management
6/27/2017	1000	Decrease	2350	Flood Control/Storage Management
6/27/2017	1400	Decrease	2250	Flood Control/Storage Management
6/28/2017	1000	Decrease	2100	Flood Control/Storage Management
6/28/2017	1400	Decrease	2000	Flood Control/Storage Management
6/29/2017	1000	Decrease	1850	Flood Control/Storage Management
6/29/2017	1400	Decrease	1750	Flood Control/Storage Management
6/30/2017	1000	Decrease	1600	Flood Control/Storage Management
6/30/2017	1400	Decrease	1500	Flood Control/Storage Management
8/30/2017	0001	Decrease	1300	Buttonbush Restoration Project
8/30/2017	0400	Decrease	1100	Buttonbush Restoration Project
8/30/2017	0800	Decrease	1000	Buttonbush Restoration Project
9/6/2017	0001	Decrease	800	Buttonbush Restoration Project
9/6/2017	0400	Decrease	600	Buttonbush Restoration Project
9/6/2017	0800	Decrease	400	Buttonbush Restoration Project