Annual Report of Activities

October 1, 2013 to September 30, 2014

Lower American River at Nimbus Basin – Newly constructed side channel and gravel placement in main channel.

Photos: John Hannon

American River Group (ARG)

September 2014

Acronyms and Abbreviations

ARG	American River Group
BiOp	Biological Opinion
cfs	Cubic Feet Per Second
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CDFW	California Department of Fish & Wildlife
FMS	Flow Management Standard
LAR	Lower American River
MRR	Minimum Required Release
NMFS	National Marine Fisheries Service
Reclamation	U.S. Bureau of Reclamation
RM	River Mile
RPA	Reasonable and Prudent Alternative
RTDOT	Real-Time Drought Operations Management Team
SWP	State Water Project
SWRCB	State Water Resources Control Board
TCD	Temperature Control Device
USFWS	U.S. Fish & Wildlife Service

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Chapter 1 – Background

1.1 American River Geographic Orientation

The American River is the second largest tributary to the Sacramento River located in California's Central Valley. The North, Middle, and South forks of the American River originate in the Sierra Nevada range and then flow into Folsom Reservoir, approximately 25 miles east of the City of Sacramento, California. Folsom Dam and Reservoir as well as Nimbus Dam and Lake Natoma are features of the Central Valley Project (CVP) operated by the U.S. Bureau of Reclamation (Reclamation). The lower American River (LAR) reach begins at Nimbus Dam, approximately river mile (RM) 23, and continues downstream until its confluence with the Sacramento River. Figure 1 illustrates the LAR and surrounding features.

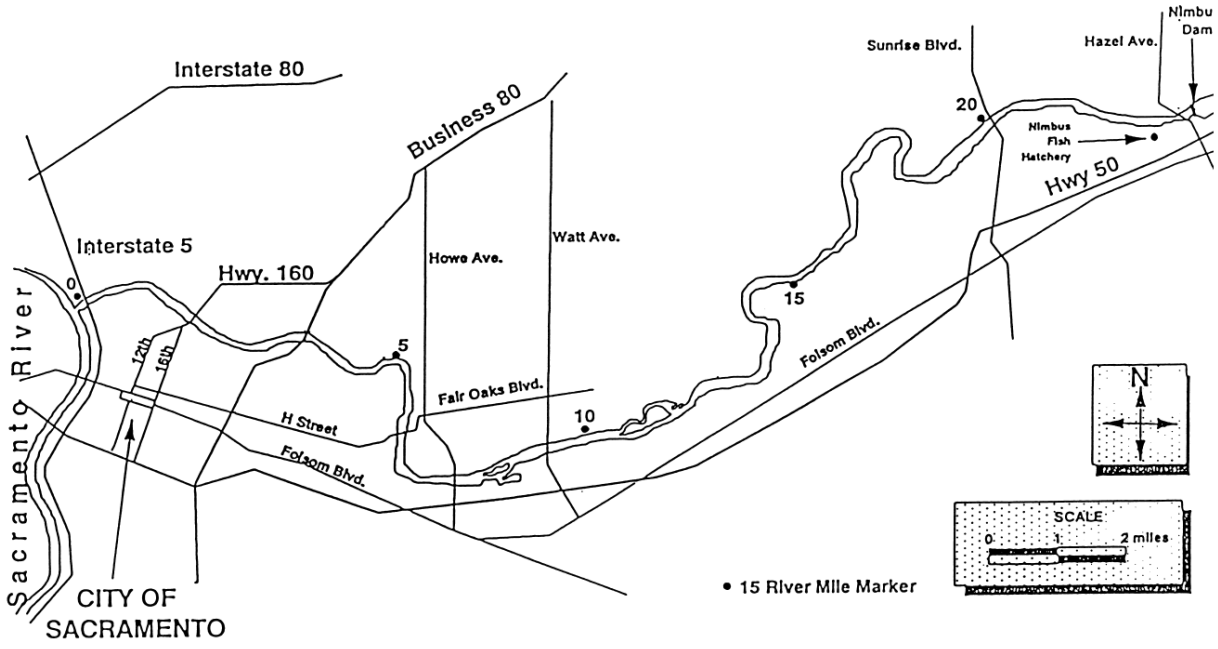

Figure 1. The lower American River between Nimbus Dam and the Sacramento River.

1.2 Lower American River Historical Background

The LAR is a significant resource of considerable interest and provides water supply to urban and agricultural uses, flood control, fish and wildlife protection, recreational opportunities, hydroelectric power generation, and protects conditions in the Sacramento-San Joaquin Delta. The regulating facilities of the Folsom/Nimbus Dam complex include Folsom Dam, Reservoir and Powerplant, Nimbus Dam and Powerplant, and Lake Natoma. Releases from Folsom Dam are re-regulated approximately seven miles downstream by Nimbus Dam. Nimbus Dam creates Lake Natoma, which serves as a forebay for the diversions to the Folsom South Canal. Additional facilities include the Nimbus Fish Hatchery, at Nimbus Dam, owned by Reclamation and operated by the California Department of Fish and Wildlife (CDFW).

Reclamation operates Folsom/Nimbus Dam under a state water right permit and fish protection requirements that were adopted in 1958 as the State Water Resources Control Board (SWRCB) Decision 893 (D-893).This decision allows flows at the mouth of the American River to fall as low as 250 cubic feet per second (cfs) from January through mid-September, with a minimum of 500 cfs required between mid-September through December 31. However, many recognize D-893 flows do not provide comprehensive habitat protection. Since 1958, additional SWRCB Decisions, Congressional Acts (i.e. Central Valley Project Improvement Act (CVPIA), and a Federal Biological Opinion (BiOp) Reasonable and Prudent Alternative (RPA) (NMFS 2009 BiOp, Appendix 2D and 2011 RPA amendment), have changed the regulatory landscape for the State and Federal Water Projects.

The Water Forum, comprised of local American River stakeholders, has successfully joined together water purveyors, environmentalists, agriculturalists, business leaders, along with city and county governments in Sacramento, El Dorado and Placer counties in an agreement to secure Sacramento region water supply through the year 2030. The Water Forum has promoted operational changes with coequal objectives: "to provide a reliable supply for planned development to the year 2030, and to preserve the Sacramento region's environmental crown jewel, the lower American River". The Water Forum, in cooperation with Reclamation, National Marine Fisheries Service (NMFS), Untied States Fish and Wildlife Service (USFWS), and CDFW developed a draft Flow Management Standard (FMS) for the LAR to potentially improve the conditions of aquatic resources in the LAR. The FMS design is to improve habitat conditions for fall-run Chinook salmon(*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*) fish in the LAR by enhancing minimum flows and water temperature, establishing a formal management process, and facilitating coordinated monitoring, and evaluation and reporting (Water Forum 2006).

The FMS was included in the NMFS 2009 BiOp on the Long-Term Operations of the CVP and State Water Project (SWP) RPA (Appendix 2D and 2011 RPA amendment). The FMS flow criteria have been tracked since 2006 and implemented, per the NMFS 2009 BiOp RPA action, since 2009. Reclamation continues to work with the Water Forum, NMFS, CDFW, USFWS, and other interested parties to integrate a revised flow management standard for the LAR into CVP operations and associated water rights.

The FMS is designed to integrate temperature performance capability for management of the downstream habitat. The NMFS 2009 BiOp also adopted components of the FMS temperature management process.

Because water temperature control operations in the LAR are affected by many factors and operational tradeoffs, ideal downstream temperature targets are sometimes infeasible (particularly with multiple years of below normal, dry conditions). The factors include available cold water resources, Nimbus release schedules, annual hydrology/snow pack, Folsom power penstock shutter management flexibility, Folsom Dam Urban Water Supply Temperature Control Device (TCD) management, power generation, and Nimbus Fish Hatchery operations and maintenance. Two structural devices provide downstream temperature management: (1) the Folsom Shutters and (2) the TCD. These devices control the desired downstream temperature by selecting the elevation where the water is withdrawn from the reservoir. In addition to accessing cooler water using the shutter elevations, a blending operation can also be employed where shutters at differing elevations are mixed or blended for temperature management. Lastly, when temperature operations exhaust the reservoir's cold water pool past the lowest shutter locations prior to the fall, Reclamation has the ability to bypass the Folsom Shutters (power generation) to release the coolest water from the river outlets, the lowest elevation outfall in Folsom Dam, to maintain targeted temperatures in the LAR.

Reclamation established a working group to coordinate fishery and operational requirements for the LAR, known as the American River Group (ARG), in 1996. Reclamation is the lead coordinator of the ARG, bringing together those who have either a legislated or resources-specific interest in the operation of Folsom Dam and Reservoir, and the LAR. Agencies with trust responsibilities for the water resources in the LAR and the surrounding area's participate. Members of the public and other agencies may attend ARG meetings and are encouraged to comment on matters under consideration by the ARG. The ARG convenes monthly or more frequently, if needed, with the purpose of providing fishery updates and reports to help inform management decisions regarding temperatures and flows necessary to sustain fish resources in the LAR.

Chapter 2 –Reasonable and Prudent Alternative (RPA) Actions (NMFS 2009 BiOp)

2.1 Summary of RPA Actions

On June 4, 2009, NMFS issued its BiOp and Conference Opinion on the Long-Term Operations of the CVP and SWP that included RPA actions for the LAR. The ARG was included amongst the four Fisheries and Operations Technical Teams whose function is to make recommendations for adjusting operations to meet contractual obligations for water delivery and to minimize adverse effects on listed anadromous fish species (see Section 11.2.1.1, NMFS 2009 BiOp).

There are several RPA actions that discuss minimal flow requirements and temperature objectives for the LAR: Action II.1.; "Lower American River Flow Management", Action II.2; "Lower American River Temperature Management", and Action II.4; “Minimize Flow Fluctuation Effects” (NMFS 2009 BiOp, Appendix 2D, and 2011 RPA amendment). The objectives of these RPA actions are to provide minimum flows for all stages of steelhead and to maintain suitable temperatures to support over-summer rearing of juvenile steelhead. A Temperature Management Plan is prepared for NMFS' consideration in May of each year that takes into consideration actions under Reclamation's authority using iterative modeling techniques (i.e. The iterative Coldwater Pool Management model-see NMFS 2009 BiOp, Appendix 2D). Since 2009 Reclamation and NMFS continue to work together to address all of the elements of the RPA actions.

Chapter 3 – Summary of ARG Discussions

The following agenda items were discussed at monthly ARG meetings from October 2013 through September 2014. Meeting notes and supplemental ARG documents were made available.

3.1 Monthly Discussion Topics

- **Lower American River Fisheries Monitoring**
    - The status of current fisheries monitoring activities provided by Reclamation, NMFS, USFWS, and CDFW, as well as planned future fisheries monitoring activities.
- **Water Operations and Water Quality**
    - Flows measured at Nimbus Dam, temperatures at Watt Avenue. See Chapter 4.
- **NMFS BiOp RPA Actions – American River Division:**
    - **RPA Action II.1 – Lower American River Flow Management**

      Implementation of flow schedule specified in the FMS, which is summarized in Appendix 2-D of the NMFS 2009 BiOp. Reclamation convenes the ARG to make recommendations for management within the constraints of the FMS.
    - **RPA Action II.2 – Lower American River Temperature Management**

      Maintain suitable temperatures to support over-summer rearing of juvenile steelhead in the LAR. Reclamation convenes the ARG to make recommendations regarding cold water management alternatives to improve water temperature conditions for fish, including potential power bypasses.
    - **RPA Action II.4 – Minimize Flow Fluctuation Effects**

      Reduce stranding and isolation of juvenile steelhead through ramping protocols. Reclamation convenes the ARG to make recommendations regarding ramping protocols and monitoring activities to effectively adjust releases from Nimbus to reduce the risk of stranding and isolation of steelhead.

3.2 Other Discussion Topics

- **Central Valley Project Improvement Act**
    - **LAR Gravel Augmentation Program**

      Restore and replenish spawning and rearing habitat that was lost due to the construction and operation of the CVP. Spawning and rearing habitat restoration projects on the LAR are part of a continuing program under the CVPIA. The 2014 Project was constructed just downstream of the Nimbus Dam, in Nimbus Basin at approximately RM 23. The project included the addition of 12,000 tons of spawning gravel in the main channel and the creation of a side-channel approximately 350 yards long with the incorporation of

woody material. The project could create approximately 3.3 acres (combined) of spawning and rearing habitat that was lost due to the construction of the CVP dams.

- **LAR fall-run Chinook Carcass Survey**

  Estimate the escapement of fall-run Chinook salmon in a 13.1-mile section of the LAR from Nimbus Hatchery weir downstream to the Watt Avenue Bridge. The objectives of the surveys are to: 1) estimate the population size of returning Chinook salmon spawning in a 13.1-mile section of the LAR; 2) determine the general age and sex of returning Chinook salmon; 3) determine pre-spawning mortality; and 4) determine the ratio of returning hatchery-reared, coded-wire tagged salmon.

Chapter 4 – Water Operations Summary

Water Year Conditions and Operations

In 2014, California experienced a third consecutive dry year. Water year 2014 yielded just 35% of the April through July full-natural-flow statewide (DWR 2014). Extremely low precipitation volumes, snow-pack, and reservoir storages contribute to very challenging operations of the CVP and SWP water storage and delivery systems. The regulatory requirements and system constraints offer some range in operational flexibility due to drier hydrology, but are insufficient to restore system expectations to "normal" conditions. In April a multi-agency team released a guiding document called "Central Valley Project and State Water Project Drought Operations Plan and Operational Forecast: April 1, 2014 through November 15, 2014 – Balancing Multiple Needs in a Third Dry Year" offering multi-agency objectives and purposes for state-wide project operations. This year is evidence of prolonged drought conditions resulting in dependency of previously stored water supplies and reduced carryover storage, degraded water quality, reduced deliveries, and lower flow rates/reduced stage.

Hydrologic Conditions – American River

Watershed runoff in California is typically driven by winter precipitation and spring snow-melt runoff and quantified as a late spring through summer inflow volume (April through July volume, in addition to a water year total volume). The American River watershed spring/summer forecasted inflow volume is fundamental in operational planning and is a product updated routinely from the Department of Water Resources (DWR), where uncertainty is represented by percent runoff exceedences). The initial April – July 90% (conservative volume) unimpaired runoff exceedence forecast volume (February) was estimated at 180 TAF (330 TAF for the water year. Average water year volume is 2,683 TAF.). The actual full natural flow volume April -July, however, was 420 TAF (final water year information is not yet available). The following table provides data and statistics characteristic of water year 2014 (Table 1). Because operational planning is significantly influenced by future forecasts, these uncertainties and eventually modified decisions are translated into the performance and efficiency of the system-wide operation.

Table 1. 2014 Water Year Northern Sierra precipitation, American River Basin snowpack, and Sacramento Valley Index statistics by month.

Water year 2014 Month	Northern Sierra 8-Station Precipitation (Cumulative water year in inches)	Northern Sierra 8-Station percentage of historic monthly average	American River Basin Snowpack (percent of April 1 average)	Sacramento Valley Index (40-30-30 Index 50% Exceedence)
November	2.44	26%	NA	NA
December	3.33	11%	NA	5.6 (Dry)

January	(driest Nov-Jan on record) 4.55	14%	10%	4.5 (Critical)
February	16.09	144%	6%	3.7 (Critical)
March	25.93	143%	25%	3.8 (Critical)
April	28.25	59%	28%	4.1 (Critical)
May	28.93	32%	7%	4.0 (Critical)

(DWR 2014)

Operations – Lower American River

Operational decisions on the LAR are influenced by local and CVP and SWP system-wide multi-purpose objectives including those that are planned and uncertain. Many factors contribute to operational actions including, but not limited to: flood protection, forecasted inflows, facility maintenance schedules, physical/mechanical facility limitations, upstream operations, minimum in-stream flow criteria, downstream Delta regulatory requirements, Delta exports, power generation, recreation, fish hatchery accommodations, temperature management capabilities, and others. In addition, uncertain or unplanned events can also influence real-time operation decisions (e.g. additional flow reduction for debris removal prior to fish weir and picket installation for the Nimbus Fish Hatchery in 2013). Planned operational decisions are regularly updated late winter through early summer (depending on hydrologic conditions) on Reclamation's website (http://www.usbr.gov/mp/cvo/) (Reclamation 2014).

Key decisions that influenced 2014 LAR operations:

- Minimum flow rate/FMS: Codified outflow criteria were developed with consideration for low storage/low precipitation conditions that address the objective to meet future in-stream temperature objectives. Storage conservation was critical in the winter months to preserve operational flexibility in future months; in January flows were reduced to 500 cfs following multi-agency discussions.
- Reduced flows were closely coordinated with the City of Sacramento operational needs during plant outage/repairs.
- Reduced CVP Deliveries: The CVP reduced water allocations to the following groups:
    - South of Delta Agricultural Contractors to 0%,
    - South of Delta Municipal and Industrial Contractors to 50%, and
    - American River Municipal and Industrial Contractors to 50%.
- Temporary Urgency Change Petition- SWRCB permit conditions: Reclamation and DWR sought relief from multiple requirements due to record low precipitation/poor runoff conditions to protect water resources.
- Cold Water Pool (CWP): The historical conditions of the CWP volume is recorded in Table 2 for comparison. Water year 2014 end of September values are projected.

- Temperature Management Plan: At the end of April (given initial conditions, 90% runoff exceedence forecast, and future assumptions) the Iterative Cold-Water Pool Management Model results indicated a reasonably feasible maximum mean daily temperature target at Watt Avenue Bridge of 70 ^{o}F. The model iteratively trades-off (pre-assumed) habitat benefits between steelhead and fall-run Chinook temperature conditions. This information is updated monthly and discussed with the ARG.
- Cold Water Bypass: Reclamation is tentatively planning a cold-water bypass (foregoing power generation) to release water from the deepest elevation in Folsom Reservoir to manage fall Nimbus Dam release temperatures.

Table 2. Historical Folsom Reservoir Cold Water Pool dynamics.

Historical Conditions (2001-2012)						
Year	**End of May**		**All Upper Shutters Lowered by**	**End of September**		**Watt Avenue Target (˚F)**
	Storage (TAF)	**CWP Volume < 58˚F (TAF)**		**Storage (TAF)**	**CWP Volume < 60˚F (TAF)**	
2001	696	275	30 Mar	368	30	65-71
2002	822	455	04 Mar	510	50	65-69
2003	962	640	02 Apr	658	135	65-67
2004	635	300	05 Mar	376	30	69
2005	959	705	15 Mar	652	140	65
2006	928	670	29 Mar	639	125	65
2007	787	355	21 Mar	323	30	68
2008	617	250	None Lowered	270	25	69-70
2009	933	550	12 Mar	412	60	67
2010	905	580	14 Apr	624	130	66
2011	880 (960-July)	590	28 Mar	740	180	65
2012	926	536	29 Mar	450	60	65-66

2013	734	277	15 Apr	361	50	69
2014 modified 90%-Exceedence Outlook						
2014	548	299	None Lowered	351	44	70

4.1 RPA Action II.1 – Lower American River Flow Management

RPA Action II.1 is designed to provide minimum flow for all steelhead life stages, as specified by the FMS. These Minimum Release Requirements (MRR) are total release measured at Nimbus Dam and are dependent on upstream storage and hydrologic conditions. The prescribed flows are minimums only and do not preclude Reclamation from making higher releases. Storage and flood control conditions are illustrated in Figure 2 which also includes inflow and releases October 2013 through August 2014.

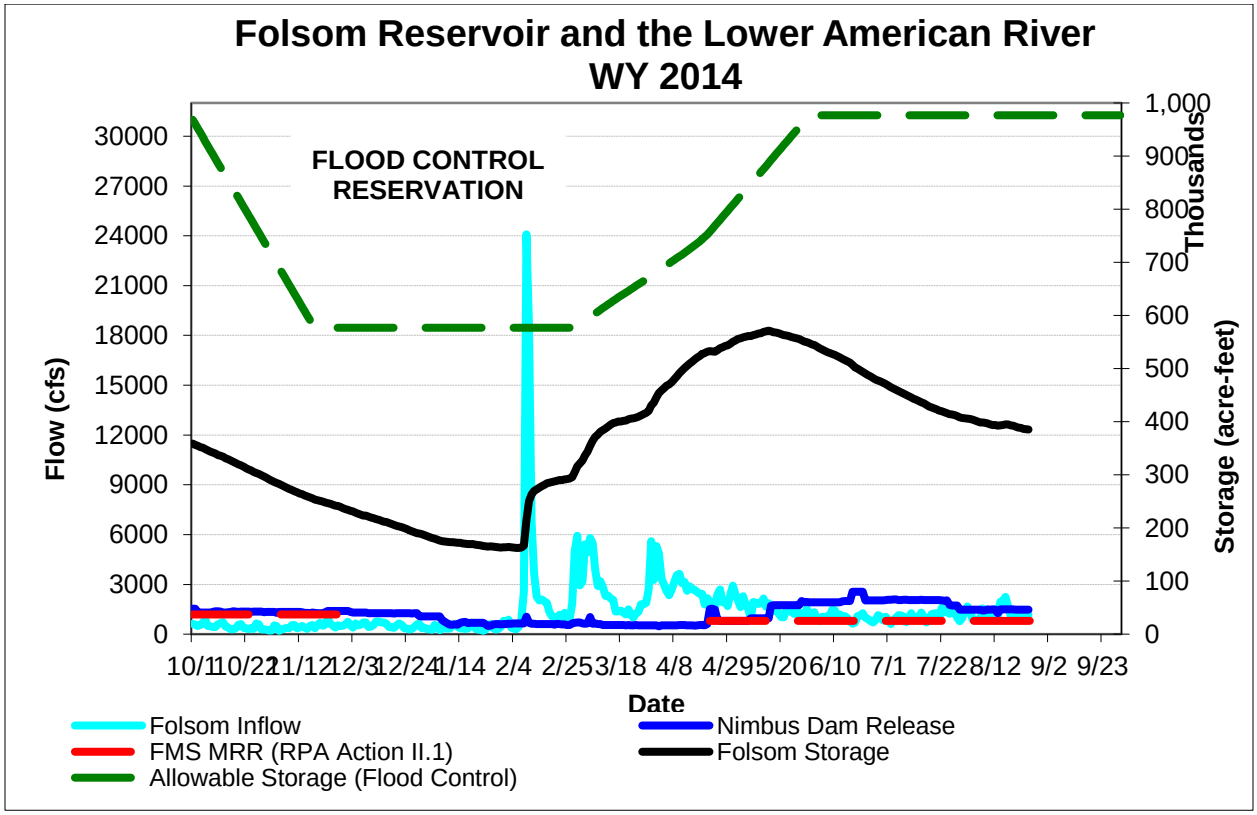

Figure 2: Summary of Folsom Reservoir Storage and Lower American River Flows

The Nimbus Dam releases to the LAR and the MRR prescribed by the FMS for water year 2014 is shown on Figure 3. In addition, the primary reasons for release changes to the LAR are identified on the figure. Operational decisions were closely coordinated with agencies as a result of the extreme drought situation. During the winter and spring (December 2013 through mid-April 2014) the FMS MRR operational

decisions were outside "normal conditions" and were decided based on multi-agency input. This early coordination and effort eventually lead to the Real-Time Drought Operations Management Team (RTDOT), a multi-agency team created in response to a State Water Resources Control Board Order and April 8, 2014, document, "Central Valley Project and State Water Project Drought Operations Plan and Operational Forecast April 1, 2014 through November 15, 2014," dedicated to meeting at least weekly to resolve real-time operational issues.

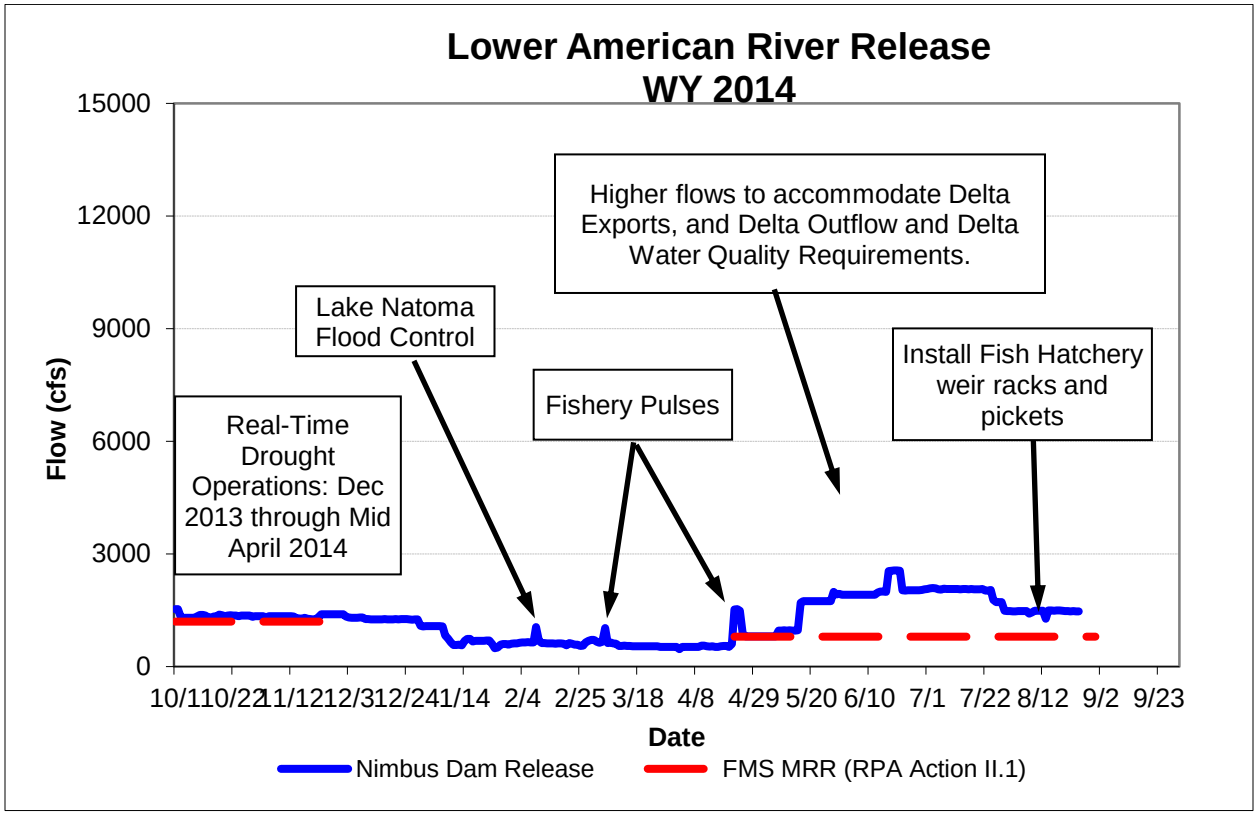

Figure 3: Summary of Lower American River Releases at Nimbus Dam

Table 1 contains a summary of operational release changes from Nimbus Dam including the purpose. The flow management adjustments that were implemented for fish purposes included:

- Late December and early January flow reductions (for storage conservation) were coordinated with fish spawn timing.
- Early March fishery pulse flow to aid in the fall-run fry emergence in dewatered zones and increase fall-run and steelhead yearling outmigration.
- Late April fishery pulse flow to aid in steelhead and fall-run outmigration.
- August releases were decreased for the installation of the hatchery weir. The weir was again installed earlier this year in response to the high number of fish that were upstream of the weir in previous years.

Table 1: Release Changes at Nimbus Dam

Start Date	End Date	Release	To (cfs)	Comment
10/3/2013	10/3/2013	Decrease	1,300	Reduction to FMS minimum release and storage conservation
12/29/2013	12/29/2013	Decrease	1,100	Storage conservation
1/7/2014	1/10/2014	Decrease	500	Storage conservation
2/9/2014	2/9/2014	Increase	1,500	Lake Natoma Flood Control
2/9/2014	2/10/2014	Decrease	500	Ramping down from Lake Natoma Flood Control
3/5/2014	3/5/2014	Increase	1,000	Fish Pulse Flow
3/6/2014	3/6/2014	Decrease	500	Fish Pulse Flow
4/21/2014	4/21/2014	Increase	1,500	Fish Pulse Flow
4/24/2014	4/25/2014	Decrease	800	Fish Pulse Flow
5/8/2014	5/8/2014	Increase	950	Delta Requirements
5/16/2014	5/16/2014	Increase	1,750	Delta Requirements
5/28/2014	5/28/2014	Increase	2,000	Delta Requirements
6/17/2014	6/17/2014	Increase	2,500	Delta Water Quality Requirements
6/22/2014	6/22/2014	Decrease	2,000	Delta Water Quality Requirements Adj.
7/25/2014	7/25/2014	Decrease	1,750	Storage conservation
7/29/2014	7/29/2014	Decrease	1,500	Storage conservation
8/13/2014	8/13/2014	Decrease/Increase	800/1,500	Temporary reduction for fish hatchery weir and pickets installation.

4.2 Action II.2 - Lower American River Temperature Management

RPA Action II.2 is designed to provide suitable temperatures to support over-summer rearing of juvenile steelhead in the LAR. Figure 4 is a summary of Reclamation's temperature operations, from October 2013 through August 2014, to target the temperature requirements at the temperature compliance point at Watt Avenue Bridge (~RM 9). A draft Temperature Management Plan was submitted to NMFS May 8, 2014 and an update on July 10, 2014 for concurrence. The plan included a temperature model run with the objective to achieve temperature (mean daily) target(s) at Watt Avenue Bridge. The model run incorporated the latest operation's forecast (inflow, outflow and storage) and iteratively selected a temperature target based on available resources and a pre-assumed habitat balance between steelhead and fall-run Chinook. The selected plan requires NMFS approval, with input from members of the ARG. The plan is reviewed for potential updates every month based on the latest hydrology and cold-water pool conditions. NMFS must concur on proposed deviations from the plan that may reduce the likelihood that the temperature objective will be met. Temperature modeling results are one component that guides the decision making for the Temperature Management plan. The model results were influenced in water year 2014 due to: low storage conditions and smaller cold-water pool volume, low precipitation/snow-pack and inflow, warmer inflow, reduced delivery requirements, and Delta regulatory requirements. Based on these existing conditions, assumed future conditions, and iterative modeling results, the Temperature Management Plan recommended a reasonably feasible maximum mean daily temperature target at Watt Avenue Bridge of 70 ^{o}F through September 2014. To date, no adjustments to the Temperature Management Plan target temperature were necessary. Low storage conditions in water year 2014 prevented the lowering of the Top set of Temperature Shutters (due to the risk of structural damage). As a result, a larger volume of cooler water was evacuated from the Middle set of Temperature Shutters.

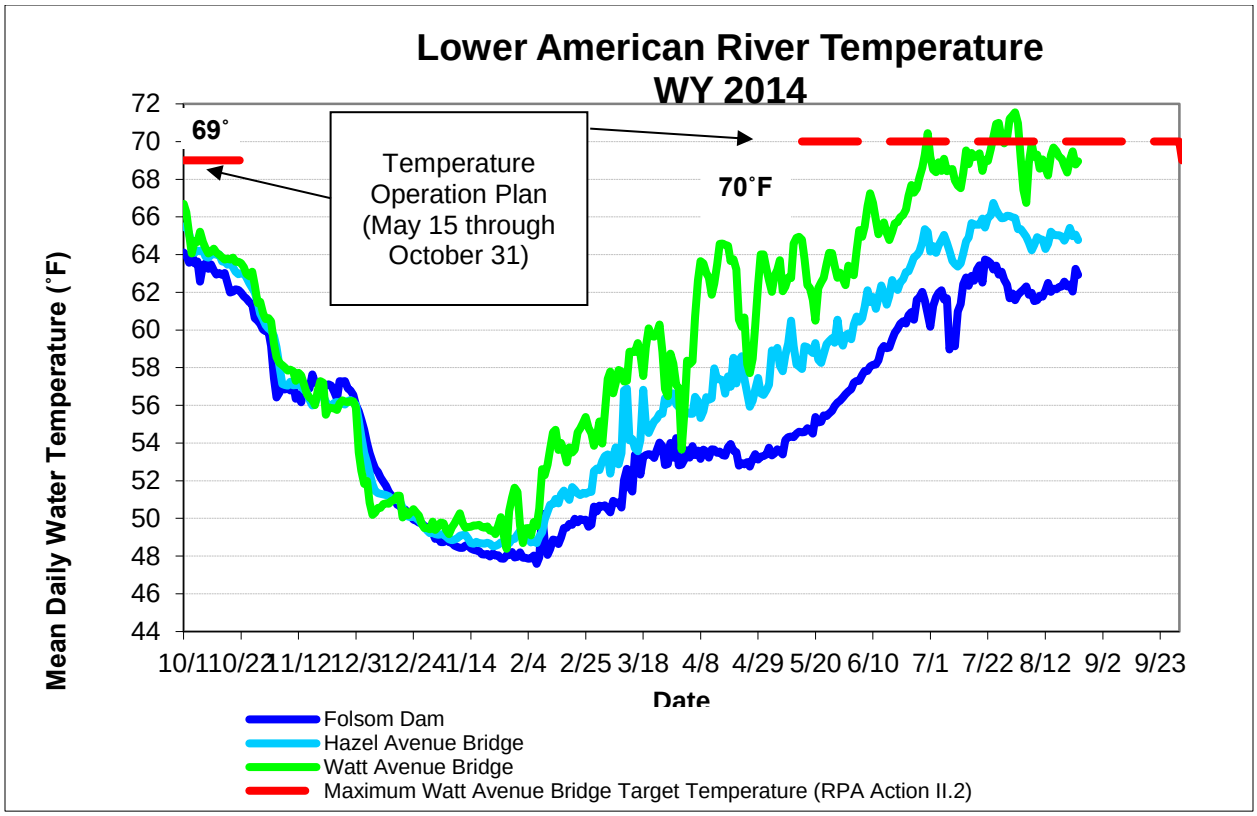

Figure 4: Summary of Temperature in the Lower American River

Table 2 is a list of Folsom Dam temperature shutter and power penstock blending operations taken to meet downstream temperature requirements.

Date	Operation
10/1/2013	Target Unit 2 at approximately 35% of the daily load.
10/11/2013	Target Unit 2 at approximately 45% of the daily load.
10/17/2013	Target Unit 2 at approximately 75% of the daily load.
10/22/2013	Target Unit 2 at approximately 90% of the daily load.
10/24/2013	Raise the Bottom set of temperature shutters on Unit 1 & 3
10/25/2013	Target Unit 2 at approximately 100% of the daily load.
10/25/2013	Remove all blending preferences as a result of the shutter raise.
10/28/2013	Bypass (hydropower generation) 150 cfs through the lower-tier river outlets.
10/31/2013	Bypass (hydropower generation) 250 cfs through the lower-tier river outlets.
11/2/2013	Bypass (hydropower generation) 350 cfs through the lower-tier river outlets.
11/3/2013	Bypass (hydropower generation) 450 cfs through the lower-tier river outlets.
11/4/2013	Bypass (hydropower generation) 500 cfs through the lower-tier river outlets.
11/25/2013	Reduce bypass (hydropower generation) to 400 cfs through the lower-tier river outlets
11/27/2013	Terminate bypass (hydropower generation) through the lower-tier river outlets
2/12/2014	Lower Bottom set of temperature shutters on Unit 3
2/13/2014	Lower Bottom set of temperature shutters on Unit 1 & 2
3/11/2014	Lower Middle set of temperature shutters on Unit 3

3/14/2014	Lower Middle set of temperature shutters on Unit 1 & 2
6/11/2014	Raise the Middle set of temperature shutters on Unit 1
6/16/2014	Minimize the use of Unit 1
6/29/2014	Target Unit 1 at approximately 10% of the daily load
6/30/2014	Target Unit 1 at approximately 20% of the daily load
7/6/2014	Target Unit 1 at approximately 30% of the daily load
7/8/2014	Raise Middle set of temperature shutters on Unit 2
7/11/2014	Remove all blending preferences as a result of the shutter raise and target Unit 3 at approximately 70% of the daily load
7/15/2014	Target Unit 3 at approximately 60% of the daily load
7/24/2014	Target Unit 3 at approximately 50% of the daily load
7/26/2014	Target Unit 3 at approximately 40% of the daily load
7/28/2014	Target Unit 3 at approximately 30% of the daily load
7/29/2014	Target Unit 3 at approximately 20% of the daily load
7/30/2014	Target Unit 3 at approximately 10% of the daily load
8/1/2014	Target Unit 1 & 2 at approximately 100% of the daily load
8/4/2014	Raise Middle set of temperature shutters on Unit 3 and Bottom on Unit 1
8/4/2014	Remove all blending preferences as a result of the shutter raise. Target Unit 2 & 3 at 100% of the daily load and minimize Unit 1.
8/6/2014	Target Unit 1 at approximately 10% of the daily load
8/8/2014	Target Unit 1 at approximately 20% of the daily load
8/15/2014	Target Unit 1 at approximately 25% of the daily load
8/21/2014	Target Unit 1 at approximately 35% of the daily load
8/26/2014	Target Unit 1 at approximately 30% of the daily load

4.3 Action II.4 - Minimize Flow Fluctuation Effects

The goal of RPA Action II.4 of the NMFS 2009 BiOp is to reduce stranding and isolation of juvenile steelhead through ramping protocols, from January 1 through May 30; and to minimize the occurrence of flows exceeding 4,000 cfs throughout the year, except as necessary for flood control or in response to high inflow events.

Ramping protocols as specified under RPA II.4 were met from January 1 through May 30; with two exceptions. Deviation from the ramping protocol as specified under RPA II.4 was necessary in order to install the fish hatchery weir racks and pickets. This action was coordinated with NMFS, USFWS, and CDFW. The second deviation occurred following a Lake Natoma flood control action on February 10, 2014. Results from Isolation Pool Monitoring are provided in section 5.1.3, below.

Chapter 5 – Lower American River Monitoring

The monitoring activities described below are currently being implemented on the LAR and include actions which are either a requirement in the NMFS 2009 BiOp, assist Reclamation in meeting the NMFS 2009 BiOp RPA requirements, provide supplemental information, or are a CVPIA requirement.

5.1 RPA Monitoring Activities

5.1.1 Steelhead Spawning Surveys

NMFS RPA Actions II.1 – Lower American River Flow Management and II.4 - Minimize Flow Fluctuation Effects

Reclamation, with assistance from the USFWS, CDFW, and contracted staff, conduct bi-weekly steelhead redd surveys from Nimbus Dam to Watt Ave, covering approximately 14 river miles and provide bi-weekly updates on the spawning surveys as per the NMFS 2009 BiOp and RPA actions. The surveys began January 15, 2014 and extended through April 15, 2014 (the end of the spawning season). Redds were surveyed and recorded from a jet-boat, cataraft, or on foot and plotted using GPS and biometric equipment. Updates were sent to NMFS bi-weekly and at the conclusion of the survey season. Figure 5 shows the locations of redds that were observed throughout the 2014 survey season. The cumulative redds mapped through the survey season totaled 112 redds (Figure 6).

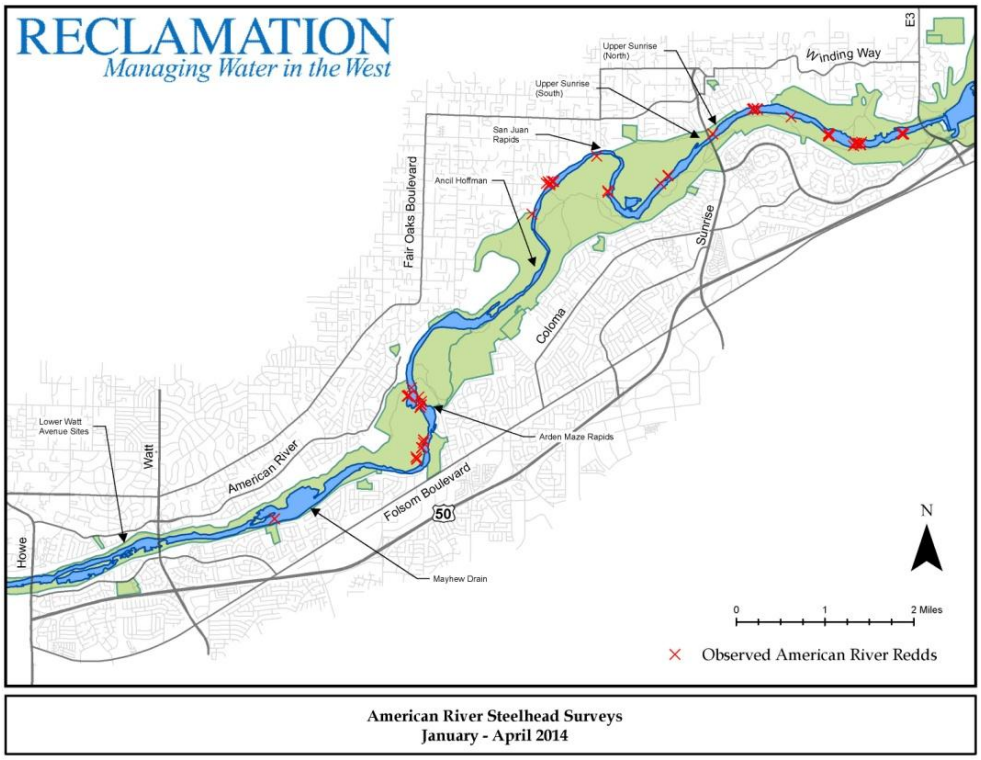

Figure 5: Locations of Observed Redds Throughout 2014 Survey Season

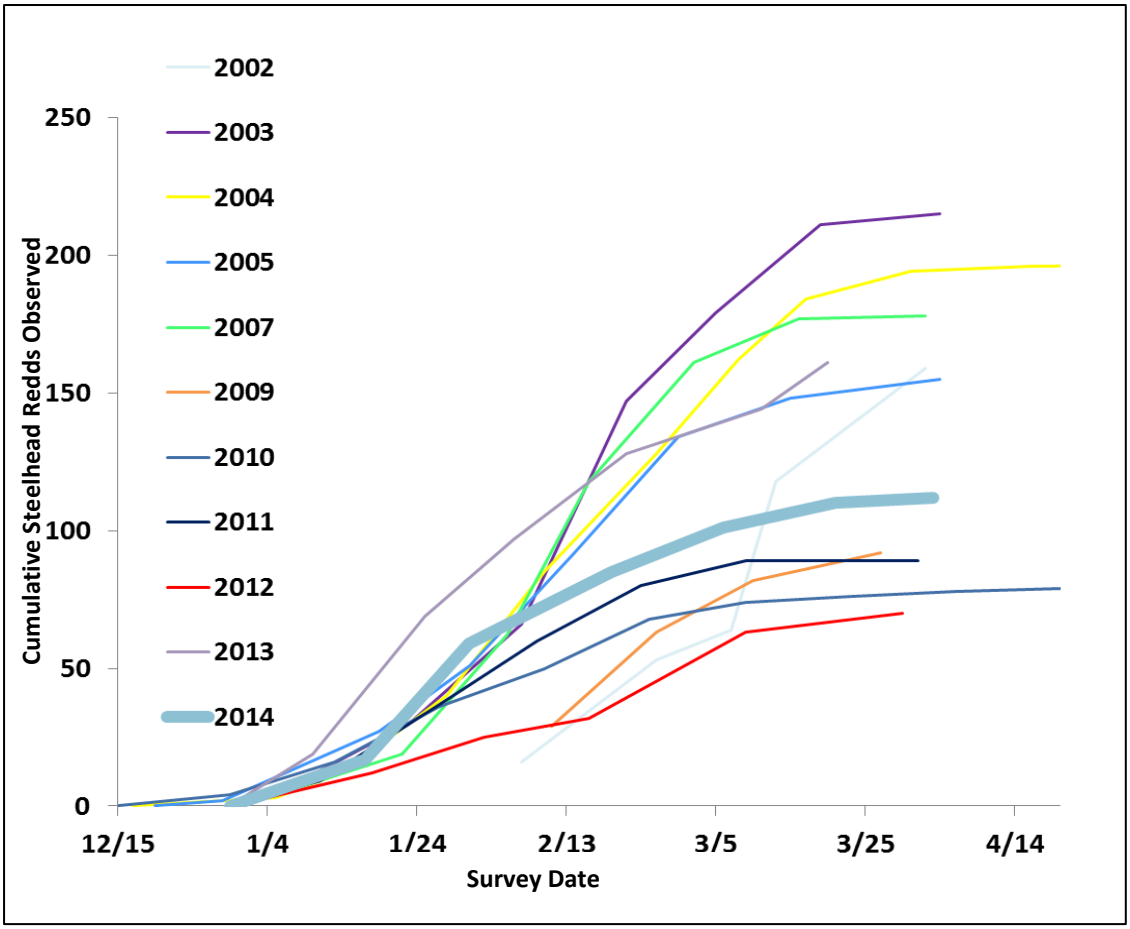

Figure 6: Summary of Cumulative Surveyed Redd Observations by Year

5.1.2 Manual Temperature Profiles

RPA Action II.2 – Lower American River Temperature Management

Twice per month from May through November, Reclamation collects temperature profile data in Folsom Reservoir to assist in meeting RPA Action II.2 – Temperature Management. The temperature profile data are used to model downstream temperatures through the operation season so Reclamation can plan temperature shutter operations to meet the downstream temperature compliance point at Watt Avenue Bridge. Manual temperature profiles are taken at six locations in Folsom Reservoir (see Chapter 4, Section 4.2).

5.1.3 Isolation Pool Monitoring

RPA Action II.4 – Minimize Flow Fluctuation Effects

Reclamation monitors flow fluctuations in the LAR to reduce and assess stranding and isolation of juvenile steelhead when ramping down flows that are above 4,000 cfs. Flow fluctuations in the LAR have been documented to result in steelhead redd dewatering and isolation, fry stranding, and fry and juvenile isolation. Habitat evaluations have identified several locations where

isolation of salmonids and other fish species have either been observed or conditions of the existing habitat could potentially be utilized by other species in normal conditions.

Stranding and isolation surveys were also conducted in conjunction with the steelhead spawning surveys and bi-weekly updates were sent to NMFS describing the isolation pool observations made during the steelhead spawning surveys. The surveys helped to determine how many salmon embryos could potentially be stranded during flow reductions.

Additional isolation pool monitoring surveys were conducted in conjunction with flow release changes that were scheduled by Reclamation. An isolation survey was conducted on April 18, 2014 during flows of approximately 800 cfs. During the survey, 12 isolation pools were identified in the Sailor Bar area though no fish or fry were present in the isolated pools. A cluster of six isolation pools where observed above Sailor Bar and approximately 50 Chinook salmon fry were distributed among these pools. There were also five Chinook salmon fry observed in two isolation pools directly downstream. On March 5 and 6, when flows were approximately 500 cfs an isolation pool survey was conducted and resulted in approximately 800 Chinook salmon fry observed in the isolation pools near Sailor Bar and also in isolation pools just below the Sunrise Avenue Bridge. On March 20 and 21, when flows were approximately 500 cfs, there were six isolation pools found to be disconnected from the main river channel with a total of 123 Chinook salmon fry observed near Sailor Bar and just below the Sunrise Avenue Bridge.

5.2 Other Monitoring Activities

5.2.1 Chinook Redd Dewatering and Pulse Flow Monitoring

Chinook Redd Dewatering Monitoring

On December 23, 2013 Folsom Reservoir storage fell below 200 TAF. Reclamation proposed several decreases in flow dropping from 1100 cfs to 500 cfs in an effort to curb the evacuation rate and maintain Folsom Reservoir storage. It was suggested that timely and gradual release reductions would also likely discourage steelhead spawning in side channels and other areas of higher elevation that may become dewatered during the year due to the environmental conditions. On Tuesday, January 7, 2014, Reclamation made an initial flow reduction from 1100 cfs to 800 cfs. An additional 100 cfs decrease in flow was made each day until Friday, January 10th, when the target flow rate of 500 cfs was reached. CBEC, funded through the Water Forum and on behalf of the USFWS, performed an analysis of the potential Chinook redd dewatering on the LAR. The analysis calculated that approximately 11.5% of Chinook redds would be dewatered as a result of decreasing releases to 500 cfs.

In the event of further flow reductions, CBEC performed additional analysis of potential Chinook redd dewatering on the LAR at flow rates of 450 cfs, 400 cfs, 350 cfs, 300 cfs, and 250 cfs. The model indicated that all side channels disconnect at flows below 400 cfs with the exception of the Riverbend Park. Analysis also showed that if flows were called for at or beyond 400 cfs, the loss of channel connectivity results in a dramatic increase in dewatering of Chinook redds from 21%

at 400 cfs to 45% at 350 cfs, due to the high concentration of spawning in the channels during higher flows. Flows from Nimbus Dam were not reduced lower than 500 cfs.

The ARG recommended monitoring during the various stages of flow reduction. A monitoring regime was developed by Cramer Fish Sciences and various ARG members partnered to conduct the monitoring effort. The partnership included Reclamation, the Water Forum, State Water Resources Control Board, CDFW, USFWS, and Cramer Fish Sciences technicians funded by the Water Forum. The monitoring effort focused primarily on changes in water elevations throughout the LAR following each flow rate reduction. Additional monitoring is focusing on in gravel conditions including temperature, hyporheic flows, rate of flow, and dissolved oxygen.

The LAR was split into three sections (Reach 1: Nimbus Fish Hatchery to the Lower Sunrise side channel; Reach 2: Lower Sunrise to Watt; Reach 3: Watt to the confluence). In addition, all LAR gravel augmentation sites (eight total) were mapped in their entirety and photographed each day. Channel connectivity and isolated pools were also recorded. On Tuesday, January 7, 2014, aerial photographs were taken of the LAR from the Nimbus Fish Hatchery to the confluence. The aerial photos taken at a flow rate of 800 cfs will be compared to those taken in November and December of 2013 when flows were at 1300 cfs and 1100 cfs, respectively. The GIS data collected during the monitoring transect surveys delineated the water's edge after each flow reduction to illustrate the dewatered areas. Those dewatered areas will then be compared to locations of Chinook redds within the gravel augmentation sites that were surveyed by Cramer Fish Sciences four times throughout the season, and Chinook redds throughout the river identified by aerial photos. Cramer Fish Sciences will be processing all GIS data and photo points. This information and analysis will be useful in assessing the viability of redds that are threatened by flow reductions, informing future modeling applications and operational decisions.

Pulse Flow Monitoring

In the spring of 2014, pulse flow suggestions were made in response to the low flow rates and monitoring observations. Pulse flows are intended to promote fish emigration so fewer individuals would become stranded in isolated areas and to decrease the amount of time that they would remain in the LAR later in the season when summer water temperatures would become increasingly problematic for fish. The estimated time of emergence for LAR Chinook is as follows: 50% emergence between February 5 and February 15, 75% emergence between February 13 and February 22, and 99% emergence between March 13 and March 22. Prior to the early February increase in flows for flood control purposes it was estimated that 11% were stranded and of those 11%, 30% were ready to emerge during the early February increase in flows and therefore 70% remained stranded. Of those 70%, it was estimated that 5-25% were within stressful water quality conditions. Observations recorded during the March 6 pulse flow showed that the pulse flow resulted in a reduction in stranded fry from disconnected channels and alevins in redds were undetectable. Pulse flow preliminary results indicated a 63% reduction in stranded fry from disconnected side channels. In addition, a pulse flow was initiated in late April to aid in steelhead and fall-run outmigration.

5.2.2 Steelhead Acoustic Tagging Study 2014

The CDFW is conducting studies on Steelhead migration and survival on the LAR. Acoustic tagging is the primary tool being used to track movements of steelhead in the river. Acoustic tags were used to evaluate various questions regarding steelhead use and survival in the LAR during the reporting period (October 1, 2013 through September 30, 2014). Tag battery lives range from 203-403 days (6.8 - 13.4 months).

From October 2013 through December 2013, 23 natural-origin sub-yearling steelhead were tagged to assess their migration timing and survival to the mouth of the American River. The estimated survival was approximately 22%. Of the 23, only five left the LAR between November 15, 2013 and January 31, 2014. On December 31, 2013, 11 hatchery-origin adult steelhead were caught by hook-and-line near the Nimbus Hatchery fish ladder and then acoustic tagged to assess hooking mortality of adult steelhead in the winter steelhead sport fishery. Of the 11 tagged, only two fish left the LAR between January 8, 2014 and February 7, 2014. From January 2014 through February 2014, 12 steelhead were tagged to assess drought-induced low flow conditions on the LAR, and included five natural-origin steelhead smolts, one natural-origin sub-adult steelhead, and six hatchery-origin adult steelhead. The natural-origin steelhead smolt survival to the mouth of the river was 20%. One smolt emigrated from the river on February 13, 2014. The natural-origin sub-adult steelhead survival was 0% (1 fish only). This fish was last detected near the I-80 crossing on February 13, 2014. Of the six hatchery-origin adult steelhead, three of the hatchery adults were tagged in river and had poor survival (0%), two of the fish were never detected after initial release, and one fish was harvested by an angler 21 days post release. On January 28, 2014 three adult hatchery females were tagged to determine if fish could return to the hatchery during periods when flows nearly expose critical riffles and therefore might prevent passage up river. All three fish moved upstream, two returned to at least Fair Oaks and then were not detected again. One fish moved upstream to Ancil Hoffman and then turned around and left the river in mid-February. In total, 46 steelhead were acoustic tagged.

5.2.3 Rotary Screw Trap

Rotary screw traps were deployed 1/8 mile downstream of the Watt Avenue Bridge on the LAR in Sacramento County, California, for 122 days between January 7 and May 23, 2014. The trapping operations in 2014 reflect the second year in a collaborative five year effort by the USFWS's Comprehensive Assessment and Monitoring Program, Pacific States Marine Fisheries Commission, and CDFW. The primary objective of the trapping operations is to gather juvenile Chinook salmon and steelhead data pertaining to fish size, weight, life stage, and abundance/production. Secondary objectives of the trapping operations focus on collecting data on non-salmonid fish species, and gathering data pertaining to salmonid size, temporal presence, and abundance as they relate to environmental factors.

During the 2014 field season, two traps were deployed in one of the two river channels below the Watt Avenue Bridge. Fifteen trap efficiency tests were conducted to collect data that were used to estimate juvenile salmon production. A total of 379,542 fall-run, 5 putative spring-run, 13 winter-run, and 2 late-fall-run juvenile Chinook salmon were captured. In addition, 591 natural origin juvenile steelhead/rainbow were captured, and 642 ad-clipped hatchery-produced steelhead from the Nimbus Fish Hatchery were captured. The majority of the captured juvenile Chinook

salmon belonged to the fry life stage; lesser numbers of the parr, silvery parr, and smolt life stages were also collected. The outmigration of juvenile fall-run Chinook salmon from the LAR during the 2014 field season peaked between 9 February and 8 March when 310,229 fry or 82% of the total seasonal salmon catch was caught. The natural juvenile fall-run Chinook salmon production estimate for the LAR in 2014 has not been finalized but will likely be ~ 1,700,000 fish. In addition to the salmonids 5,116 individuals belonging to 24 non-salmonid taxa were also caught in 2014. The 2014 LAR rotary screw trap report is currently being developed. The appendices will characterize the 2013 vs. 2014 differences in salmon and steelhead abundance and life history. The report will include analysis on how steelhead movements/abundance were affected by the two pulse flows from Nimbus Dam that were conducted in 2014.

5.2.4 Other Monitoring

Additional project specific fisheries monitoring is being conducted to evaluate spawning and rearing habitat restoration projects. This monitoring includes river-wide Chinook salmon redd surveys, ground based redd surveys at project sites, an assessment of juvenile use of various types of habitat structure, an evaluation of egg incubation survival, evaluation of measured intragravel conditions for egg incubation, and comparisons of habitat availability before and after projects. A structured decision making process is being used to determine future project types and identify monitoring needs.

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