Annual Report of Activities

October 1, 2013 to September 30, 2014

Stanislaus Operations Group (SOG)

September 2014

Acronyms and Abbreviations

3DADM	Three-Day-Average Daily Maximum temperature
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
DWR	California Department of Water Resources
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
SRMFFN	Stanislaus River Minimum Flows for Fishery Needs
SSJID	South San Joaquin Irrigation District
SWP	State Water Project
SWRCB	State Water Resources Control Board
USFWS	U.S. Fish & Wildlife Service
VAMP	Vernalis Adaptive Management Program
WOMT	Water Operations Management Team

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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 October 1, 2013 through September 30, 2014 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). The report is broken down into an introduction/background; summary of actions and SOG discussions; implementation of reasonable and prudent alternative (RPA) actions in WY2014; a water operations summary; and summary of selected Stanislaus fish monitoring data. Below is the list of RPA actions from the NMFS BiOp that establish the requirements related to Stanislaus operations (Table 1).

Table 1 NMFS BiOp Reasonable and Prudent Alternative (RPA) actions, description, and page references in the 2009 RPA with 2011 amendments[1] 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[2]	Operate the East Side Division Dams to Meet the Minimum Flows, as Measured at Goodwin Dam.

[1] 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

[2] 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 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.
Action III.2.4	55	Evaluate Fish Passage at New Melones, Tulloch, and Goodwin Dams

1.2 Background

The Stanislaus River is a significant resource of considerable interest to fishery management agencies, the public, and the Bureau of Reclamation (Reclamation). The U.S. Fish and Wildlife Service (USFWS), NMFS, California Department of Fish and Wildlife (CDFW), and State Water Resource Control Board (SWRCB), are agencies with trust responsibilities for fishery and water resources in the Stanislaus River. Reclamation is responsible for operating the East Side Division, which includes New Melones Dam and its powerplant. Tri-Dam Project, a partnership between the Oakdale Irrigation District (OID) and the South San Joaquin Irrigation District (SSJID), owns and operates Donnells and Beardsley dams and reservoirs upstream of New Melones Reservoir and Tulloch Dam and Reservoir downstream of New Melones Reservoir. OID and SSJID own Goodwin Dam and Reservoir located downstream of Tulloch Dam. The East Side Division is operated to provide flood control, irrigation, power generation, general recreation, water quality, and fish and wildlife enhancement[3].

On June 4, 2009, NMFS issued its NMFS BiOp[4]. On April 7, 2011, NMFS issued adjustments[5] to the RPA of the NMFS BiOp (2011 NMFS RPA Adjustments). All references to page numbers in this document refer to the page numbers in the 2011 NMFS RPA adjustments, unless noted otherwise; all references to the NMFS BiOp should be considered to include the 2011 NMFS RPA Adjustments. The NMFS BiOp included the requirement that Reclamation create the Stanislaus Operations Group (SOG). The SOG is a technical team that provides advice to

[3] PL 78–534 and PL 87-874
[4] 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
[5] 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

NMFS and to the Water Operations Management Team (WOMT) on issues related to fisheries and water resources on the Stanislaus River, per the decision-making procedures outlined on pages 8-9 of the 2011 NMFS RPA Adjustments.

The purpose of the SOG is "to gather and analyze information, and make recommendations, regarding adjustments to water operations within the range of flexibility prescribed in the implementation procedures"[6] 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 has no authority to make operational decisions, but rather provides advice to NMFS and WOMT. NMFS will consider advice from SOG when making a final determination as to whether or not a proposed operational action is consistent with the NMFS BiOp and ESA obligations.

1.3 Membership

The SOG consists of representatives from Reclamation, USFWS, NMFS, CDFW, DWR, and the SWRCB. Other agencies may be added to the SOG provided existing agencies approve of the change in SOG membership.

[6] 2011 NMFS RPA Adjustments at p. 7.

Chapter 2 –Review of Independent Review Panel Feedback

Starting in 2010, NMFS and Reclamation, with assistance from the Delta Science Program, has coordinated an annual review of the implementation of the NMFS and FWS Biological Opinions on the long-term operations of the CVP and SWP. A summary of the recommendations from the Independent Review Panel (IRP) that relate to SOG activities is provided below by year, and by topic area (underlined). For each topic area, a summary of the actions taken by SOG (italicized text) follows the summary of the IRP recommendation (regular text):

All years (2010, 2011, 2012, 2013):

Assess biological responses, not just physical compliance: The IRP has consistently urged all technical teams to, to the extent possible, review RPA action effectiveness in terms of ecological and behavioral responses, not just in terms of physical compliance with flow or temperature requirements. *SOG members generally agree that assessing the biological responses of listed species to the flow, habitat, and temperature conditions achieved through implementation of RPA actions would be very informative, but data limitations (particularly on steelhead) remain that make such assessments difficult. In 2013 and 2014, the USFWS has conducted studies on the outmigration survival of radio-tagged Chinook salmon in the Stanislaus across a limited range of river flows; those data provide some preliminary estimates of reach specific survival within the Stanislaus that can be linked to flow.*

2010:

Additional cooperation and coordination of flows within the San Joaquin watershed: The IRP encouraged "additional cooperation to improve flexibility and maximize multipurpose water use within the San Joaquin River watershed". *NMFS issued some RPA amendments in 2011 which explicitly provided SOG the authority to adjust the timing and shape (but not the volume) of the pulse flows to allow coordination with releases on the Merced and Tuolumne rivers and in consideration of other regulatory requirements such as flow or water quality requirements in the Bay Delta Water Quality Control Plan. Subsequent to that flexibility, the SOG has coordinated the Stanislaus pulse flows with the other tributaries, in addition to shaping the magnitude, timing, and duration of various pulse flows in consideration of factors such as salmonid migration and any forecasted storm events.*

2011:

Maintain gauging stations: Because of problems with both the Orange Blossom Bridge and Ripon temperature gauges, the IRP suggested that maintenance of existing gauges be prioritized. *Problems at those gauges have been corrected.*

Link timing and shape of pulsed dam releases to natural events: *Even before this recommendation was made, SOG had shifted the timing of the winter instability flows to coincide with natural storm events if possible. The new RPA language issued in April 2011 made it clear that SOG could advise adjustments to the fall, winter, and spring pulse flows that maintained the*

same volume and still met the objectives of the RPA action; SOG has reshaped many of the required pulses to better match the shape of a natural event within the constraints of the system. Build a "RIVERNET" system linked to a flow routing model coupled with a climate component to forecast and manage temperature: *No meteorological stations have been added at the New Melones or Tulluch outlets, no temperature buoys have been placed in Goodwin Reservoir. NMFS has been working with Tetra Tech to develop a temperature model for the Stanislaus River based on the Environmental Fluid Dynamics Code (EFDC) platform. This EFDC application, in conjunction with an existing HEC-5Q based temperature model for the Stanislaus, provide two tools for evaluating how water temperatures might respond to different operational scenarios. The EFDC model was only recently completed and has not yet been used by NMFS or SOG for implementation of the NMFS BiOp.*

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Chapter 3 – Summary of Actions and SOG Discussions

The following agenda items were discussed at monthly SOG meetings from October 2013 through September 2014.

3.1 Monthly Discussion Topics

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

3.2 Other Discussion Topics

The following list of SOG discussion topics highlights some additional substantive issues reviewed by SOG over the past year. Minor or logistical discussion items are documented in the notes, but not listed here.

- Fall Attraction Flows (September 2013 meeting) – modified schedule in a way still consistent with the intent of the RPA action.
- Winter Instability Flows (December and January meetings) –explored different options for pulse shapes and timing.
- Drought Operations Plan (DOP) - emergency meeting in early April to discuss spring pulse to coordinate with the recently developed DOP. Per the DOP, flows were scheduled in April and May.
- Annual Review Report (June, July and August meetings).

3.3 Implementation of RPA Actions in WY2014

3.3.1 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.

The 56^{o}F temperature criterion at OBB in the fall is intended to provide temperatures suitable for the migration and holding of CV steelhead. The NMFS BiOp notes that "This criterion shall apply as of October 1 or as of initiation date of fall pulse flow as agreed to by NMFS." SOG expected that few CV steelhead would migrate into the Stanislaus River before the fall

pulse flow. The net upstream cumulative count of fall-run Chinook counted at the Stanislaus Weir from 9/3/2013 through 9/24/2013 was 119 fish, and no CV steelhead had been observed during the fall at the weir.

For 2013, SOG advised that the fall temperature criterion of 56°F at Orange Blossom Bridge apply as of the initiation of the main attraction pulse within the reshaped fall pulse flow, 10/23/13.

3.3.2 RPA Action III.1.3 (Flow Management)

This RPA action requires Reclamation to operate releases from the East Side Division reservoirs according to the New Melones yeartype specific minimum flow schedules in Appendix 2-E of the NMFS BiOp.

Fall Pulse Flow

The fall attraction flow is one component of the daily flow schedule required in Appendix 2-E of the NMFS BiOp. As noted 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."

SOG considered two reshaped flow schedules (Alternative A and Alternative B in Table 2 and Figure 1), both of which had the same volume (26,775 AF) as the Dry water year type in Appendix 2-E. SOG advised Alternative B in order to (a) achieve the slightly higher peak flow, which may provide a stronger signal to returning adults to reduce straying, (b) include a longer pulse "tail", which SOG expected would help to buffer water temperatures through mid-November, and (c) still provide variability in flow in order to deter spawning until flows steady in the pulse tail. Factors considered in the design of the SOG-advised fall attraction pulse are listed in Table 3.

Table 2 SOG fall pulse flow schedules considered. The subheadings in the "SJ Vernalis-Alt A" and "SJ Vernalis-Alt B" columns summarize the lags used to account for the time it takes water from the mouths of each tributary to reach Vernalis, on the mainstem San Joaquin River. The aggregate flow reaching Vernalis from all tributaries was estimated based on an approximate travel time of two days for water from the Stanislaus River (S-2) and Tuolumne River (T-2), and three days for water from the Merced River (M-3).

	SJ Vernalis - Alt A	SJ Vernalis - Alt B	Stanislaus River			Tuolumne River		Merced River		
	Lag S-2, T-2, M-3	Lag S-2, T-2, M-3	NMI - Dry			Based on Intermediate BN-AN year type = 89,882 AF				
			Table 2E	Reshaped	Reshaped			MNWR		
Date	Flow CFS	Flow CFS	Dry CFS	SOG A CFS	SOG B CFS	Base CFS	Pulse CFS	Base CFS	Transfer CFS	Pulse CFS
10-Oct	381	381	200	200	200	126		15	40	
11-Oct	381	381	200	200	200	126		15	40	
12-Oct	381	381	200	200	200	126		15	40	
13-Oct	381	381	200	500	500	126		15	40	
14-Oct	381	381	200	1,000	900	126		15	40	
15-Oct	681	681	500	800	775	126		15	40	
16-Oct	1,181	1,081	750	700	725	126		60	40	
17-Oct	981	956	1,000	500	450	126		60	40	
18-Oct	881	906	1,250	300	450	126		60	40	
19-Oct	726	676	1,250	800	450	126		60	40	
20-Oct	526	676	1,250	1,499	450	126		60	40	
21-Oct	1,026	676	1,500	1,350	450	126		60	40	
22-Oct	1,725	676	1,500	1,050	450	126	400	60	40	
23-Oct	1,576	676	1,500	900	2,000	126	600	60	40	
24-Oct	1,676	1,076	1,250	700	1,700	126	600	60	40	600
25-Oct	1,726	2,826	1,250	500	1,500	126	600	60	40	1,600
26-Oct	1,526	2,526	1,250	300	1,300	126	300	60	40	1,300
27-Oct	1,926	2,926	1,000	1,499	1,100	126	200	60	40	1,000
28-Oct	2,426	3,426	750	1,350	900	126	64	60	40	800
29-Oct	3,225	2,826	500	1,050	700	126		60	40	600
30-Oct	2,640	2,190	200	900	500	126		60	40	300
31-Oct	2,076	1,726	200	700	350	126		60	40	103

Table 2. Continued.

	SJ Vernalis - Alt A Lag S-2, T-2, M-3	SJ Vernalis - Alt B Lag S-2, T-2, M-3	Stanislaus River NMI - Dry			Tuolumne River Based on Intermediate BN-AN year type = 89,882 AF		Merced River		
Date	Flow CFS	Flow CFS	Table 2E Dry CFS	Reshaped SOG A CFS	Reshaped SOG B CFS	Base CFS	Pulse CFS	MNWR Base CFS CFS	MNWR Transfer CFS	Pulse CFS
1-Nov	1,726	1,326	200	600	350	150		180	40	
2-Nov	1,226	876	200	450	350	150		180	40	
3-Nov	953	703	200	325	350	150		180	40	
4-Nov	820	720	200	275	350	150		180	40	
5-Nov	695	720	200	252	350	150		180	40	
6-Nov	645	720	200	200	350	150		180	40	
7-Nov	622	720	200	200	250	150		180	40	
8-Nov	570	720	200	200	250	150		180	40	
9-Nov	570	620	200	200	250	150		180	40	
10-Nov	570	620	200	200	250	150		180	40	
11-Nov	570	620	200	200	250	150		180	40	
12-Nov	570	620	200	200	250	150		180	40	
13-Nov	570	620	200	200	250	150		180	40	
14-Nov	570	620	200	200	250	150		180	40	
15-Nov	570	620	200	200	250	150		180	40	
16-Nov	570	620	200	200	250	150		180	40	
17-Nov	570	620	200	200	250	150		180	40	
18-Nov	570	620	200	200	250	150		180	40	
19-Nov	570	620	200	200	250	150		180	40	
20-Nov	570	620	200	200	250	150		180	40	
21-Nov	570	620	200	200	250	150		180	40	
22-Nov	570	620	200	200	200	150		180	40	
23-Nov	570	620	200	200	200	150		180	40	
24-Nov	570	570	200	200	200	150		180	40	
25-Nov	570	570	200	200	200	150		180	40	
26-Nov	570	570	200	200	200	150		180	40	
27-Nov	570	570	200	200	200	150		180	40	
28-Nov	570	570	200	200	200	150		180	40	
29-Nov	570	570	200	200	200	150		180	40	
30-Nov	570	570	200	200	200	150		180	40	

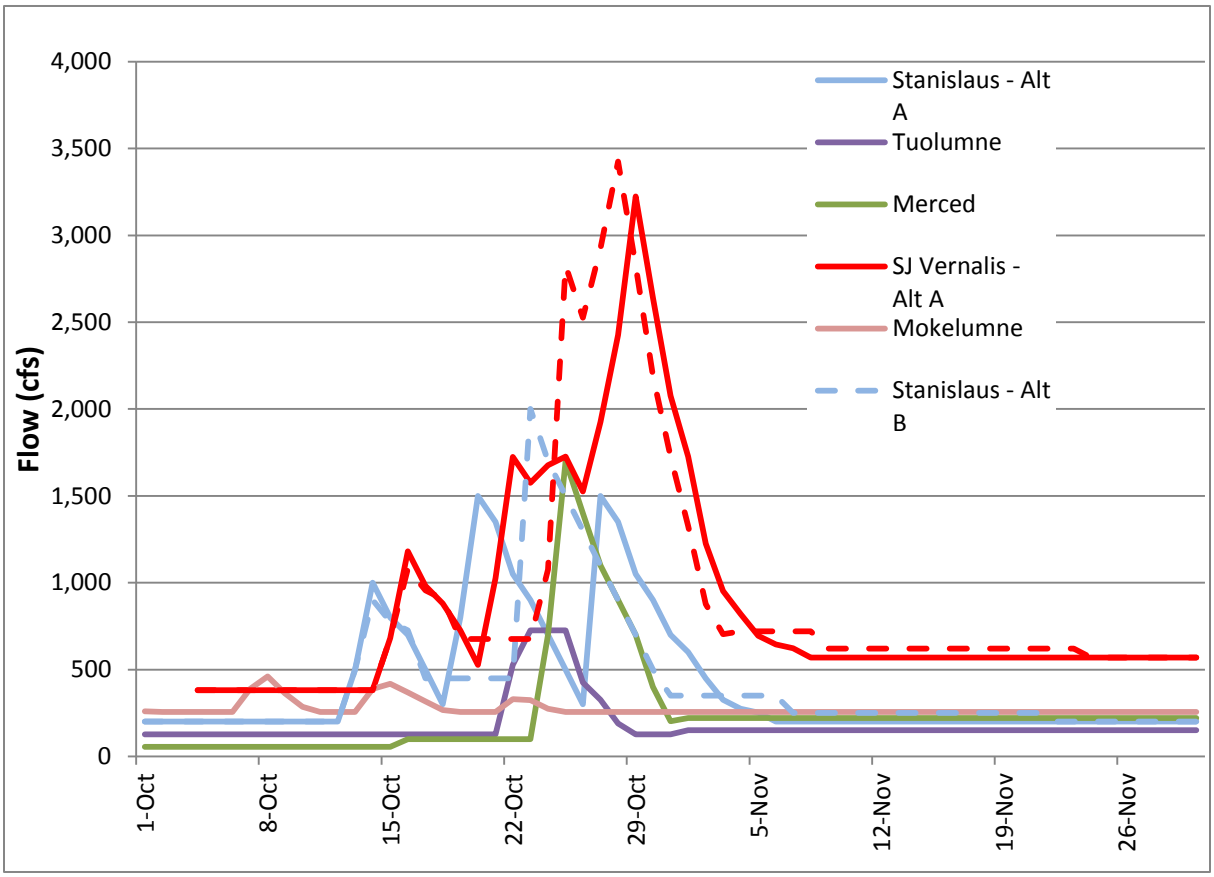


Figure 1. San Joaquin River tributary releases and resulting Vernalis flow for fall 2013 under the SOG-advised flow schedule (Alt-B) as well as under the alternative flow schedule considered by SOG (Alt-A). The estimated Vernalis flow was calculated as the sum of the estimated flows (with appropriate lag due to travel time to Vernalis) from the San Joaquin River at the confluence with the Merced River (3 day lag), Tuolumne River (2 day lag), and Stanislaus River (2 day lag).

Table 3. Factors considered in the design of the SOG-advised fall attraction pulse. The expected timing and volume of pulse flows on the Merced and Tuolumne were also considered when evaluating how the Stanislaus fall pulse flow might affect conditions at Vernalis and in the San Joaquin River.

Driver	Location	Lifestage	Notes
Agriculture	lower tributary	N/A	The NMFS Appendix 2-E flow schedule does, in some yeartypes, require flows above 1500 cfs. Because of seepage concerns, NMFS limited the duration of those flows to no more than 10 consecutive days. Since the Below Normal Appendix 2-E flow pulse peaks at 1500 cfs, NMFS doesn't require flows above this level during this yeartype.
D.O.	Vernalis	Adult	The combined pulse should, ideally, provide sufficient flow to achieve a D.O. of at least 7 ppm in the deepwater ship channel.
Migration Window	Vernalis	Adult	Provide temperature/D.O. suitable for upmigration for at least several weeks.
Monitoring	Riverbank	N/A	Weir operation is impacted when flows exceed 1500 cfs, or last for more than a few days at 1500 cfs. Ramping down to 500 cfs after peak flows allow the weir to be cleaned.
Redd Scour/ Dewatering	Trib/ spawning area	redd/eggs/fry	The main pulse should occur before a significant number of the season's redds are constructed. Historically, few redds are constructed before the 4th week of Oct, though in some years redd activity picks up in mid-October.
Redd Dewatering	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.

Straying	Vernalis	Adult	Straying may be reduced when San Joaquin flows at Vernalis exceed 4,000 cfs.
Straying	delta	Adult	Straying may be reduced when the ratio of south delta exports to inflow is no greater than 2:1.
Straying	Vernalis/ I street	Adult	Straying may be reduced when the ratio of Sacramento Inflow (I Street) to SJ Inflow (Vernalis) is no greater than 2:1.
Temperature	Vernalis	Adult	Pulse should be late enough to provide cool enough temperatures for upmigrants through the San Joaquin to avoid egg mortality within migrating adults.
Temperature	Trib/spawning area	Adult	Pulse should be shaped and timed to provide and maintain instream temperatures sufficient to avoid egg mortality for returning adults.
Swiftwater Rescue Training	Knights Ferry	N/A	National Search and Rescue Academy (NSARA) has requested flows above 800 cfs from 10/14/13-10/16/13 for a scheduled swiftwater rescue training course at Knights Ferry.
Maintenance	New Melones	N/A	The lower level outlet at New Melones will be in use from 11/4/13-11/22/13 during maintenance of the main outlet. During this time, releases should be minimized.

Winter Instability Flows

Winter instability flows in January and February are another component of the daily flow schedule in Appendix 2-E of the NMFS BiOp required per Action III.1.3 of the Reasonable and Prudent Alternative (RPA). As noted in the 2011 RPA Amendments (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."

SOG advised a modified winter instability flow for implementation in both January and February that met the intent of the RPA action. For January and February 2014, SOG advised that the winter instability flow (Dry yeartype): (a) be reshaped according to the "Alternative H" flow schedule described in Table 4 and Figure 2, and (b) be shifted in time to coincide with a natural storm event.

a) RESHAPING: The alternate pulse shaping had the same volume (1,190 AF) as the Dry winter instability pulse in Appendix 2-E but was reshaped to include a higher peak flow. It provided variability in the winter hydrograph by simulating a small storm pulse. The shape of the "Alternative H" 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 850 cfs for part of the first day of the pulse would inundate a greater portion of the Honolulu Bar restoration area and would 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 familiar with those areas that, since the restoration at Honolulu Bar, there are minimal stranding concerns for juvenile salmonids for flow changes up to 800 cfs, and probably even up to flows of 1,000-1,500 cfs.

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 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 would co-occur with the pulse of regulated flow.

Table 4. Selection of winter instability flow shapes considered by SOG; not all preliminary flow shapes considered are included.

Day	Time	Appendix 2-E	Alt D	Alt H
1	1	400	200	200
1	2	400	246	200
1	3	400	302	**300**
1	4	400	372	300
1	5	400	457	**400**
1	6	400	562	400
1	7	400	690	**500**
1	8	400	849	500
1	9	400	825	**750**
1	10	400	802	750
1	11	400	780	**850**
1	12	400	758	850
1	13	400	737	850
1	14	400	716	850
1	15	400	696	**800**
1	16	400	677	800
1	17	400	658	800
1	18	400	639	800
1	19	400	622	**650**
1	20	400	604	650
1	21	400	587	650
1	22	400	571	650
1	23	400	555	**550**
1	0	400	539	550
2	1	400	524	550
2	2	400	510	550
2	3	400	495	**475**
2	4	400	482	475
2	5	400	468	475
2	6	400	455	475
2	7	400	442	**425**
2	8	400	430	425
2	9	400	418	425
2	10	400	406	425
2	11	400	395	**350**
2	12	400	384	350
2	13	400	373	350
2	14	400	363	350
2	15	400	353	**320**
2	16	400	343	320
2	17	400	333	320
2	18	400	324	320
2	19	400	315	**300**
2	20	400	306	300
2	21	400	298	300
2	22	400	289	300
2	23	400	281	**270**
2	0	400	273	270
3	1	400	266	270
3	2	400	258	270
3	3	400	251	**245**
3	4	400	244	245
3	5	400	237	245
3	6	400	231	245
3	7	400	224	**200**
3	8	400	218	200
3	9	400	212	200
3	10	400	206	200
3	11	400	200	**200**
3	12	400	200	200
3	13	400	200	200
3	14	400	200	200
3	15	400	200	200
3	16	400	200	200
3	17	400	200	200
3	18	400	200	200
3	19	400	200	200
3	20	400	200	200
3	21	400	200	200
3	22	400	200	200
3	23	400	200	200
3	0	400	200	200
4	1	200	200	200
4	2	200	200	200
4	3	200	200	200
4	4	200	200	200
4	5	200	200	200
4	6	200	200	200
4	7	200	200	200
4	8	200	200	200
4	9	200	200	200
4	10	200	200	200
4	11	200	200	200
4	12	200	200	200
4	13	200	200	200
4	14	200	200	200
4	15	200	200	200
4	16	200	200	200
4	17	200	200	200
4	18	200	200	200
4	19	200	200	200
4	20	200	200	200
4	21	200	200	200
4	22	200	200	200
4	23	200	200	200
4	0	200	200	200
avg hourly cfs		350	350.5207	350.42
over 4 days		1400	1402.1	1401.7

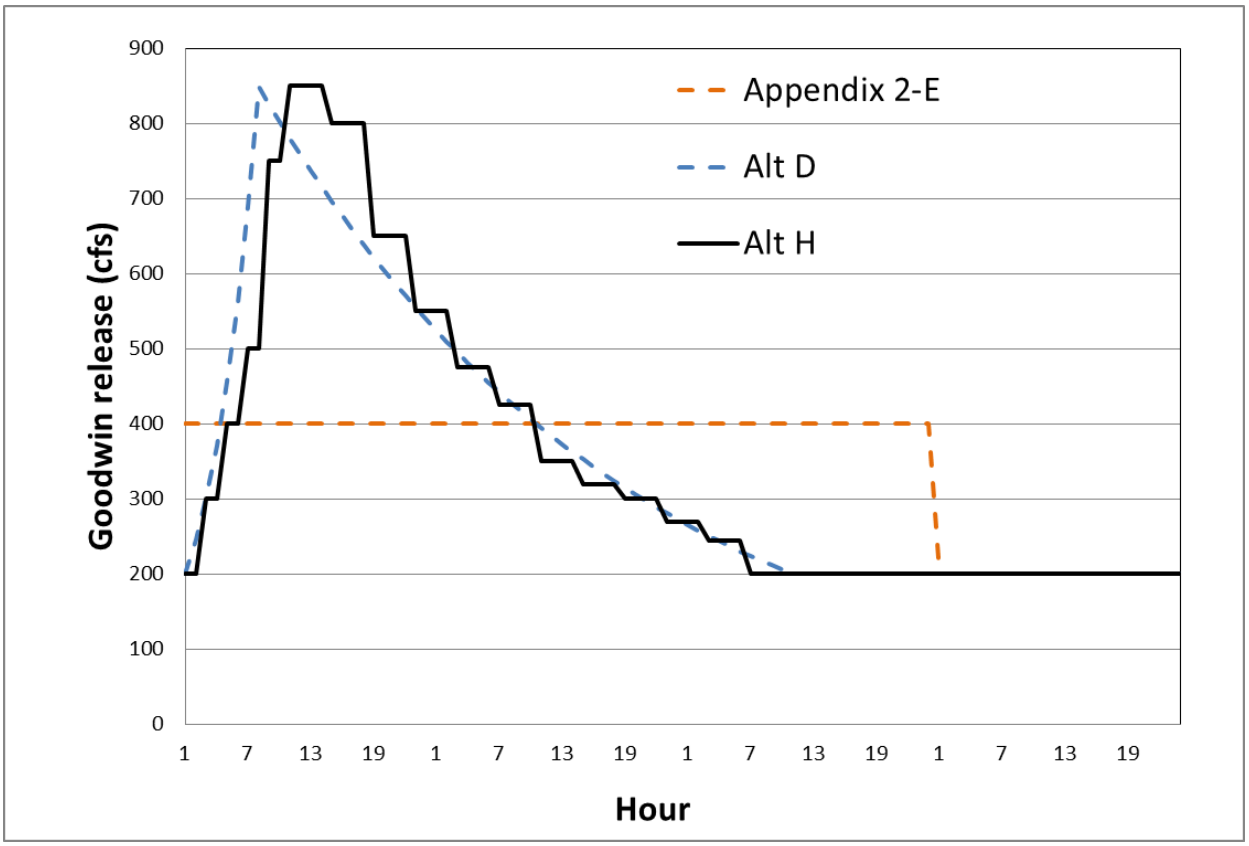


Figure 2. Plot of winter instability flow shapes from Table 4. Note that the horizontal "Hour" axis is *not* intended to imply any particular date, since the advice is to implement the pulse, if possible, coincident with a natural storm event rather than on a specific calendar date.

The SOG advice noted that if the January winter instability pulse had not been implemented by the January SOG meeting on 1/15/14, then SOG would schedule the pulse to be initiated no later than 1/31/14. The January winter instability flow was initiated on 1/27/14. The advice also noted that if the February winter instability pulse had not been implemented by the February SOG meeting on 2/19/14, then SOG would schedule the pulse to be initiated no later than 2/28/14. By mid-February, the second winter instability pulse flow had not yet been implemented. Because the yeartype for implementation of the minimum flow schedule changed from Dry to Critically Dry based on the February forecast, SOG provided a revised flow schedule (see Table 5 and Figure 3) to accommodate the slightly smaller pulse volume of the February winter instability flow in a Critical year. The February winter instability flow was initiated on 2/27/14.

Table 5. Winter instability flow shape advised by SOG (Feb 2014, highlighted in yellow), in comparison to the pulse as described in Appendix 2-E.Bold numbers in the "Feb 2014" column indicate changes in flow.

Day	Time	Appendix 2E (Critically Dry)	Feb 2014
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

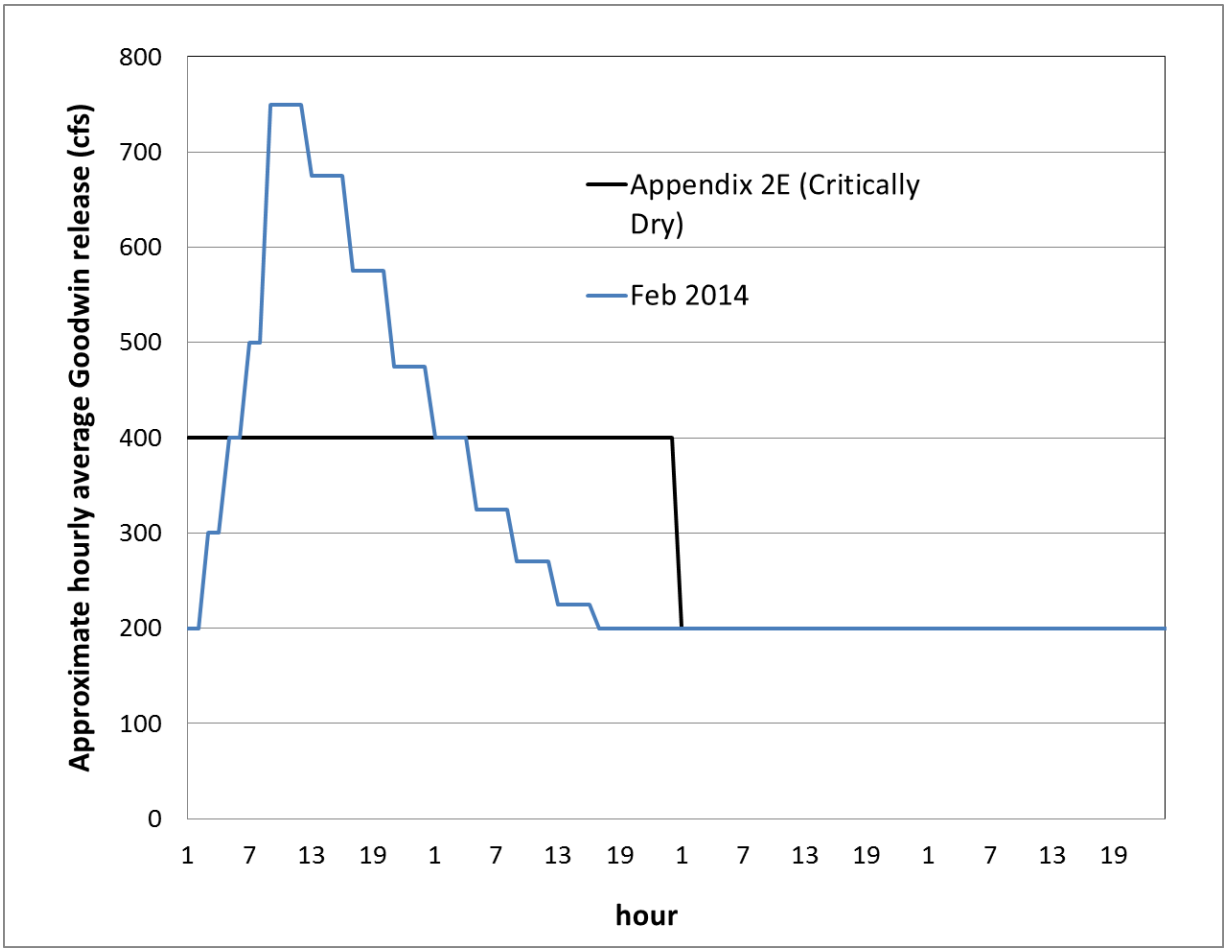


Figure 3. Plot of winter instability flow shapes from Table 5. Note that the horizontal "Hour" axis is *not* intended to imply any particular date since the advice is to implement the pulse, if possible, coincident with a natural storm event rather than on a specific calendar date.

Spring Pulse Flow

In WY 2014, the spring pulse flow on the Stanislaus was implemented in the context of the Drought Operations Plan (DOP)[7], which required that the spring pulse flow on the Stanislaus be coordinated with other actions in the DOP, including a flow requirement at Vernalis on the San Joaquin River. Reclamation and the State Water Resources Control board (SWRCB) asked that SOG meet to provide input on coordinating the pulse flows identified in the DOP. SOG convened an urgent meeting on April 9, 2014, and provided the advice for implementation of a spring outmigration pulse flow schedule on the Stanislaus that was consistent with the commitments in the DOP for both Stanislaus and Vernalis flow targets. Flow advice would be adjusted, as needed, at later meetings that reviewed recent actual flows and the additional flows

[7] Available at: http://www.ca.gov/Drought/2014-Operations-Plan.pdf

necessary to meet the modified Vernalis flow requirement. The later meetings, held 4/24/14 and 5/5/14, included a broader range of invitees, including Real Time Drought Operations Management Team and Water Operations Management Team participants that do not typically participate in SOG. The initial advice from SOG (Attachment 1 of Appendix A), and associated adjustments to that advice from the larger group are provided in Appendix A; the approximate flow schedule included in the 5/7/14 advice is shown below in Table 6 and Figure 4.

Table 6. Approximate flow schedule to meet the pulse flow commitments in the 2014 DOP. The estimated contributions from each source to Vernalis flows are estimates, and may not have been implemented exactly as shown below. "Pulse days" are highlighted in yellow; estimated flows are in italics, the Goodwin releases and estimated Vernalis flows affected by this advice are in bold. The estimated flow at Vernalis is the sum of flows from the Stanislaus River (lagged two days), the Tuolumne River (lagged two days), the Merced River (lagged three days), above the Merced River (lagged three days) and ungaged flows below the Merced River (not lagged).

		3 dy lag to VNS	2 dy lag to VNS	2 dy lag to VNS			2 dy lag to VNS		0 day lag to VNS		
		Cressy (Merced)	Below La Grange Dam (Tuolumne)	Goodwin Dam (Stanislaus)	SJR near Newman (at the confluence with the Merced)	Merced River near Stevinson (near confluence with SJR)	Estimate of flow from upstream of the Merced	Vernalis (SJR)	Calculated as: VNS-CRS-LGN-GDW-(NEW-MST), with listed lags	Calculated as: CRS + LGN + GDW + (NEW-MST) + Ungaged Flow Estimate, with listed lags	Over 31 days, VNS should be equivalent to:
Pulse Day	Date	CRS	LGN	GDW	NEW	MST	NEW-MST	VNS (actual)	UNGAGED FLOW (estimated)	VNS (estimated)	
	4/15/2014	111	407	2522	283	100	183	857	*-203*	857	
	4/16/2014	95	1091	2506	259	90	169	1458	*-628*	1458	
1	4/17/2014	92	1213	2584	245	92	153	2060	*-1164*	2060	3300
2	4/18/2014	89	638	2507	239	92	147	2760	*-1117*	2760	3300
3	4/19/2014	91	631	2505	238	92	146	2941	*-1104*	2941	3300
4	4/20/2014	99	630	2511	229	88	141	2868	*-516*	2868	3300
5	4/21/2014	136	636	2507	237	104	133	2896	*-475*	2896	3300
6	4/22/2014	139	635	2503	246	112	134	2844	*-529*	2844	3300
7	4/23/2014	194	776	2524	241	112	129	2768	*-607*	2768	3300
8	4/24/2014	481	643	2521	243	144	99	2735	*-673*	2735	3300
9	4/25/2014	570	296	2501	357	286	71	2898	*-670*	2898	3300
10	4/26/2014	651	162	2510	435	353	82	3011	*-446*	3011	3300
11	4/27/2014	684	162	2507	507	428	79	3035	*-314*	3035	3300
12	4/28/2014	602	163	2509	556	455	101	2984	*-340*	2984	3300
13	4/29/2014	330	176	2599	511	385	126	2925	*-474*	2925	3300
14	4/30/2014	213	183	2351	382	248	134	2867	*-590*	2867	3300
15	5/1/2014	137	164	2110	304	186	118	2795	*-708*	2795	3300
16	5/2/2014	128	164	2109	253	148	105	2488	*-510*	2488	3300
17	5/3/2014	127	164	2114	236	136	100	2288	*-317*	2288	1500
18	5/4/2014	123	164	2112	232	136	96	2276	*-239*	2276	1500
19	5/5/2014	125	*164*	*2100*	*232*	*136*	*96*		*-300*	*2206*	1500
20	5/6/2014	125	*164*	*2100*	*232*	*136*	*96*		*-300*	*2199*	1500
21	5/7/2014	125	*164*	*2100*	*232*	*136*	*96*		*-300*	*2183*	1500
22	5/8/2014	125	*164*	*2100*	*232*	*136*	*96*		*-300*	*2185*	1500
23	5/9/2014	125	*164*	***2100***	*232*	*136*	*96*		*-300*	*2185*	1500
24	5/10/2014	125	*164*	***2100***	*232*	*136*	*96*		*-300*	*2185*	1500
25	5/11/2014	125	*164*	***2100***	*232*	*136*	*96*		*-300*	***2185***	1500
26	5/12/2014	125	*164*	***2100***	*232*	*136*	*96*		*-300*	***2185***	1500
27	5/13/2014	125	*164*	***2100***	*232*	*136*	*96*		*-300*	***2185***	1500
28	5/14/2014	125	*164*	***1600***	*232*	*136*	*96*		*-300*	***2185***	1500
29	5/15/2014	125	*164*	***1100***	*232*	*136*	*96*		*-300*	***2185***	1500
30	5/16/2014	125	*164*	*600*	*232*	*136*	*96*		*-300*	***1685***	1500
31	5/17/2014	125	*164*	*600*	*232*	*136*	*96*		*-300*	***1185***	1500
	5/18/2014	125	*164*	*600*	*232*	*136*	*96*		*-300*	*685*	
									Average VNS estimate (Days 1-16 of pulse)	2805	3300
									Average VNS estimate (Days 17-31 of pulse)	2100	1500
									Average VNS estimate (Days 1-31 of pulse)	2464	2429

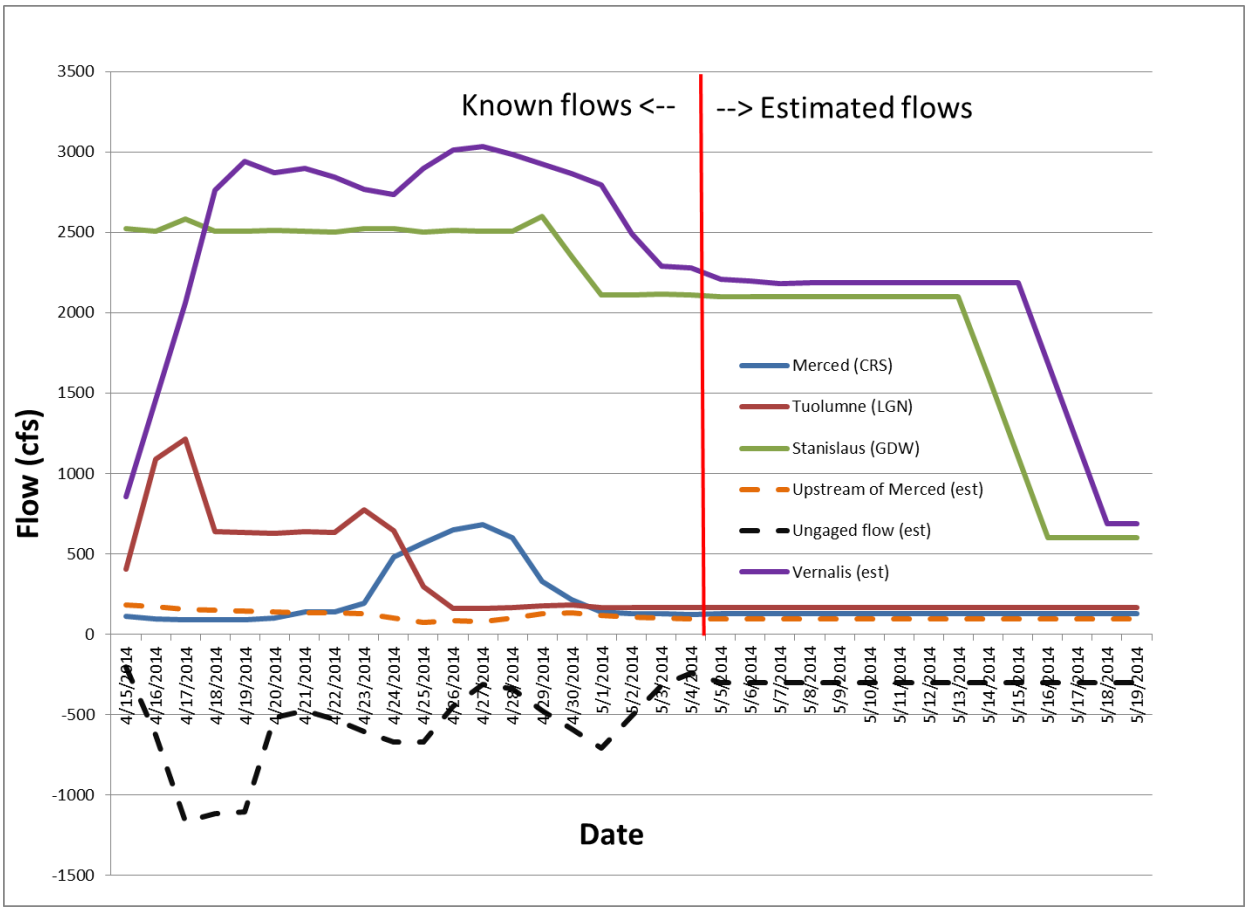


Figure 4: Approximate flow schedule to meet the pulse flow commitments in the 2014 DOP. The estimated contributions from each source to Vernalis flows are estimates, and may not have been implemented exactly as shown above. The estimated flow at Vernalis is the sum of flows from the Stanislaus River (lagged two days), the Tuolumne River (lagged two days), the Merced River (lagged three days), the San Joaquin River upstream of the confluence with the Merced River (lagged three days) and ungaged flows in the San Joaquin River downstream of the confluence with the Merced River (not lagged; the negative ungagged flow estimate indicates an expected net channel depletion).

3.3.3 RPA Action III.2 (Habitat Restoration)

Gravel augmentation -- RPA Action III.2.1 (2011 NMFS RPA Adjustments at p. 53)

This RPA action calls for Reclamation to minimize effects of water operations on the Stanislaus River through improving spawning habitat for steelhead trout. On June 30, 2010, Reclamation submitted to NMFS a plan which outlines projects that aim to achieve placement of 50,000 cubic yards of gravel in the Stanislaus River by 2014. This plan includes project descriptions for projects scheduled or likely to occur (*e.g.*, Honolulu Bar, Goodwin Canyon, Lover's Leap) as well as implementation schedules and monitoring efforts to improve spawning habitat. Project descriptions for *potential* projects that may help to

meet the gravel augmentation requirements under this action, but are in various stages of development, are also described (*e.g*., Knights Ferry, Two Mile Bar, Horseshoe Recreation Area, and Valley Oak Restoration Area).

Since the NMFS BiOp was issued in 2009, approximately 8,000 tons (5,333 cubic yards) of gravel has been placed in Goodwin Canyon. Substantial improvements in project funding need to be made in the future to meet the gravel augmentation target, since only 16% of the target amount was completed since 2009. No gravel was added in 2013 because Reclamation's funding authority for gravel projects requires a cost share agreement that was not able to be executed for 2013 projects. Draft designs and test pitting have been completed for a spawning and rearing habitat project (side channel, floodplain, gravel) at Two Mile Bar. This project is awaiting a property appraisal. The Honolulu Bar project is complete and floodplain/side-channel restoration projects with potential to augment instream gravel are in the design stage at the Buttonbush and Knights Ferry Recreation Areas. Funding for the Buttonbush and Knights Ferry projects has been delayed due to shortfalls in the CVPIA Restoration Fund resulting from the current drought.

During monitoring of RPA-related gravel placements in Goodwin Canyon in November and December of 2012, 285 Chinook salmon redds were mapped in the gravel placement reach. The peak river-wide redd count was 1,023 redds which occurred the week of November 12, 2012. No monitoring of steelhead or trout spawning has occurred in the Stanislaus other than sporadic incidental observations. Gravel movement from the gravel placements in Goodwin Canyon has been monitored through snorkel surveys. The primary source of gravel to the canyon since Goodwin Dam was built has been the recent gravel placements (over the last 15 years or so) so the cumulative movement of this material can be visually monitored with snorkel surveys in the canyon. A 2013 survey showed gravel accumulations creating spawning habitat 0.2 mile downstream of the placement reach (Figures 5 and 6). No gravel has reached the downstream end of the large pool at the old stream gauge site located 0.5 mile downstream of the gravel placement site and one mile downstream of Goodwin Dam.

Steelhead in the Stanislaus River likely spawn at times similar to steelhead in other CVP rivers. Formal spawning surveys have not been conducted, but a trial survey was conducted by Reclamation and CDFW on February 5, 2014 between Knights Ferry and Horseshoe Bar and near Goodwin Dam. Ten redds were found in the Knights Ferry reach (Figure 5) and two were found in Goodwin Canyon at the Cable crossing area (Figure 6). The redds are likely a mixture of resident and potentially anadromous *O. mykiss*. One of the redds was occupied by spawners with estimated lengths of 25 m (10 inches) and 35 cm (14 inches). The absence of abundant spawning near Goodwin Dam during this survey probably indicates mostly resident (later spawning) fish in the area.

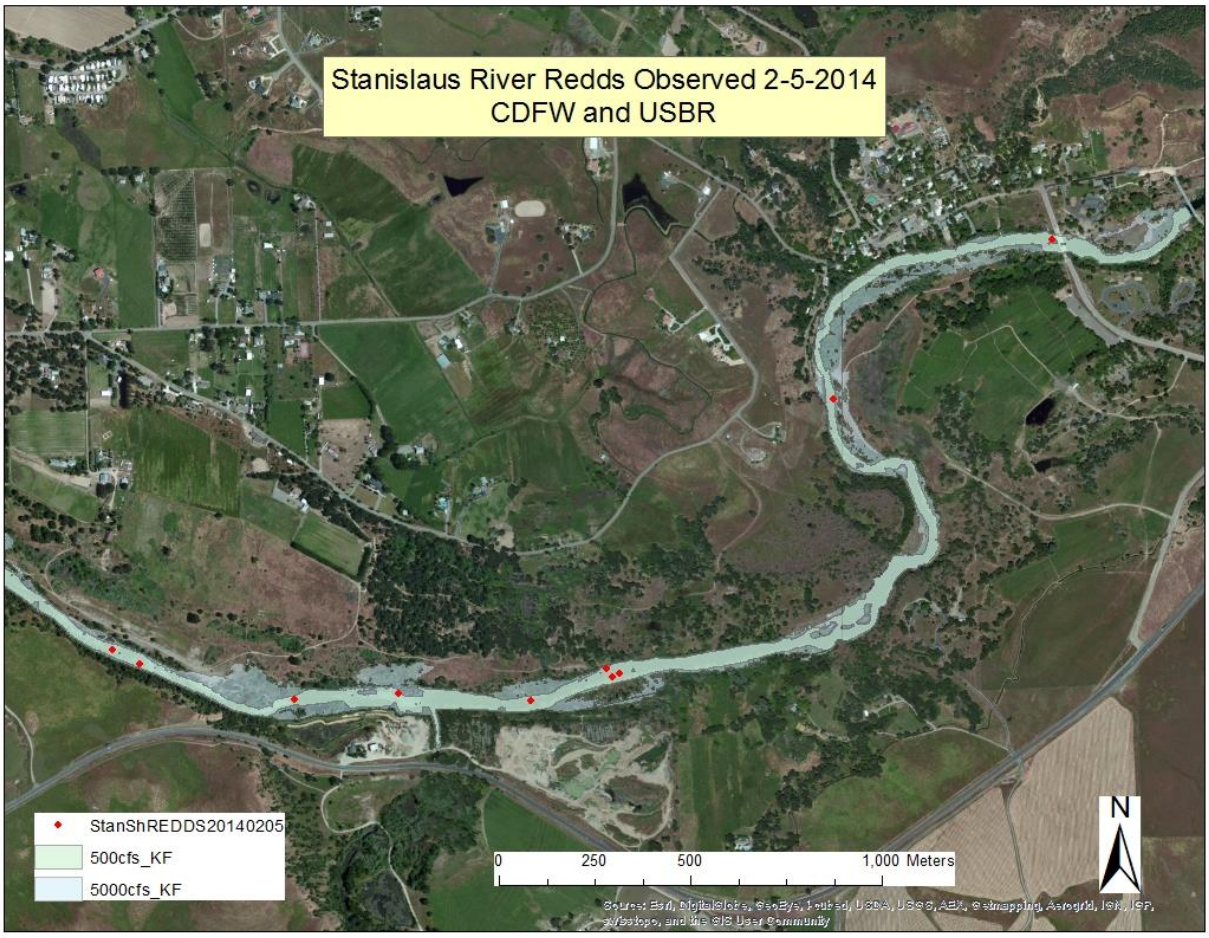


Figure 5 Fresh Redd Locations Identified in a Redd Survey Conducted February 5, 2014 by CDFW and Reclamation between Knights Ferry and Horseshoe Bar

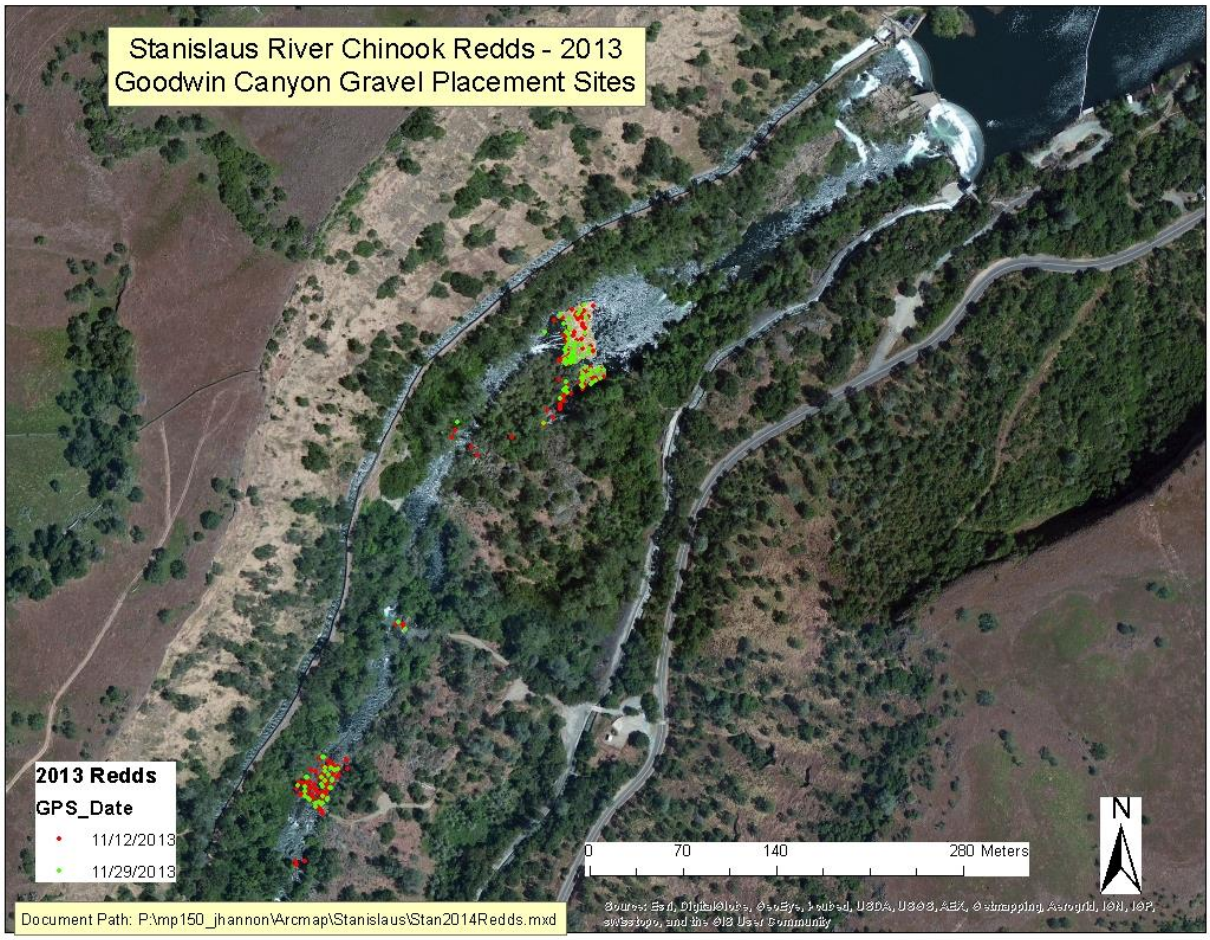


Figure 6 Map of the 2013 Goodwin Canyon Redds

Conduct Floodplain Restoration and Inundation Flows -- RPA Action III.2.2 (2011 NMFS RPA Adjustments at p. 54)

This RPA action calls for Reclamation to seek advice from SOG to develop an operational strategy to achieve floodplain inundation flows that inundate CV steelhead juvenile rearing habitat on a 1- to 3-year return schedule, and to submit a proposed plan of operations to achieve this flow regime by June 2011. During 2010, SOG discussed several ongoing or proposed floodplain restoration projects (*e.g*. Honolulu Bar, Buttonbush, and Two Mile Bar) which provide several ecological benefits such as: providing refuge from predators, producing additional food resources, improving vegetative contaminant removal, and promoting natural riparian recolonization of woody species which can reduce water temperatures, attenuate flood flows, increase groundwater recharge, and clean instream gravels through deposition of fine sediments on the floodplain. These projects can also provide local gravel for meeting the requirements of Action III.2.1, minimizing the need to import gravel from other watersheds and reducing transportation costs. Projects which restore floodplain and side-channel habitats can increase the acres of seasonally inundated habitats necessary for rearing salmonids without requiring changes to the existing hydrograph. A draft plan was submitted in 20l1 and resubmitted in 2013 for review and approval. Reclamation and NMFS are working on refining

the draft plan, which may benefit from a recently developed inundation model for the Stanislaus River developed by Newfields based on some initial work by Mark Gard (USFWS) and Reclamation.

Evaluate Fish Passage at New Melones, Tulloch, and Goodwin Dams -- RPA Action III.2.4 (2011 NMFS RPA Adjustments at p. 55)

SOG expects that Action III.2.4, which calls for an evaluation of fish passage at New Melones, Tulloch, and Goodwin Dams, will be addressed by the Interagency Fish Passage Steering Committee.

Chapter 4 – Water Operations Summary

This chapter briefly describes Stanislaus River operations for water year 2014, pertaining to RPA Actions III.1.2 and III.1.3. These actions are presented in reverse order for clarity.

4.1 Action III.1.3 – Flow Management

Figure 7 summarizes New Melones Reservoir operations from October 2013 through mid-September 2014.

Figure 7 Summary of New Melones Reservoir Operations during the 2014 water year.

The 2014 water year classifications for determining Appendix 2-E minimum flows, based on the New Melones Index, were as follows in Table 7 (the New Melones Index is based on forecasted inflows and storage volume). Per agreement (SOG meeting notes from February 17, 2010), the New Melones Water Supply Parameter was calculated by using the Interim Plan of Operations (IPO) methodology.

Table 7 Water Year Classification by Month

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

Stanislaus River Operations:
The October pulse was implemented according to the September SOG advice. SOG recommended that the fall attraction flow (below normal yeartype) be reshaped according to the flow schedule described in Chapter 2.3. During April and May, releases were governed by Appendix 2-E and the DOP. In July, operations were governed by the Ripon Dissolved Oxygen standard. This continued to be the controlling standard through late August 2014.

Goodwin Reservoir releases to the Stanislaus River are shown in Figure 8, including the primary reasons for those releases. Table 8 contains a summary of release changes from Goodwin Reservoir indicating the purpose of the operational change. Reclamation has made provisions to notify the public of potential safety or high flow considerations such as recreational precautions, inundation, and seepage as appropriate.

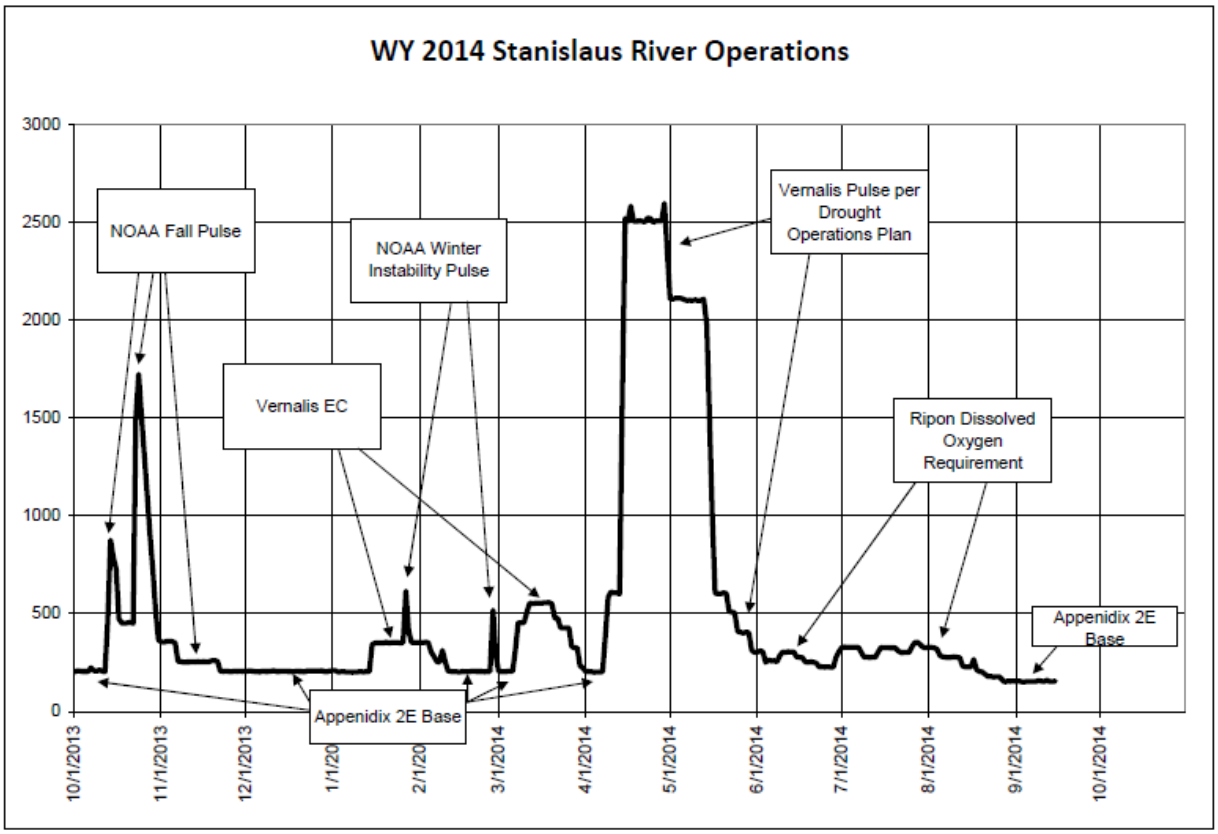


Figure 8 Summary of Stanislaus River Release at Goodwin Dam. Boxes identify the controlling requirements

Table 8 Release Changes at Goodwin Dam

Date	Time of Change	INC OR DEC	Flow in cfs	Comment/Reason
1/15/2014	0100	INC	300	D-1641 Vernalis EC
	0300	INC	350	
1/27/2014	0500	INC	400	App 2E Pulse
	0700	INC	500	
	0900	INC	750	
	1100	INC	850	
	1500	DEC	800	
	1900	DEC	650	
	2300	DEC	550	
2/5/2014	0100	DEC	300	D-1641 Vernalis EC
2/6/2014	1300	DEC	250	D-1641 Vernalis EC
2/11/2014	0100	DEC	200	NOAA 2E minimums
2/27/2014	0300	INC	300	NOAA Pulse
	0500	INC	400	
	0700	INC	500	
	0900	INC	750	
	1300	DEC	675	
	1700	DEC	575	
	2100	DEC	475	
2/28/2014	0100	DEC	400	NOAA Pulse
	0500	DEC	325	
	0900	DEC	270	
	1300	DEC	225	
	1700	DEC	200	
3/7/2014	1200	INC	300	Vernalis EC
	1400	INC	400	
	1600	INC	450	
3/11/2014	1200	INC	550	Vernalis EC
3/21/2014	0100	DEC	475	Vernalis EC
3/23/2014	0100	DEC	425	Vernalis EC
3/27/2014	0100	DEC	325	Vernalis EC
3/30/2014	1300	DEC	225	Vernalis EC
3/31/2014	1300	DEC	200	NOAA 2E minimums
4/8/2014	0100	INC	300	Vernalis EC
	0300	INC	400	
4/9/2014	0100	INC	500	Vernalis EC
	0300	INC	600	

4/14/2014	0400	INC	750	Vernalis Pulse per Drought Operations Plan
	0600	INC	1,000	
	0800	INC	1,250	
	1000	INC	1,500	
	1200	INC	1,750	
	1400	INC	2,000	
	1600	INC	2,500	
4/29/2014	1800	INC	2,750	Vernalis Pulse per Drought Operations Plan
	1900	INC	2,900	
4/30/2014	0600	DEC	2,400	Vernalis Pulse per Drought Operations Plan
	1000	DEC	2,100	
5/14/2014	1800	DEC	1,600	Rampdown from VNS pulse
5/15/2014	1500	DEC	1,400	Rampdown from VNS pulse
	1900	DEC	1,200	
	2300	DEC	1,100	
5/16/2014	1500	DEC	900	Rampdown from VNS pulse
	1900	DEC	700	
	2300	DEC	600	
5/22/2014	0100	DEC	500	Targeting VNS flow reqmt
5/24/2014	0100	DEC	400	Targeting VNS flow reqmt
5/30/2014	0100	DEC	300	Targeting VNS flow reqmt
6/4/2014	0100	DEC	250	RPN DO
6/9/2014	0800	INC	300	RPN DO
6/15/2014	0100	Dec	275	RPN DO
6/18/2014	0100	Dec	250	RPN DO
6/22/2014	1800	Dec	225	RPN DO
6/28/2014	0100	INC	275	RPN DO
6/30/2014	1100	INC	325	RPN DO
7/8/2014	1200	DEC	275	RPN DO
7/14/2014	1300	INC	325	RPN DO
7/21/2014	1000	DEC	300	RPN DO
7/26/2014	1200	INC	350	RPN DO
7/29/2014	1200	DEC	325	RPN DO
8/4/2014	1300	DEC	300	RPN DO
8/5/2014	0900	DEC	275	RPN DO
8/13/2014	0100	DEC	225	RPN DO
8/18/2014	1200	DEC	200	RPN DO
8/21/2014	1200	DEC	175	RPN DO
8/27/2014	1000	DEC	150	RPN DO

4.2 Action III.1.2 Temperature Management

Figure 9 is a summary of temperature operations from October 2013 through July 2014. Temperature exceedances were reported to NMFS and the SOG.

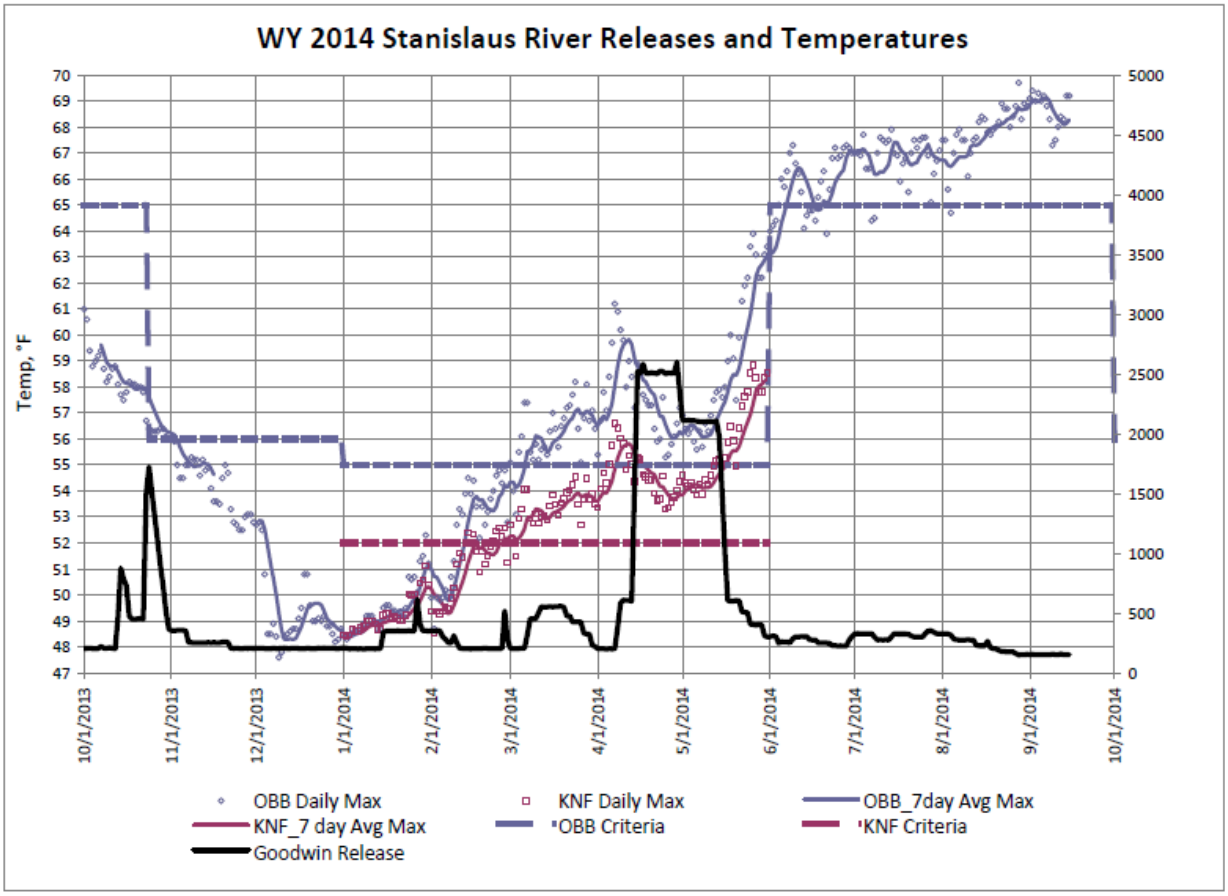


Figure 9 Summary of temperature and flow at Orange Blossom Bridge and Knights Ferry

Summary of Water Year 2014 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). Temperature control devices or other physical structures are not available to manage for temperature blending at these facilities. 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 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 2014 were noted and discussed within SOG. In the fall, river temperatures exceeded the OBB criterion (which went into effect on 10/23/13 per SOG advice) for a short time in late October and early November in spite of elevated flows for a fishery pulse. Even with typical weather conditions, and high releases of up to 2,500 cfs, the Knights Ferry temperature criterion was exceeded from late February through May; the OBB temperature criterion was also exceeded from early March through May. The Orange Blossom summer temperature criterion was also exceeded beginning in June (Figure 9).

Chapter 5 – Summary of Selected Stanislaus Fish Monitoring Data

Monitoring data from the Stanislaus River are summarized below for both fall-run Chinook salmon and (when available) *O. mykiss*. The location of monitoring sites is shown in Figure 10.

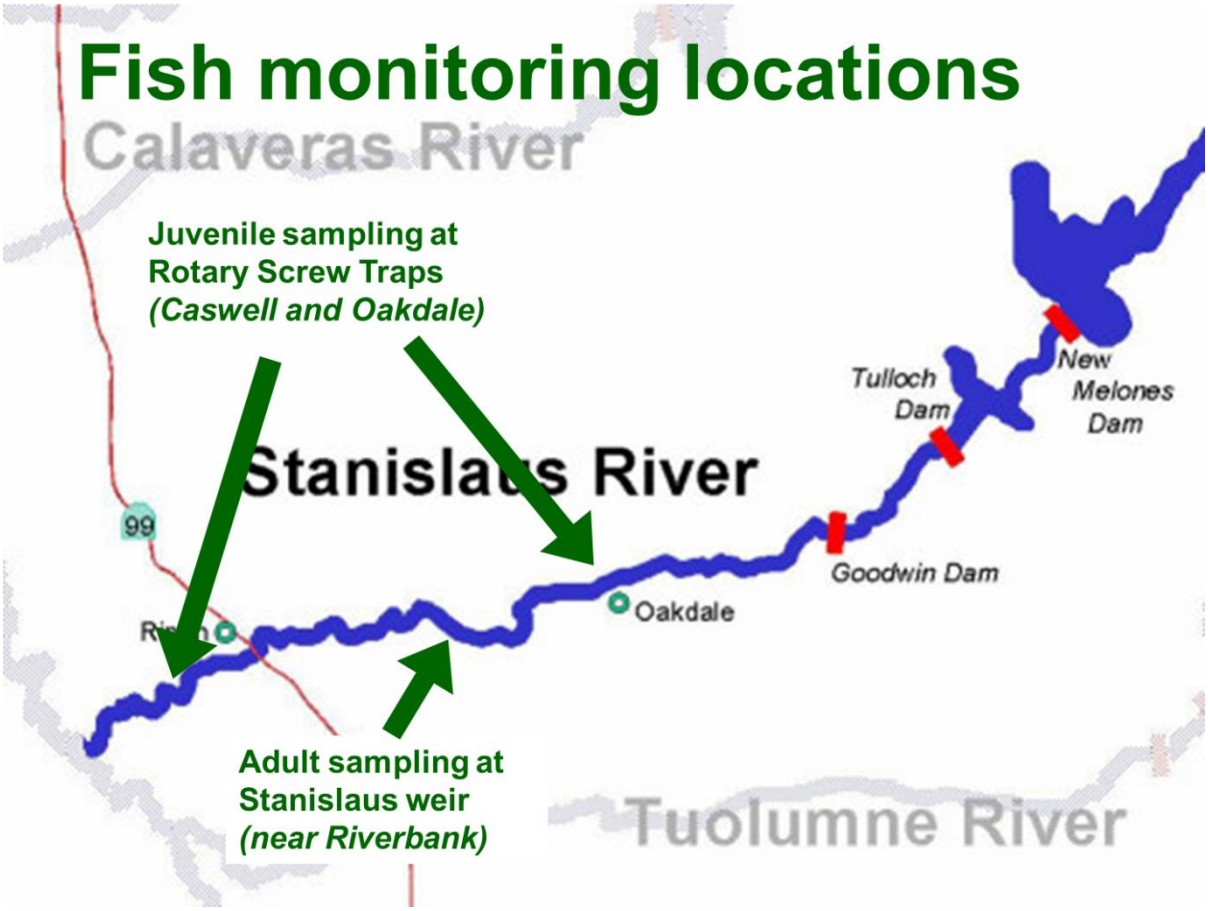


Figure 10 Location of fish monitoring efforts on the Stanislaus River.

U.S. Fish and Wildlife Service funds Cramer Fish Sciences to conduct rotary screw trap monitoring on the Stanislaus River at Caswell Memorial State Park (approximately river mile 9). During the 2014 juvenile outmigration season, the trap sampled 138 out of 188 days during the 12/22/13 to 6/27/14 sampling season. A total of 2,141 Chinook salmon were captured during the season. Daily Chinook salmon catch and lengths are reported in Figures 11 and 12.

A total of 3 *O. mykiss* were captured during the 2014 monitoring season. The first *O. mykiss* was captured 3/1/14 with a fork length (FL) of 250 mm, the second was captured 5/13/14 with a FL of 194 mm, and the third was captured 6/18/14 with a FL of 144 mm.

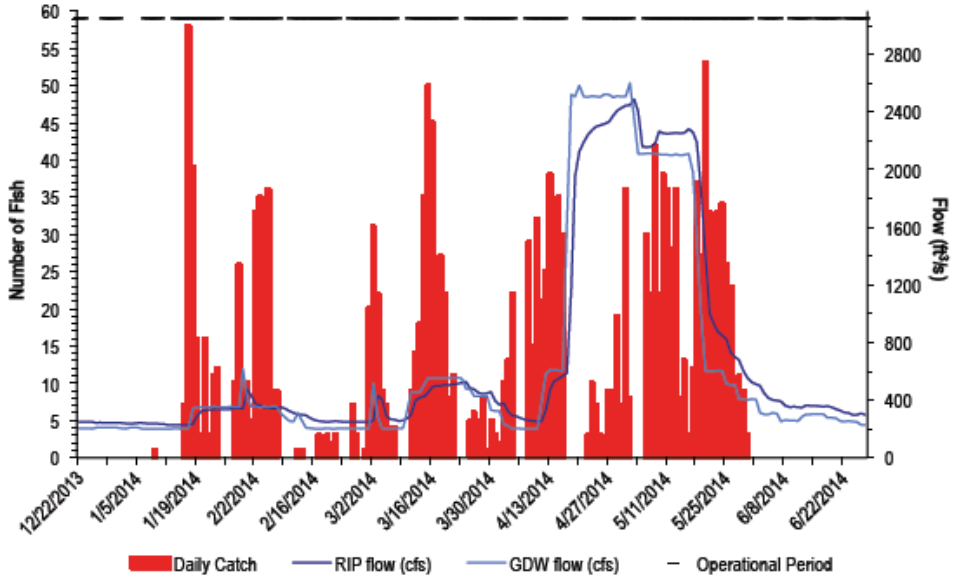


Figure 11 Daily Chinook salmon catch at Caswell and daily average flow (cfs) at Ripon (RIP) and Goodwin Dam (GDW) from 12/22/13 to 6/27/14.

Figure A.1. Daily fork length distribution of various life stages of Chinook salmon captured at Caswell (22 December 2013 – 27 June 2014).

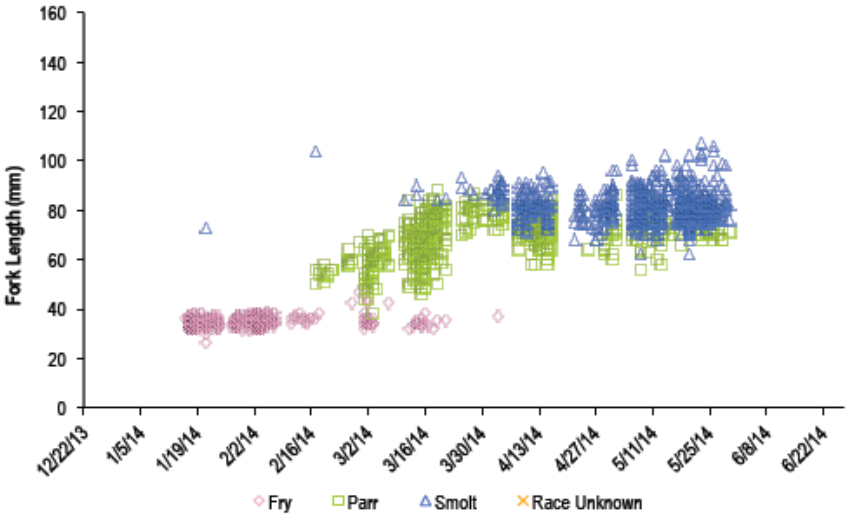


Figure 12 Length-frequency distribution of Chinook salmon captured at Caswell from 12/22/13 to 6/27/14.

SOG has not received permission from FISHBIO to include the following monitoring data in the 2014 SOG Annual Report:

- 2014 adult monitoring data from sampling at the Stanislaus Weir near Riverbank
- 2014 juvenile migration monitoring data from sampling at the Oakdale rotary screw traps

References

Bureau of Reclamation. 1982. *Operating Plan for New Melones Reservoir as required by the February 2, 1982 Order of the United States Court of Appeals for the Ninth Circuit.*

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.*

NMFS. 2011. *Letter transmitting the 2009 Reasonable and Prudent Alternative with 2011 Amendments. April 7.*

Appendix A:

Coordination of San Joaquin River

Spring Pulse Flows

COORDINATION OF THE STANISLAUS AND VERNALIS PULSE FLOWS IN APRIL AND MAY 2014, PER THE DROUGHT OPERATIONS PLAN
05/07/2014

Background

The Central Valley Project and State Water Project Drought Operations Plan (DOP[1]), for operations through 11/15/14, was finalized on Tuesday, 4/8/14. In the DOP, "Reclamation commits to provide for the required Appendix 2-E flows per NMFS RPA Action III.1.3 and to coordinate the pulse flow schedule with the SOG, with consideration of the other flow actions in the San Joaquin River basin this spring." In addition to the spring pulse flow expected on the Tuolumne River (unrelated to the DOP), the DOP identifies a 31-day pulse flow, coordinated as possible with other San Joaquin River tributaries, to address D-1641 April-June flow requirements in 2014 on the San Joaquin. The D-1641 pulse is separate from the NMFS BiOp pulse flow, but will be coordinated with it to maximize benefits.

The Stanislaus NMFS RPA[2] and Vernalis pulse flows are described in the DOP as follows:

> *Excerpt from p. 19*
> 2. Schedule the Stanislaus River pulse flow release in coordination with releases from other San Joaquin River tributaries for 31 days, to begin sometime between April 7 and April 15. The exact timing and duration will be developed through the SOG in coordination with the WOMT and RTDOMT processes. Reclamation and DWR will maintain a San Joaquin River inflow-to-export ratio of 1:1 (with a minimum combined export of 1,500 cfs), for the duration of the pulse.
>
> *Excerpt from p. 20*
> 5. D-1641 (5) Vernalis base flow and pulse flow are modified as follows:
> - April 1 to the start of the pulse flow period – maintain Vernalis flow at or above 700 cfs (3-day running average);
> - For the 31-day pulse flow period, create a 16-day pulse averaging 3,300 cfs at Vernalis with flows averaging 1,500 cfs at Vernalis for the remainder of the 31 days. The start date and flow schedule for the overall pulse flow volume of water may be modified (with concurrence with the fishery agencies);
> - From the end of the pulse flow period through May 31– maintain an average flow of 500 cfs for the period.

The DOP notes (p. 19) that "the exact timing and duration will be developed through the SOG in coordination with the WOMT and RTDOMT processes." In early April, Reclamation and the SWRCB asked that the Stanislaus Operations Group (SOG) meet to provide input on coordinating the 31-day pulse flow period identified in the DOP. SOG convened an urgent meeting on 4/9/14 and provided initial advice (Attachment 1) for implementation of a spring outmigration pulse flow schedule on the Stanislaus that was consistent with the commitments in the DOP for both Stanislaus and Vernalis flow targets. That advice acknowledged that Stanislaus

[1] Available at: http://www.ca.gov/Drought/2014-Operations-Plan.pdf
[2] The 2009 BiOp, 2011 RPA Amendments, and all appendices are available online at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocap.html

and Vernalis flows for the first half of May would be adjusted, as needed, at a meeting in late April that reviewed recent actual flows and the additional flows necessary to meet the modified Vernalis flow requirement. The 4/24/14 meeting included a broader range of invitees including RTDOMT or WOMT participants that do not participate in SOG (this broader group will be referred to as the "DOP Stanislaus-Vernalis Pulse Flow Coordination Team" throughout this document); the advice from that meeting is provided in Attachment 2. Another meeting of the DOP Stanislaus-Vernalis Pulse Flow Coordination Team was scheduled for 5/5/14 to, again, review recent actual flows and the additional flows necessary to meet the modified Vernalis flow requirement, and to discuss a rampdown schedule for Stanislaus releases.

Advice from the DOP Stanislaus-Vernalis Pulse Flow Coordination Team

For 2014, per the commitments and constraints identified in the DOP, the pulse flow coordination team advises implementation of the flow schedule as described below and in Table 1 and Figure 1, with final adjustments to be made as necessary by Reclamation without reconvening the DOP Stanislaus-Vernalis Pulse Flow Coordination Team. Because NMFS has already approved the DOP[3] and the coordination process for pulse flows, the pulse flow coordination team expects that this advice will be reviewed by the RTDOMT but does not need specific approval by NMFS.

Rationale, caveats, and assumptions for the overall shaping of the 2014 spring pulse flows are described in Attachments 1 and 2. The flow schedule described in Table 1 and Figure 1 (which includes actual measured flows through 5/4/14, and estimated flows through the remainder of the pulse period) is a minor adjustment to the schedule described in the advice in Attachment 2 that:

(a) provides at Vernalis the "overall pulse flow volume equivalent to 16-days of flow at 3,300 cfs and 15 days of flow at 1,500 cfs" required by the 4/18/14 revised SWRCB Order[4], and

(b) includes a gradual rampdown (~500 cfs per day) in Goodwin releases on the Stanislaus. The gradual rampdown (more gradual than allowed by the ramping rates on p. 784-785 of the 2009 NMFS Opinion) is expected to reduce the risk of juvenile stranding relative to a flow schedule with a more abrupt rampdown.

Assumptions:

The advised pulse flow schedule was based on the following assumptions additional to those described in Attachments 1 and 2:

1. A change order adjusting New Melones releases could[5] be issued on Tuesday, 5/6/14 (Day 20 of the pulse period)
2. Adjusted New Melones releases/Goodwin spills could begin on Friday, 5/9/14 (Day 23 of the pulse period)
3. Adjusted releases could reach Vernalis on Sunday, 5/11/14 (Day 25 of pulse period)

[3] The NMFS response letter is available (see the set of document links provided in the lower right corner) at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/

[4] http://www.swrcb.ca.gov/waterrights/water_issues/programs/drought/docs/tucp/20140418_revised_tucp_order.pdf

[5] Because the advised flow schedule requires no immediate change in Goodwin releases, no change order is expected until the final pulse adjustment and rampdown.

Implementation flexibilities:

Rampdown: While NMFS *prefers* that the rampdown occur on the order of ~500 cfs per day, the DOP Stanislaus-Vernalis Pulse Flow Coordination Team agreed that Reclamation may implement any rampdown that meets the ramping rates on p. 784-785 of the 2009 NMFS Opinion, as needed.

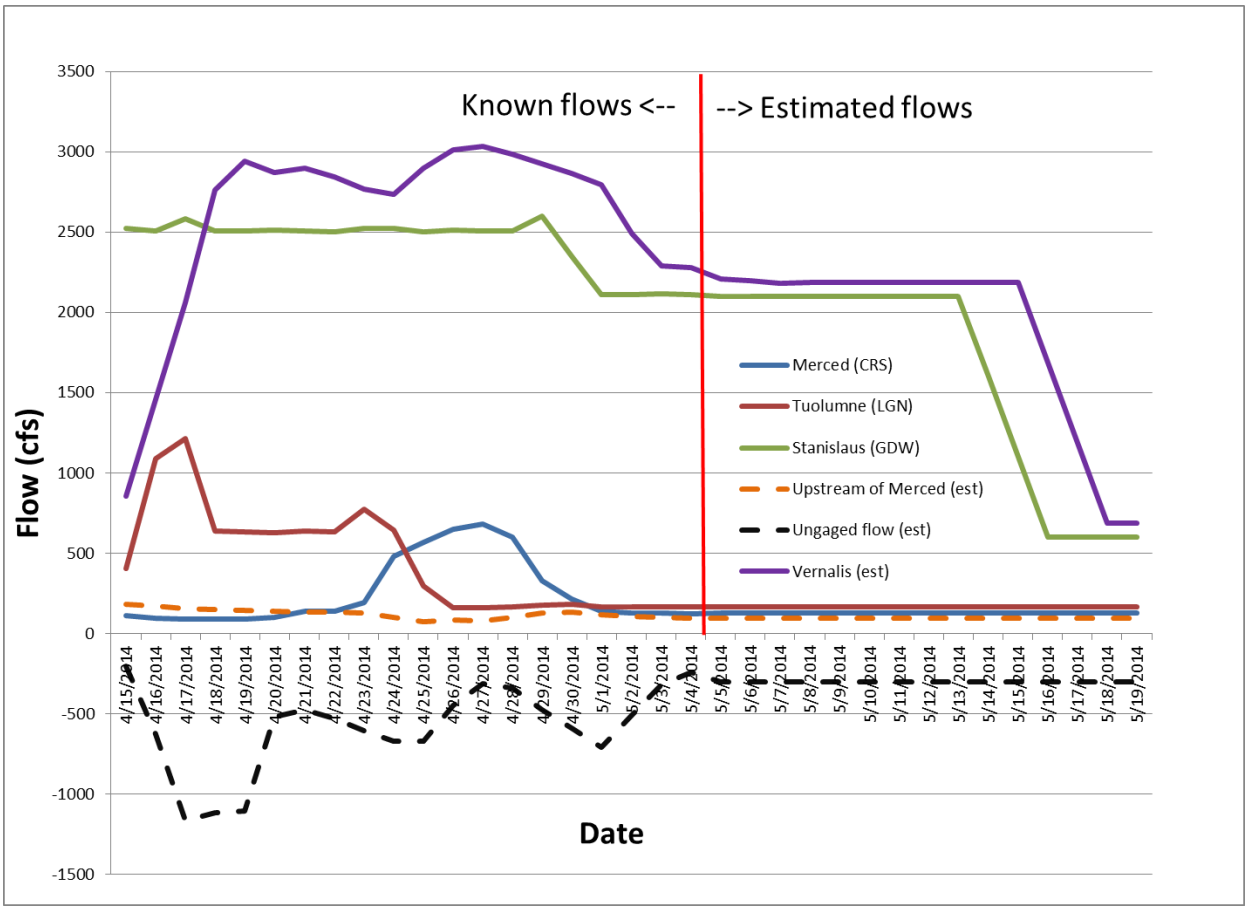
Steady flows: As described in the objectives listed in Attachments 1 and 2, steady flows on the Stanislaus through mid-May are desired in order to provide steady treatment conditions for a study that is measuring the survival of radio-tagged juvenile Chinook. The advised schedule in Table 1 and Figure 1 provide steady flows until the rampdown, but the DOP Stanislaus-Vernalis Pulse Flow Coordination Team agreed that Reclamation may increase flows (if less water than expected reaches Vernalis) or initiate the rampdown sooner (if more water than expected reaches Vernalis), as needed.

These flow schedule modifications described above may be made as necessary by Reclamation without reconvening the DOP Stanislaus-Vernalis Pulse Flow Coordination Team.

Table 1: Approximate flow schedule to meet the pulse flow commitments in the 2014 DOP. The estimated contributions from each source to Vernalis flows are estimates, and may not be implemented exactly as shown below. "Pulse days" are highlighted in yellow; estimated flows are in italics, the Goodwin releases and estimated Vernalis flows affected by this advice are in bold. The estimated flow at Vernalis is the sum of flows from the Stanislaus River (lagged two days), the Tuolumne River (lagged two days), the Merced River (lagged three days), above the Merced River (lagged three days) and ungaged flows below the Merced River (not lagged).

		3 dy lag to VNS	2 dy lag to VNS	2 dy lag to VNS			2 dy lag to VNS		0 day lag to VNS		
		Cressy (Merced)	Below La Grange Dam (Tuolumne)	Goodwin Dam (Stanislaus)	SJR near Newman (at the confluence with the Merced)	Merced River near Stevinson (near confluence with SJR)	Estimate of flow from upstream of the Merced	Vernalis (SJR)	Calculated as: VNS-CRS-LGN-GDW-(NEW-MST), with listed lags	Calculated as: CRS + LGN + GDW + (NEW-MST) + Ungaged Flow Estimate, with listed lags	Over 31 days, VNS should be equivalent to:
Pulse Day	Date	CRS	LGN	GDW	NEW	MST	NEW-MST	VNS (actual)	UNGAGED FLOW (estimated)	VNS (estimated)	
	4/15/2014	111	407	2522	283	100	183	857	*-203*	857	
	4/16/2014	95	1091	2506	259	90	169	1458	*-628*	1458	
1	4/17/2014	92	1213	2584	245	92	153	2060	*-1164*	2060	3300
2	4/18/2014	89	638	2507	239	92	147	2760	*-1117*	2760	3300
3	4/19/2014	91	631	2505	238	92	146	2941	*-1104*	2941	3300
4	4/20/2014	99	630	2511	229	88	141	2868	*-516*	2868	3300
5	4/21/2014	136	636	2507	237	104	133	2896	*-475*	2896	3300
6	4/22/2014	139	635	2503	246	112	134	2844	*-529*	2844	3300
7	4/23/2014	194	776	2524	241	112	129	2768	*-607*	2768	3300
8	4/24/2014	481	643	2521	243	144	99	2735	*-673*	2735	3300
9	4/25/2014	570	296	2501	357	286	71	2898	*-670*	2898	3300
10	4/26/2014	651	162	2510	435	353	82	3011	*-446*	3011	3300
11	4/27/2014	684	162	2507	507	428	79	3035	*-314*	3035	3300
12	4/28/2014	602	163	2509	556	455	101	2984	*-340*	2984	3300
13	4/29/2014	330	176	2599	511	385	126	2925	*-474*	2925	3300
14	4/30/2014	213	183	2351	382	248	134	2867	*-590*	2867	3300
15	5/1/2014	137	164	2110	304	186	118	2795	*-708*	2795	3300
16	5/2/2014	128	164	2109	253	148	105	2488	*-510*	2488	3300
17	5/3/2014	127	164	2114	236	136	100	2288	*-317*	2288	1500
18	5/4/2014	123	164	2112	232	136	96	2276	*-239*	2276	1500
19	5/5/2014	125	*164*	*2100*	*232*	*136*	*96*		*-300*	*2206*	1500
20	5/6/2014	125	*164*	*2100*	*232*	*136*	*96*		*-300*	*2199*	1500
21	5/7/2014	125	*164*	*2100*	*232*	*136*	*96*		*-300*	*2183*	1500
22	5/8/2014	125	*164*	*2100*	*232*	*136*	*96*		*-300*	*2185*	1500
23	5/9/2014	125	*164*	***2100***	*232*	*136*	*96*		*-300*	*2185*	1500
24	5/10/2014	125	*164*	***2100***	*232*	*136*	*96*		*-300*	*2185*	1500
25	5/11/2014	125	*164*	***2100***	*232*	*136*	*96*		*-300*	***2185***	1500
26	5/12/2014	125	*164*	***2100***	*232*	*136*	*96*		*-300*	***2185***	1500
27	5/13/2014	125	*164*	***2100***	*232*	*136*	*96*		*-300*	***2185***	1500
28	5/14/2014	125	*164*	***1600***	*232*	*136*	*96*		*-300*	***2185***	1500
29	5/15/2014	125	*164*	***1100***	*232*	*136*	*96*		*-300*	***2185***	1500
30	5/16/2014	125	*164*	*600*	*232*	*136*	*96*		*-300*	***1685***	1500
31	5/17/2014	125	*164*	*600*	*232*	*136*	*96*		*-300*	***1185***	1500
	5/18/2014	125	*164*	*600*	*232*	*136*	*96*		*-300*	*685*	
						Average VNS estimate (Days 1-16 of pulse)				2805	3300
						Average VNS estimate (Days 17-31 of pulse)				2100	1500
						Average VNS estimate (Days 1-31 of pulse)				2464	2429

Figure 1: Approximate flow schedule to meet the pulse flow commitments in the 2014 DOP. The estimated contributions from each source to Vernalis flows are estimates, and may not be implemented exactly as shown below. The estimated flow at Vernalis is the sum of flows from the Stanislaus River (lagged two days), the Tuolumne River (lagged two days), the Merced River (lagged three days), above the Merced River (lagged three days) and ungaged flows below the Merced River (not lagged).



Attachment 1

SOG ADVICE RE: COORDINATION OF THE STANISLAUS AND VERNALIS PULSE FLOWS IN APRIL AND MAY 2014, PER THE DROUGHT OPERATIONS PLAN 04/11/2014

Background

The Central Valley Project and State Water Project Drought Operations Plan (DOP[1]), for operations through 11/15/14, was finalized on Tuesday, 4/8/14. In the DOP, "Reclamation commits to provide for the required Appendix 2-E flows per NMFS RPA Action III.1.3 and to coordinate the pulse flow schedule with the SOG, with consideration of the other flow actions in the San Joaquin River basin this spring." In addition to the spring pulse flow expected on the Tuolumne River (unrelated to the DOP), the DOP identifies a 31-day pulse flow, coordinated as possible with other San Joaquin River tributaries, to address D-1641 April-June flow requirements in 2014 on the San Joaquin. The D-1641 pulse is separate from the NMFS BiOp pulse flow, but will be coordinated with it to maximize benefits.

The Stanislaus NMFS RPA[2] and Vernalis pulse flows are described in the DOP as follows:

> *Excerpt from p. 19*
> 2. Schedule the Stanislaus River pulse flow release in coordination with releases from other San Joaquin River tributaries for 31 days, to begin sometime between April 7 and April 15. The exact timing and duration will be developed through the SOG in coordination with the WOMT and RTDOMT processes. Reclamation and DWR will maintain a San Joaquin River inflow-to-export ratio of 1:1 (with a minimum combined export of 1,500 cfs), for the duration of the pulse.
>
> *Excerpt from p. 20*
> 5. D-1641 (5) Vernalis base flow and pulse flow are modified as follows:
> - April 1 to the start of the pulse flow period – maintain Vernalis flow at or above 700 cfs (3-day running average);
> - For the 31-day pulse flow period, create a 16-day pulse averaging 3,300 cfs at Vernalis with flows averaging 1,500 cfs at Vernalis for the remainder of the 31 days. The start date and flow schedule for the overall pulse flow volume of water may be modified (with concurrence with the fishery agencies);
> - From the end of the pulse flow period through May 31– maintain an average flow of 500 cfs for the period.

Reclamation and the SWRCB asked that SOG meet to provide input on coordinating the 31-day pulse flow period identified in the DOP. SOG convened an urgent meeting on 4/9/14 and provides the following advice for implementation of a spring outmigration pulse flow schedule on the Stanislaus that we believe is consistent with the commitments in the DOP for both Stanislaus and Vernalis flow targets.

[1] Available at: http://www.ca.gov/Drought/2014-Operations-Plan.pdf
[2] [2] The 2009 BiOp, 2011 RPA Amendments, and all appendices are available online at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocap.html

SOG advice

For 2014, per the commitments and constraints identified in the DOP, SOG advises implementation of the flow schedule described below and in Table 1 and Figure 1. Because NMFS has already approved the DOP[3] and the coordination process for pulse flows, SOG expects that this advice will be reviewed by the RTDOMT but does not need specific approval by NMFS. Spring pulse flows may cue anadromy in *Oncorhynchus mykiss*, cue outmigration in Chinook salmon, and are expected to improve migratory habitat quality both in 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 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.

In addition to consideration of other San Joaquin River flows (e.g. the timing and potential magnitude of the Tuolumne River pulse), SOG considered the desired shaping of the pulse flow on the Stanislaus and at Vernalis, within a variety of constraints. The flow schedule described in Table 1 and Figure 1 (described as the first release from New Melones Reservoir scheduled for Monday, 4/14/14, but the start date may be shifted to 4/15/14) achieves the following objectives:

1. Provides the same or greater pulse flow volume (30,842 AF, calculated against a base flow of 200 cfs in April and a 150 cfs base flow in May) as the spring outmigration pulse in the Critical yeartype schedule in Appendix 2-E of the NMFS RPA
2. Provides the same or greater pulse flow volume (~35,000 AF) as the CDFW April-May flow schedule proposed for 2014 per the "'87 Agreement"
3. Provides at least 2-3 consecutive weeks of inundated floodplain habitat which will provide additional food resources and inundate shallow habitats that should provide additional rearing habitat for juvenile salmonids.
4. Provides relatively stable flows for two separate two week periods. FWS is conducting the third year of a multi-year survival study in spring 2014 and providing stable flows for ~2 weeks will allow for survival estimates to be calculated for a specific instream flow rate. Because data have been collected at flows of ~3000 cfs, ~1500 cfs, and ~250 cfs, FWS would prefer steady flows at levels not yet tested, for example 2,500 cfs and 2000 cfs.
5. Limits flows to levels not to exceed 3,000 cfs in consideration of rafting safety and concerns about inundation at Caswell Park, in recognition that minimum flow requirements in the current Critical yeartype minimum flow schedule peak at 725 cfs.
6. Over 31 days, the Vernalis averages for the D-1641 pulse flows in the DOP will be met, but rather than 16 days averaging 3300 and 15 days averaging 1500, a 16-day "high" pulse and a 15-day "low" pulse will be implemented to achieve the same 31-day average (2429 cfs) that would be achieved by implementing 16 days at 3300 and 15 days at 1500.

[3] The NMFS response letter is available (see the set of document links provided in the lower right corner) at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/2014_04_08_nmfs_drought_operations_plan_letter_enclosure.pdf

This shaping helps to meet the Vernalis commitment in the DOP while also meeting the objectives listed above.

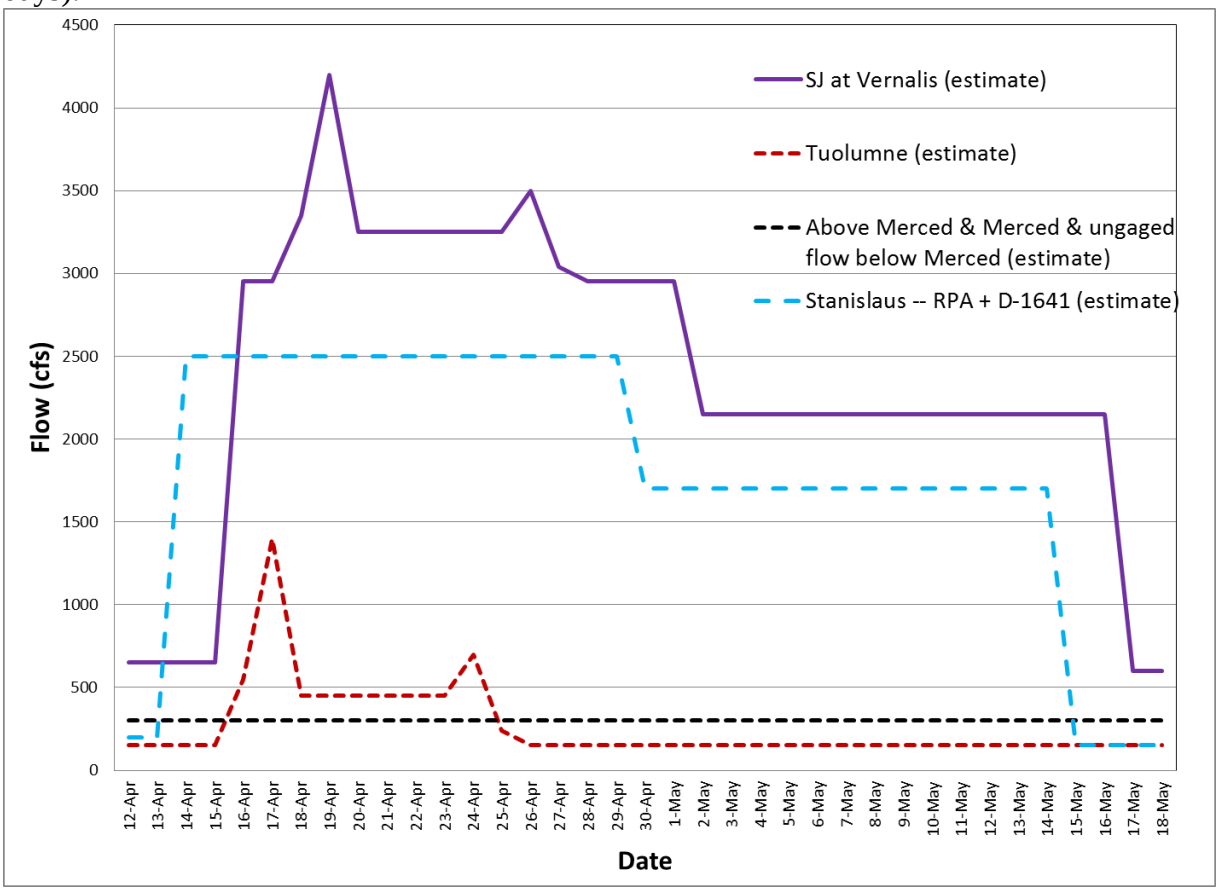
Caveats & Assumptions:

- Stan flows the first half of May will be set at a meeting in late April in order to provide steady flows for the survival experiment without releasing more water than necessary to achieve the VNS target. By late April, the contributions to Vernalis flows from above the Merced, the Merced, and the Tuolumne through April will be known and the Stanislaus flows (likely the major contributor to Vernalis flows for the first two weeks of May) will be adjusted so that the 15-day steady pulse provides the volume of water to meet the Vernalis target. For example, if the Tuolumne or Merced flows in the last two weeks of April are greater than expected, then less water may be needed at Vernalis for the first half of May, and the Stanislaus flows will be reduced accordingly.
- A steady flow of 2500 cfs will be provided for the first two weeks of the pulse flow unless there is a major change in the other San Joaquin River contributions from what was assumed in the current advice; any deviation from 2500 cfs on the Stanislaus for the first two weeks will be reviewed by RTDOT before a change is made.
- Based on the late April review of actual flows and remaining needed flows for Vernalis, Reclamation will target a steady Stanislaus flow for the second two weeks of the pulse flow at the level expected necessary to meet the Vernalis target. If actual conditions vary from projected conditions during the first two weeks of May, the Stanislaus flow may be adjusted by Reclamation without review by RTDOT or NMFS in order to track actual conditions. The fish agencies would prefer that, to the extent possible, Reclamation make any necessary adjustments to the second half of the pulse flow by maintaining stable flows, then ramping down prior to the end of the two weeks (less water needed) or adding additional days of stable flows (more water needed).
- The estimates for flows from the Tuolumne River, and the aggregated flow estimate for flows from above Merced, at Merced, and ungaged flows below Merced, are rough estimates; these contributions to Vernalis flows will be accounted for in late April as described above.
- Reclamation shall ramp releases in the Stanislaus River below Goodwin Dam according to the ramping rates on p. 784-785 of the 2009 NMFS Opinion.

Table 1: Approximate flow schedule to meet the pulse flow commitments in the 2014 DOP. The estimated contributions from each source to Vernalis flows are estimates, and may not be implemented exactly as shown below. "Pulse days" are highlighted in yellow. The estimated flow at Vernalis is the sum of the Stanislaus flow (lagged two days), the Tuolumne (lagged two days) and the aggregated flow estimate for flows from above Merced, at Merced, and ungaged flows below Merced (lagged 3 days).

Date	Stanislaus -- RPA + D-1641 (estimate)	Tuolumne (estimate)	Above Merced & Merced & ungaged flow below Merced (estimate)	SJ at Vernalis (estimate)
12-Apr	200	150	300	650
13-Apr	200	150	300	650
14-Apr	2500	150	300	650
15-Apr	2500	150	300	650
16-Apr	2500	550	300	2950
17-Apr	2500	1,400	300	2950
18-Apr	2500	450	300	3350
19-Apr	2500	450	300	4200
20-Apr	2500	450	300	3250
21-Apr	2500	450	300	3250
22-Apr	2500	450	300	3250
23-Apr	2500	450	300	3250
24-Apr	2500	700	300	3250
25-Apr	2500	242	300	3250
26-Apr	2500	150	300	3500
27-Apr	2500	150	300	3042
28-Apr	2500	150	300	2950
29-Apr	2500	150	300	2950
30-Apr	1700	150	300	2950
1-May	1700	150	300	2950
2-May	1700	150	300	2150
3-May	1700	150	300	2150
4-May	1700	150	300	2150
5-May	1700	150	300	2150
6-May	1700	150	300	2150
7-May	1700	150	300	2150
8-May	1700	150	300	2150
9-May	1700	150	300	2150
10-May	1700	150	300	2150
11-May	1700	150	300	2150
12-May	1700	150	300	2150
13-May	1700	150	300	2150
14-May	1700	150	300	2150
15-May	150	150	300	2150
16-May	150	150	300	2150
17-May	150	150	300	600
18-May	150	150	300	600

Figure 1: Approximate flow schedule to meet the pulse flow commitments in the 2014 DOP. The estimated contributions from each source to Vernalis flows are estimates, and may not be implemented exactly as shown below. The estimated flow at Vernalis is the sum of the Stanislaus flow (lagged two days), the Tuolumne (lagged two days) and the aggregated flow estimate for flows from above Merced, at Merced, and ungaged flows below Merced (lagged 3 days).



Attachment 2

COORDINATION OF THE STANISLAUS AND VERNALIS PULSE FLOWS IN APRIL AND MAY 2014, PER THE DROUGHT OPERATIONS PLAN
04/28/2014

Background

The Central Valley Project and State Water Project Drought Operations Plan (DOP[1]), for operations through 11/15/14, was finalized on Tuesday, 4/8/14. In the DOP, "Reclamation commits to provide for the required Appendix 2-E flows per NMFS RPA Action III.1.3 and to coordinate the pulse flow schedule with the SOG, with consideration of the other flow actions in the San Joaquin River basin this spring." In addition to the spring pulse flow expected on the Tuolumne River (unrelated to the DOP), the DOP identifies a 31-day pulse flow, coordinated as possible with other San Joaquin River tributaries, to address D-1641 April-June flow requirements in 2014 on the San Joaquin. The D-1641 pulse is separate from the NMFS BiOp pulse flow, but will be coordinated with it to maximize benefits.

The Stanislaus NMFS RPA[2] and Vernalis pulse flows are described in the DOP as follows:

> *Excerpt from p. 19*
> 2. Schedule the Stanislaus River pulse flow release in coordination with releases from other San Joaquin River tributaries for 31 days, to begin sometime between April 7 and April 15. The exact timing and duration will be developed through the SOG in coordination with the WOMT and RTDOMT processes. Reclamation and DWR will maintain a San Joaquin River inflow-to-export ratio of 1:1 (with a minimum combined export of 1,500 cfs), for the duration of the pulse.
>
> *Excerpt from p. 20*
> 5. D-1641 (5) Vernalis base flow and pulse flow are modified as follows:
> - April 1 to the start of the pulse flow period – maintain Vernalis flow at or above 700 cfs (3-day running average);
> - For the 31-day pulse flow period, create a 16-day pulse averaging 3,300 cfs at Vernalis with flows averaging 1,500 cfs at Vernalis for the remainder of the 31 days. The start date and flow schedule for the overall pulse flow volume of water may be modified (with concurrence with the fishery agencies);
> - From the end of the pulse flow period through May 31– maintain an average flow of 500 cfs for the period.

The DOP notes (p. 19) that "the exact timing and duration will be developed through the SOG in coordination with the WOMT and RTDOMT processes." In early April, Reclamation and the SWRCB asked that the Stanislaus Operations Group (SOG) meet to provide input on coordinating the 31-day pulse flow period identified in the DOP. SOG convened an urgent meeting on 4/9/14 and provided initial advice (Attachment 1) for implementation of a spring outmigration pulse flow schedule on the Stanislaus that was consistent with the commitments in the DOP for both Stanislaus and Vernalis flow targets. That advice acknowledged that Stanislaus

[1] Available at: http://www.ca.gov/Drought/2014-Operations-Plan.pdf
[2] The 2009 BiOp, 2011 RPA Amendments, and all appendices are available online at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocap.html

and Vernalis flows for the first half of May would be adjusted, as needed, at a meeting in late April that reviewed recent actual flows and the additional flows necessary to meet the modified Vernalis flow requirement. The 4/24/14 meeting included a broader range of invitees, including RTDOMT or WOMT participants that do not participate in SOG.

Advice from the Stanislaus-Vernalis Pulse Flow Coordination Team

For 2014, per the commitments and constraints identified in the DOP, the pulse flow coordination team advises implementation of the flow schedule described below and in Table 1 and Figure 1. Because NMFS has already approved the DOP[3] and the coordination process for pulse flows, the pulse flow coordination team expects that this advice will be reviewed by the RTDOMT but does not need specific approval by NMFS.
Spring pulse flows may cue anadromy in *Oncorhynchus mykiss*, cue outmigration in Chinook salmon, and are expected to improve migratory habitat quality both in 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 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.

In addition to consideration of other San Joaquin River flows (e.g. the timing and potential magnitude of the Tuolumne River and Merced River pulses), the pulse flow coordination team considered the desired shaping of the pulse flow on the Stanislaus and at Vernalis, within a variety of constraints. The flow schedule described in Table 1 and Figure 1 (which includes actual measured flows through 4/22/14, and estimated flows through the remainder of the pulse period) achieves the following objectives:

1. Provides the same or greater pulse flow volume (30,842 AF, calculated against a base flow of 200 cfs in April and a 150 cfs base flow in May) as the spring outmigration pulse in the Critical yeartype schedule in Appendix 2-E of the NMFS RPA
2. Provides the same or greater pulse flow volume (~35,000 AF) as the CDFW April-May flow schedule proposed for 2014 per the "'87 Agreement"
3. Provides at least 2-3 consecutive weeks of inundated floodplain habitat which will provide additional food resources and inundate shallow habitats that should provide additional rearing habitat for juvenile salmonids.
4. Provides relatively stable flows for two separate two week periods. FWS is conducting the third year of a multi-year survival study in spring 2014 and providing stable flows for ~2 weeks allows for survival estimates to be calculated for a specific instream flow rate. Because data have been collected at flows of ~3000 cfs, ~1500 cfs, and ~250 cfs, FWS would prefer steady flows at levels not yet tested, for example 2,500 cfs and 2000 cfs.
5. Provides some variability in flow by including one day (at least 12 hours) at 2900 cfs before flows are reduced to a steady flow of approximately 2050 cfs. This short-term flow increase is expected to provide several benefits: (a) variable flow is expected to

[3] The NMFS response letter is available (see the set of document links provided in the lower right corner) at: http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/

spur outmigration, (b) a slightly higher flow may bring in some additional leaf litter and nutrients that could boost food production, and (c) an increase in flow may increase turbidity which might also spur outmigration and provides some protection to juvenile salmonids from visual predators.

6. Limits flows to levels not to exceed 3,000 cfs in consideration of rafting safety and concerns about inundation at Caswell Park, in recognition that minimum flow requirements in the current Critical yeartype minimum flow schedule peak at 725 cfs.
7. As described in the 4/18/14 revised Order[4], "the 31-day pulse flow period shall consist of an overall pulse flow volume equivalent to 16-days of flow at 3,300 cfs and 15 days of flow at 1,500 cfs."

Caveats & Assumptions:

- The Stanislaus River pulse flow release began on 4/14/14, within the start date window of 4/7-4/15 specified in the DOP. Because it takes several days for water released from New Melones Reservoir to reach Vernalis, the San Joaquin River pulse period is considered to be 4/17/14-5/17/14 for the purposes of implementing the following provisions of the DOP:
    - export limitation per the NMFS RPA I:E ratio (see VI.A.1 of the DOP, p. 18)
    - export limitation per D-1641 (see VI.C.4 of the DOP, p. 20)
    - 31-day pulse flow requirement per D-1641 (see VI.C.5 of the DOP, p. 20)
- Stanislaus flows for the last week of the pulse may be adjusted, if needed, at a pulse flow coordination team meeting in early May. For example, if ungaged flow in late April and early May is greater than expected, then less water may be needed at Vernalis to achieve the flow target, and the Stanislaus flows will be reduced accordingly.
- The estimates for flows from above the Merced River, the Merced River, the Tuolumne River, and ungaged flows between the Merced River and Vernalis, are estimates based on a combination or scheduled releases and recent measured flows. These contributions to Vernalis flows will be reviewed in early May and, as described above, the Stanislaus flow schedule may be adjusted if necessary.
- Reclamation shall ramp releases in the Stanislaus River below Goodwin Dam according to the ramping rates on p. 784-785 of the 2009 NMFS Opinion.

[4] http://www.swrcb.ca.gov/waterrights/water_issues/programs/drought/docs/tucp/20140418_revised_tucp_order.pdf

Table 1: Approximate flow schedule to meet the pulse flow commitments in the 2014 DOP. The estimated contributions from each source to Vernalis flows are estimates, and may not be implemented exactly as shown below. "Pulse days" are highlighted in yellow. The estimated flow at Vernalis is the sum of flows from the Stanislaus River (lagged two days), the Tuolumne River (lagged two days), the Merced River (lagged three days), above the Merced River (lagged three days) and ungaged flows below the Merced River (not lagged).

	3 dy lag to VNS	2 dy lag to VNS	2 dy lag to VNS	2 dy lag to VNS	0 day lag to VNS	
	Cressy (Merced)	Below La Grange Dam (Tuolumne)	Goodwin Dam (Stanislaus)	Estimate of flow from upstream of the Merced	Calculated as: VNS-CRS-LGN-GDW-(NEW-MST), with listed lags	Calculated as: CRS + LGN + GDW + (NEW-MST) + Ungaged Flow Estimate, with listed lags
Date	CRS	LGN	GDW	NEW-MST	UNGAGED FLOW (estimated)	VNS (estimated)
4/15/2014	111	407	2522	183	-203	857
4/16/2014	95	1091	2506	169	-628	1458
4/17/2014	92	1213	2584	153	-1164	2060
4/18/2014	89	638	2507	147	-1117	2760
4/19/2014	91	631	2505	146	-1104	2941
4/20/2014	99	630	2511	141	-516	2868
4/21/2014	136	636	2507	133	-475	2896
4/22/2014	139	635	2503	134	-529	2844
4/23/2014	405	725	2500	134	-500	2875
4/24/2014	680	614	2500	134	-500	2908
4/25/2014	680	275	2500	134	-500	2998
4/26/2014	680	150	2500	134	-500	3153
4/27/2014	680	150	2500	134	-500	3089
4/28/2014	430	150	2500	134	-500	2964
4/29/2014	226	150	2900	134	-500	2964
4/30/2014	125	150	2050	134	-500	2964
5/1/2014	125	150	2050	134	-500	3114
5/2/2014	125	150	2050	134	-500	2060
5/3/2014	125	150	2050	134	-500	1959
5/4/2014	125	150	2050	134	-500	1959
5/5/2014	125	150	2050	134	-500	1959
5/6/2014	125	150	2050	134	-500	1959
5/7/2014	125	150	2050	134	-500	1959
5/8/2014	125	150	2050	134	-500	1959
5/9/2014	125	150	2050	134	-500	1959
5/10/2014	125	150	2050	134	-500	1959
5/11/2014	125	150	2050	134	-500	1959
5/12/2014	125	150	2050	134	-500	1959
5/13/2014	125	150	2050	134	-500	1959
5/14/2014	125	150	2050	134	-500	1959
5/15/2014	125	150	2050	134	-500	1959
5/16/2014	125	150	600	134	-500	1959
5/17/2014	125	150	600	134	-500	1959
5/18/2014	125	150	600	134	-250	759
5/19/2014	125	150	600	134	-250	759

Figure 1: Approximate flow schedule to meet the pulse flow commitments in the 2014 DOP. The estimated contributions from each source to Vernalis flows are estimates, and may not be implemented exactly as shown below. The estimated flow at Vernalis is the sum of flows from the Stanislaus River (lagged two days), the Tuolumne River (lagged two days), the Merced River (lagged three days), above the Merced River (lagged three days) and ungaged flows below the Merced River (not lagged).