The Water Forum Testimony by George "Buzz" Link for Presentation at the March 22, 2010 Public Informational Proceeding To Develop Flow Criteria for the Delta Ecosystem Necessary to Protect Public Trust

Introduction

My name is George "Buzz" Link. I am a registered professional civil engineer employed by HDR Engineering, a consultant to The Water Forum. I have spent the last 33 years studying various issues concerning the operations of the Central Valley Project (CVP) and State Water Project (CVP). In recent years I have been a member of the technical team that developed the Water Forum Agreement for the American River.

Key Issue

As described in the State Water Board Notice, *"The key issue for this informational proceeding is what volume, quality, and timing of Delta outflows are necessary for the Delta ecosystem under different hydrologic conditions to protect public trust resources pursuant to the State Water Board's public trust obligations and the requirements of SB 1."*

The State Water Board identified several example questions in the Notice, and it is the subject of one of these that solicits my testimony. Specifically, The State Water Board asks *"When determining Delta outflows necessary to protect public trust resources, how important is the source of those flows? How should the State Water Board address this issue when developing Delta outflow criteria?"* In response to these two questions my testimony is in several parts.

First, I will discuss the American River and the historic Water Forum Agreement which identifies a Flow Management Standard for the lower American River. Second, I will discuss the significance of the June 4, 2009 NMFS Biological and Conference Opinion on the Long-Term Operation of the Central Valley Project and State Water Project and Related Documents, which affects the flows in the lower American River. Third, I will discuss the significance of timing and volume of flows in the lower American River with respect to instream water temperatures and potential effects on the federally listed threatened Central Valley steelhead (O. mykiss).

Water Forum Agreement

The American River is the second largest tributary to the Sacramento River, a critical component of the San Francisco Bay/Sacramento-San Joaquin Delta system. The lower American River is a particularly valuable asset within the Sacramento region, providing important fish and wildlife habitat, a high-quality water source, a critical floodway, and a spectacular regional recreational parkway.

Background

The U.S. Bureau of Reclamation (Reclamation) operates Folsom Dam and Reservoir to provide water for irrigation, municipal and industrial uses, hydroelectric power, recreation, water quality, flood control, and fish protection. Reclamation operates under a state water right permit and fish

protection requirements that were adopted in 1958 as State Water Board 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 September 15 and December 31. Biological, socioeconomic, legal, and institutional conditions have changed substantially since the State Water Board adopted D-893 in 1958. The State Water Board and many diverse stakeholders involved in various American River actions have agreed that the conditions specified in D-893 are not sufficiently protective of the fishery resources within the lower American River.

By the early 1990s the Sacramento region had suffered a 30 year litigious battle over the American River. Additionally, the last two California droughts brought the region water supply cutbacks and environmental degradation. Compounding these problems was a water table that had been lowered in some areas by as much as 90 feet due to over reliance on groundwater. Moreover, parts of area groundwater basins were contaminated.

Adding to water supply concerns was an increasing awareness of environmental conditions along the lower American River (LAR). The LAR provides important habitat, water supply, a critical floodway and a regional recreational parkway to the Sacramento area. The American River Parkway records over 5 million visitor-days each year and the LAR supports 43 species of native and nonnative fish, including endangered fall-run Chinook salmon and steelhead.

With water demand growing alongside population and rising concern for the environment, leaders recognized that only negotiations involving all sides would result in a solution to the area's water woes. In 1993, the City and County of Sacramento created the Water Forum, a diverse group of business and agricultural leaders, citizens groups, environmentalists, water managers and local governments to find solutions to the water dilemma. In 1995 they were joined by water managers in Placer and El Dorado counties.

These leaders devoted tens of thousands of hours agreeing on principles to guide development of a regional solution and negotiating the Water Forum Agreement. This diverse group agreed to implement a comprehensive package of linked actions that achieve two coequal objectives:

- Provide a reliable and safe water supply for the region's economic health and planned development to the year 2030;

- AND, Preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River.

Signed by 40 stakeholder organizations in April 2000, the Water Forum Agreement has already resulted in successfully implemented programs that will maintain the long-term sustainable yield of the North Area Groundwater Basin, conserve municipal and industrial water use, and protect fish and other public trust assets in the lower American River (Water Forum Exhibit No. 5).

The Water Forum Flow Management Standard

The Flow Management Standard (FMS) is intended to result in improved conditions for fish in the lower American River, particularly fall-run Chinook salmon (Oncorhynchus tshawytscha) and

steelhead (O. mykiss). Beginning in the early 2000's, the Water Forum, Reclamation, U.S. Fish and Wildlife Service, NOAA Fisheries, and the California Department of Fish and Game worked on the development of an improved flow standard. After several years of scientific investigation and regular meetings of the participants, an FMS was agreed to in 2006. The FMS:

- Establishes minimum required flow, water temperature, ramping rate, and flow fluctuation criteria;
- Establishes a river management process for Folsom Reservoir and lower American River operations; and
- Provides for monitoring, evaluation, and reporting of the resultant hydrologic and biologic conditions.

In 2007, Reclamation began operating in substantial compliance with the FMS flow criteria. This operation continued until 2009 when the NMFS instituted the FMS flow criteria as a condition of the June 4, 2009 NMFS Biological and Conference Opinion on the Long-Term Operation of the Central Valley Project and State Water Project and Related Documents Reasonable and Prudent Alternatives for the operation of Folsom and Nimbus Dams on American River.

Biological Opinion

In June 2009, the National Marine Fisheries Service issued its NMFS Biological and Conference Opinion on the Long-Term Operation of the Central Valley Project and State Water Project and Related Documents (NMFS BO). Contained in this Biological Opinion are reasonable and prudent alternatives (RPAs) specific to the lower American River.

Significant among the RPA actions, are the inclusion of portions of the Water Forum FMS related to flow and temperature operations in the lower American River. NMFS incorporated the flow component of the Water Forum FMS directly into their RPA and recognized the need to manage water temperatures in a manner that balances the needs of the anadromous fish species in the lower American River. Specifically:

- The NMFS BO contains the FMS water availability indices and associated prescribed minimum instream flow requirements.
- The NMFS BO contains water temperature management requirements incorporating components of the FMS.

The following **Table 1** is an abbreviated representation of flow requirements of the FMS (Water Forum Exhibit No. 4). This table is presented to suggest the level of rigor considered in the development of the FMS. It shows the extent of considerations that are necessary to estimate hydrologic conditions and appropriately determine water availability in the American River.

Table 1. Flow Management Standard Indices and Flow Requirements

Month	Index	Index Flows (cfs)	Prescriptive Adjustments	Minimum Release Requirements (cfs)	Discretionary Adjustments	Adjusted Minimum Release Requirements (cfs)
October	FRI	800-1,500	NA	800-1,500	Fish Protection Adjustment	1,250- 1,499
November	FRI	800-2,000	Spawning Flow Progression	800-2,000	NA	
December	FRI	800-2,000	NA	800-2,000	NA	
January	SRI If Above Normal or Wet Year (SRI ≥ 15.7 MAF) then release 1,750 cfs	1,750	December End-of-Month Storage Adjustment When End-Of-December Storage is < 300 TAF, then January MRR is 85% of December MRR	800-1,750	NA	
	SRI If Dry or Below Normal Year (10.2 < SRI < 15.7 MAF) then maintain December MRR up to 1,750 cfs	800-1,750			NA	
	SRI If Critical Year (SRI < 10.2 MAF) then reduce MRR	85% of December MRR, but not less than 800	NA		NA	
February	SRI If Above Normal or Wet Year (SRI ≥ 15.7 MAF) then release 1,750 cfs	1,750	January End-of-Month Storage Adjustment When End-Of-January Storage is < 350 TAF, then February MRR is 85% of January MRR	800-1,750	NA	
	SRI If Dry or Below Normal Year (10.2 < SRI < 15.7 MAF) then maintain January MRR up to 1,750 cfs	800-1,750			NA	
	SRI If Critical Year (SRI < 10.2 MAF) then reduce MRR	85% of January MRR, but not less than 800	NA		NA	
March through May	IFII	800-1,750	May End-of-Month Storage Adjustment When Calculated End-Of-May storage is < 700 TAF, then IFII Index Flow or February MRR, whichever is less	800-1,750	NA	
June though Labor Day	IFII	800-1,750	September End-of-Month Storage Adjustment When Calculated End-Of-September storage is < 300 TAF, then IFII Index Flow or Calculated Storage-Based Flow, whichever is less	800-1,750	Water Conservation or Fish Protection Adjustment	1,500-1,749
Post-Labor Day through	IFII	June through Labor Day	NA	800-1,500	Fish Protection Adjustment	1,250-1,499

Table 1. Flow Management Standard Indices and Flow Requirements

Month	Index	Index Flows (cfs)	Prescriptive Adjustments	Minimum Release Requirements (cfs)	Discretionary Adjustments	Adjusted Minimum Release Requirements (cfs)
September 30		MRR, but not more than 1,500				

Appendix 2-D of the NMFS BO also includes a description of the tools to be utilized in development of Reclamation's Annual Water Temperature Management Plan, including the Coldwater Pool Management Model (CPMM) and the Automated Temperature Selection Procedure (ATSP).

Managing water temperatures in the lower American River takes on major significance given that Folsom Reservoir has a coldwater pool that in most years is too small to maintain optimal water temperatures for Chinook salmon and steelhead throughout the spring-summer-fall months. As a result of this condition, it is necessary to manage the use of the available cold-water in Folsom Reservoir in a way that appropriately "balances" the achieved monthly water temperatures consistent with the biological needs of the steelhead and salmon.

Finding a "balance" for allocating the limited coldwater pool in Folsom Reservoir to instream water temperature control for the competing needs of over-summering steelhead and those of salmon and steelhead spawning in fall months, led to the development of the Automated Temperature Selection Procedure (ATSP). The ATSP is a series of 78 different combinations, or schedules, of monthly lower American River water temperature targets that guide the use of coldwater resources when they are insufficient to achieve the most desirable water temperature conditions. The schedules are numbered with number one (1) being the most desirable of conditions throughout the spring-summer-fall and number seventy-eight (78) being the least desirable. Theses schedules were agreed upon by biologists from NMFS, U.S. Fish and Wildlife Service, California Department of Fish and Game, Reclamation and the Water Forum.

Successful management of the limited coldwater pool in Folsom Reservoir can thus be measured by achieving the lowest ATSP schedule for given meterological and hydrologic conditions. A complete listing of the 78 ATSP schedules is contained in Appendix 2-D of the NMFS BO.

Since both flow rate and temperature of releases from Folsom Dam affect downstream water temperatures, a tool that can simulate reservoir water temperatures at depth, water release rates, released water temperature, and instream warming/cooling is necessary. Reclamation has such a tool, the Cold Water Pool Management Model, (CPMM) which it uses for developing its annual temperature management plan. This model can model releases from multiple dam outlets with varying water temperatures to simulate resultant downstream water temperatures. Using this tool allows the operators to evaluate, as measured by the achieved ATSP schedule, the effects of manipulation to flow schedules and released water temperatures.

Recently the Water Forum has completed modifications to the CPMM model to enable it to incrementally select combinations of temperature shutter configurations and release facilities (penstocks, outlet gates, etc.) to find the best (lowest) attainable ATSP schedule for a given set of weekly releases from Folsom Reservoir. This enhanced CPMM model is called the iCPMM model. Using the iCPMM model provides an analytical method to identify the effect of alternative

release scenarios wherein the measure of effect can be observed by the difference in achievable ATSP schedule.

The emphasis placed on water temperature in both the Water Forum FMS and the NMFS BO reflects recognition that flows alone are not indicative of good conditions for fish in the lower American River. The following discussion will illustrate that in fact, increased flows can be detrimental to conditions.

Water Temperature in the Lower American River as a First Responder Unintended Consequences

In the past, Folsom Reservoir has been called upon first among the upstream reservoirs to provide water in the Delta. This reliance on Folsom Reservoir can be ascribed in part to its close proximity to the Delta and the relative ease of filling the reservoir in the following year with something less than wet conditions.

In 2005, the Water Forum prepared a Report and subsequent Addendum on the effect of Delta water quality releases from Folsom Reservoir on lower American River salmonids (Water Forum Exhibit No. 3). That work was submitted on September 15, 2005 to the State Water Board workshop on Potential Amendments or Revisions to the Delta Outflow Objective of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. The findings of the report were documented instances of potential flow and water temperature impacts on lower American River salmonids that are associated with increased water releases from Folsom Reservoir to meet Delta water quality objectives and demands. In that report, water temperature conditions in the lower American River contributing to disease incidents of a bacterial-caused inflammation of the anal vent in steelhead, and higher than desired water temperatures in the fall spawning months, were identified with documented Delta water quality releases from Folsom Reservoir.

The Water Forum maintains its previous assertion in the 2005 Report that releasing water from Folsom Reservoir for Delta water quality does have detrimental effects on coldwater operations. To test this assertion and to illustrate the methodology and effect of using Folsom Reservoir to provide Delta water quality flows, three recent water years were studied and are presented here. In each of the example years, Reclamation's actual 90% Exceedance spring forecast of Folsom reservoir water operations is used to identify a base condition. This base condition is input to the iCPMM model and a best case ATSP schedule is obtained. For each example year, the base condition Folsom reservoir release is increased first by 50,000 af in May, and a resultant best case ATSP schedule obtained. Finally, the base case is increased by 100,000 af in May, and a resultant best case ATSP scheduled obtained. Using 50,000 af is equivalent to an increase in flow of roughly 900 cfs over a four week period and would be roughly equivalent in magnitude to the capacity of one export pump at either the C.W. "Bill" Jones Pumping Plant, or Harvey O. Banks Pumping Plant. One hundred thousand acre-feet is about 1,800 cfs over a four week period, The progression of ATSP schedules from the base case through the subsequent 50,000 af and 100,000 af cases demonstrates that increased reservoir releases of magnitudes less than those historically documented (Water Forum Exhibit No. 3), can be counter to water temperature requirements in the lower American River.

Figures 1(a) through 1(c) are iCPMM results showing that water temperature conditions for a dry year are made worse with minimal use (50,000 af in May) from Folsom Reservoir responding to releases for Delta water quality and much worse with a use of 100,000 af in May, more typical of first responder usage.

Figures 2(a) through 2(c) show a result similar to that shown for an above normal year.

Figures 3(a) through 3(c) show a catastrophic temperature impact from the use of Folsom Reservoir as first responder in a critically dry year.

Conclusion

As noted above, regional interests have invested significant effort to achieve a comprehensive solution to the conflicts of competing needs for water in the lower American River. The State Water Board should be aware that the scientific effort utilized in the development of the FMS was thorough and utilized current information. Any proposed Delta action considered by the State Water Board needs to be evaluated in light of their potential to alter the efficacy of the FMS.

The iCPMM results demonstrates that assigning responsibility for providing additional Delta inflow from upstream sources, without thorough scientific analysis, may have unintended environmental consequences to other important public trust resources. The State Water Board should consider the regional cooperation that has resulted in the development of comprehensive management actions and tools for the protection of the lower American River and should not undo the achievements made on this tributary when establishing criteria for the Delta.

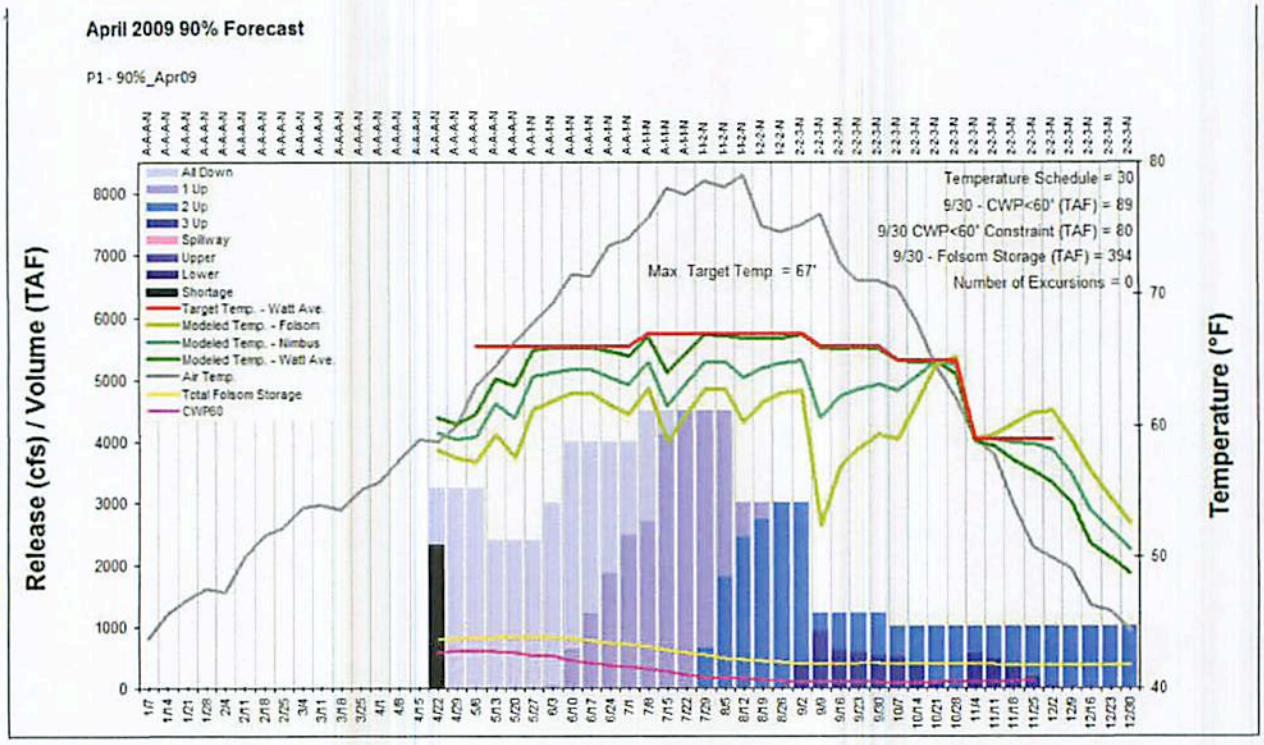

Figure 1(a) - Dry Year (2009) Water Temperature Without Using Folsom Reservoir As First Responder.

Notes:

- The Folsom Reservoir release schedule shown in this figure was issued by Reclamation in their spring 2009 temperature plan.
- End-of-September Folsom Reservoir Storage: 394 TAF
- Lowest attainable ATSP schedule: 30
- Maximum summer water temperature target: 67°F for 9 weeks
- First Responder Volume: None

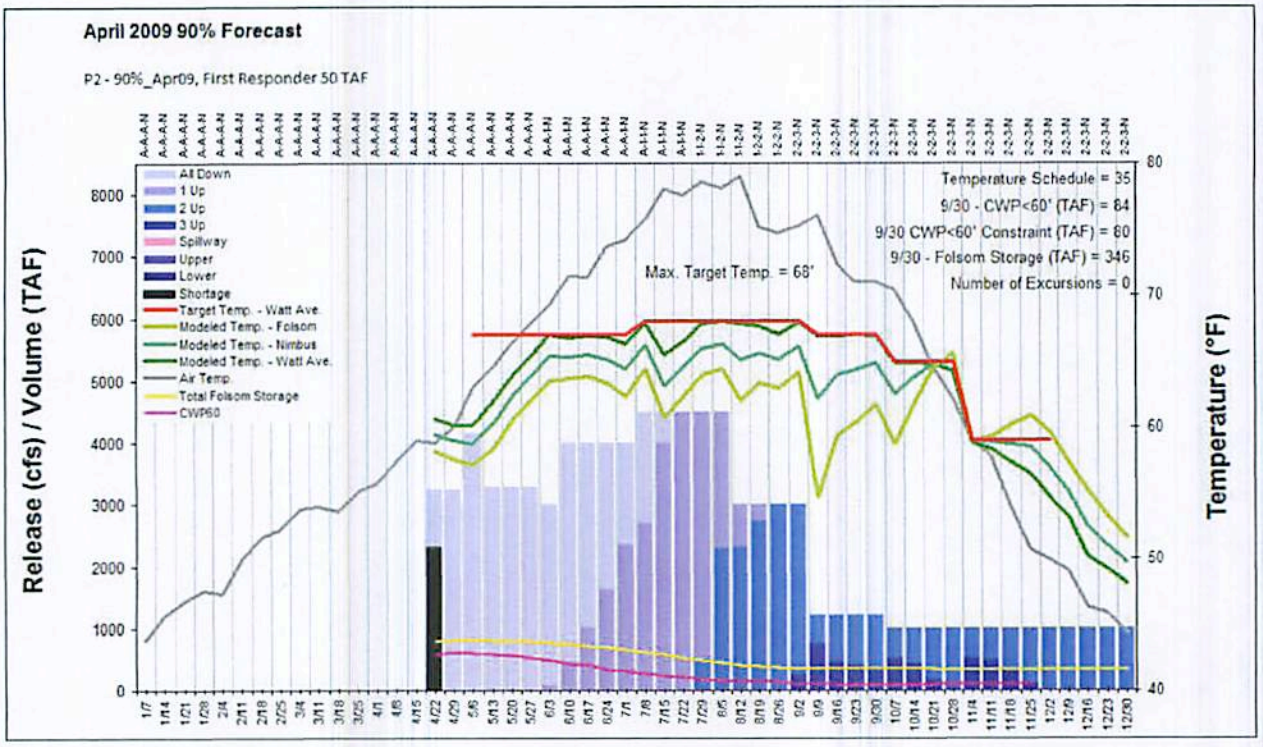

Figure 1(B) - Dry Year (2009) Water Temperature Using Folsom Reservoir As Minimal First Responder.

Notes:

- End-of-September Folsom Reservoir Storage: 346 TAF
- Lowest attainable ATSP schedule: 35
- Maximum summer water temperature target: 68°F for 9 weeks
- First Responder Volume: 50 TAF

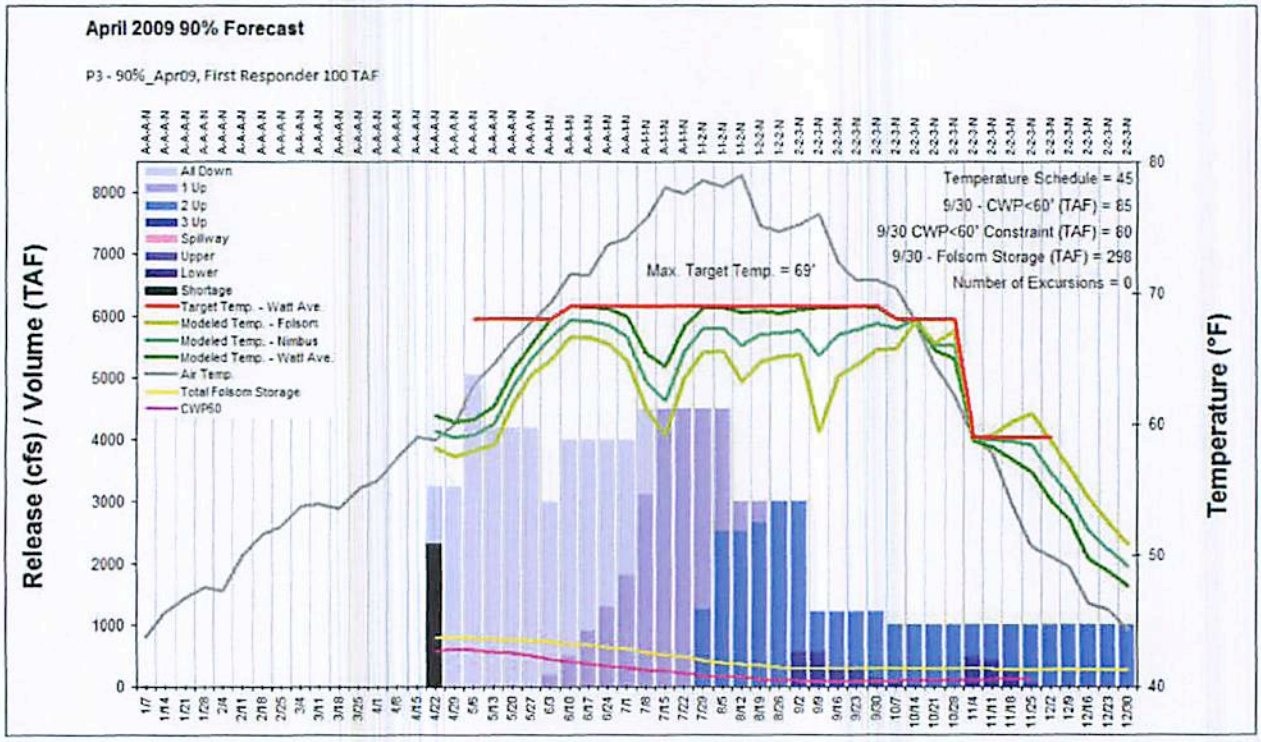

Figure 1(C) - Dry Year (2009) Water Temperature Using Folsom Reservoir As First Responder.

Notes:

- End-of-September Folsom Reservoir Storage: 298 TAF
- Lowest attainable ATSP schedule: 45
- Maximum summer water temperature target: 69°F for 17 weeks
- First Responder Volume: 100 TAF

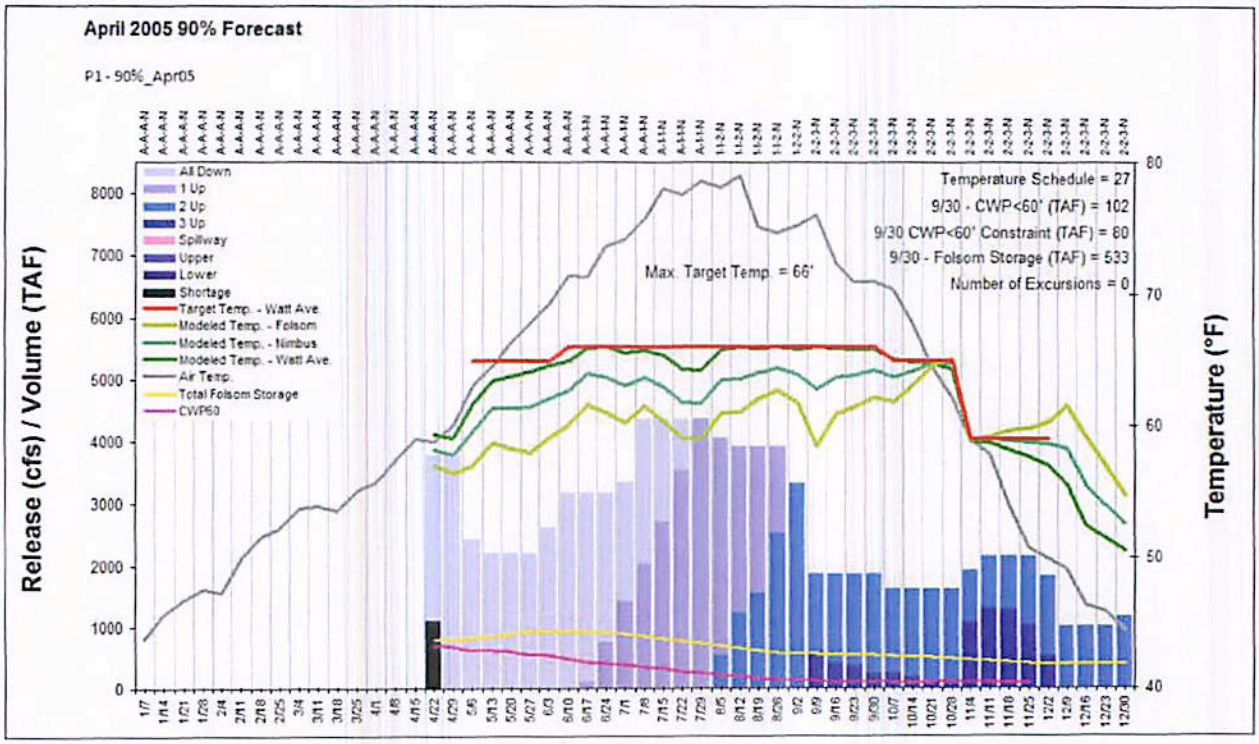

Figure 2(A) – Above Normal Year (2005) Water Temperature Without Using Folsom Reservoir As First Responder.

Notes:

- The Folsom Reservoir release schedule shown in this figure was issued by Reclamation in their spring 2005 temperature plan.
- End-of-September Folsom Reservoir Storage: 533 TAF
- Lowest attainable ATSP schedule: 27
- Maximum summer water temperature target: 66°F for 17 weeks
- First Responder Volume: None

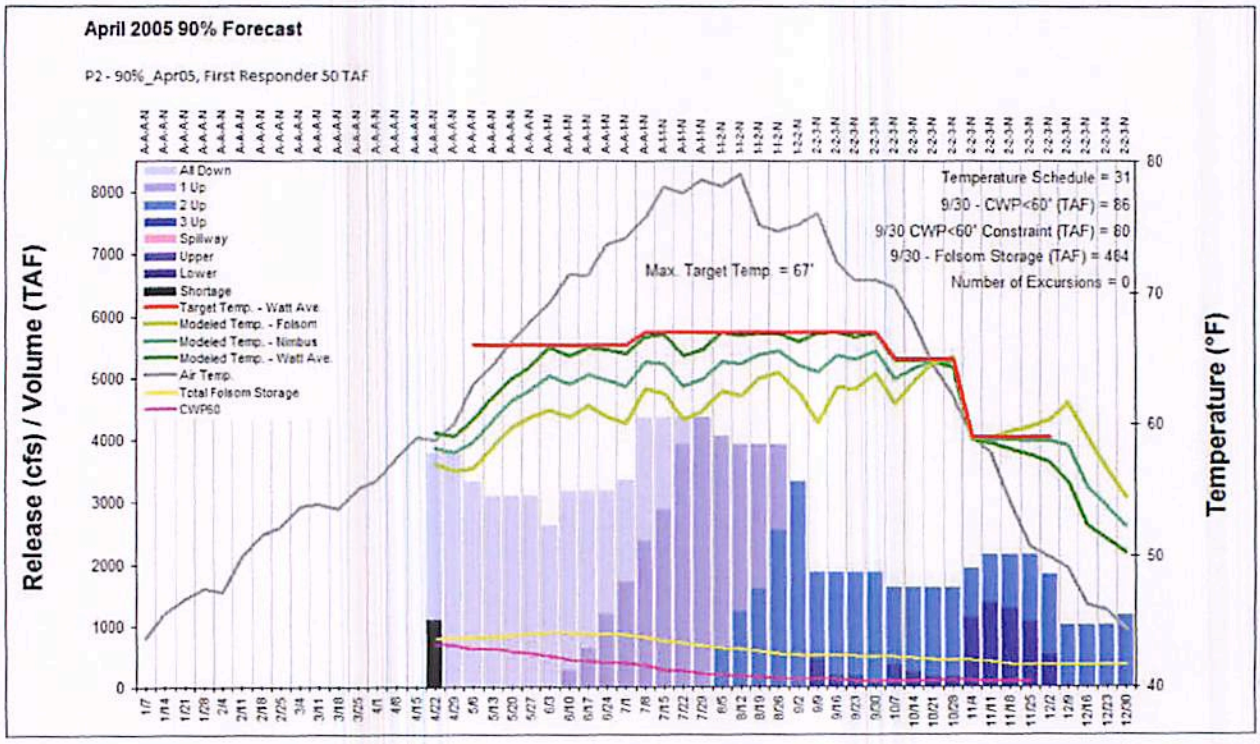

Figure 2(B) – Above Normal Year (2005) Water Temperature Using Folsom Reservoir As Minimal First Responder.

Notes:

- End-of-September Folsom Reservoir Storage: 484 TAF
- Lowest attainable ATSP schedule: 31
- Maximum summer water temperature: 67°F for 13 weeks
- First Responder Volume: 50 TAF

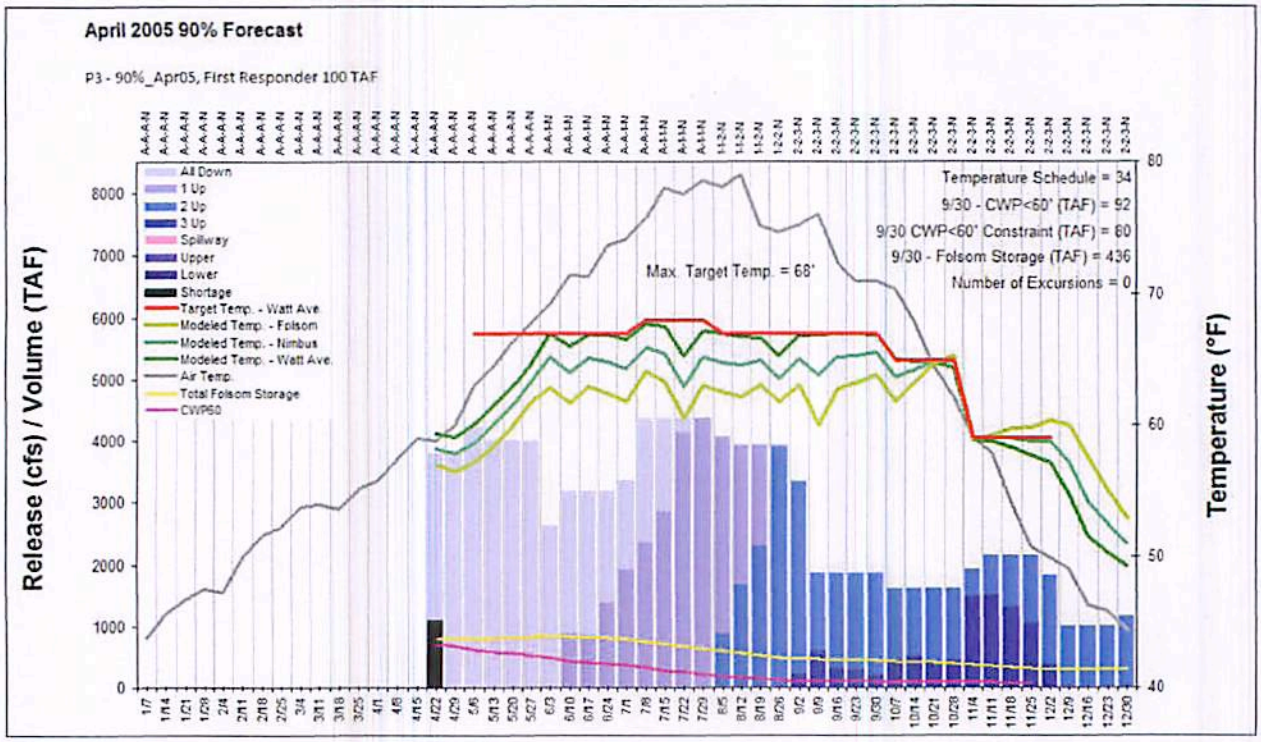

Figure 2(C) – Above Normal Year (2005) Water Temperature Using Folsom Reservoir As First Responder.

Notes:

- End-of-September Folsom Reservoir Storage: 436 TAF
- Lowest attainable ATSP schedule: 34
- Maximum summer water temperature target: 68°F for 4 weeks
- First Responder Volume: 100 TAF

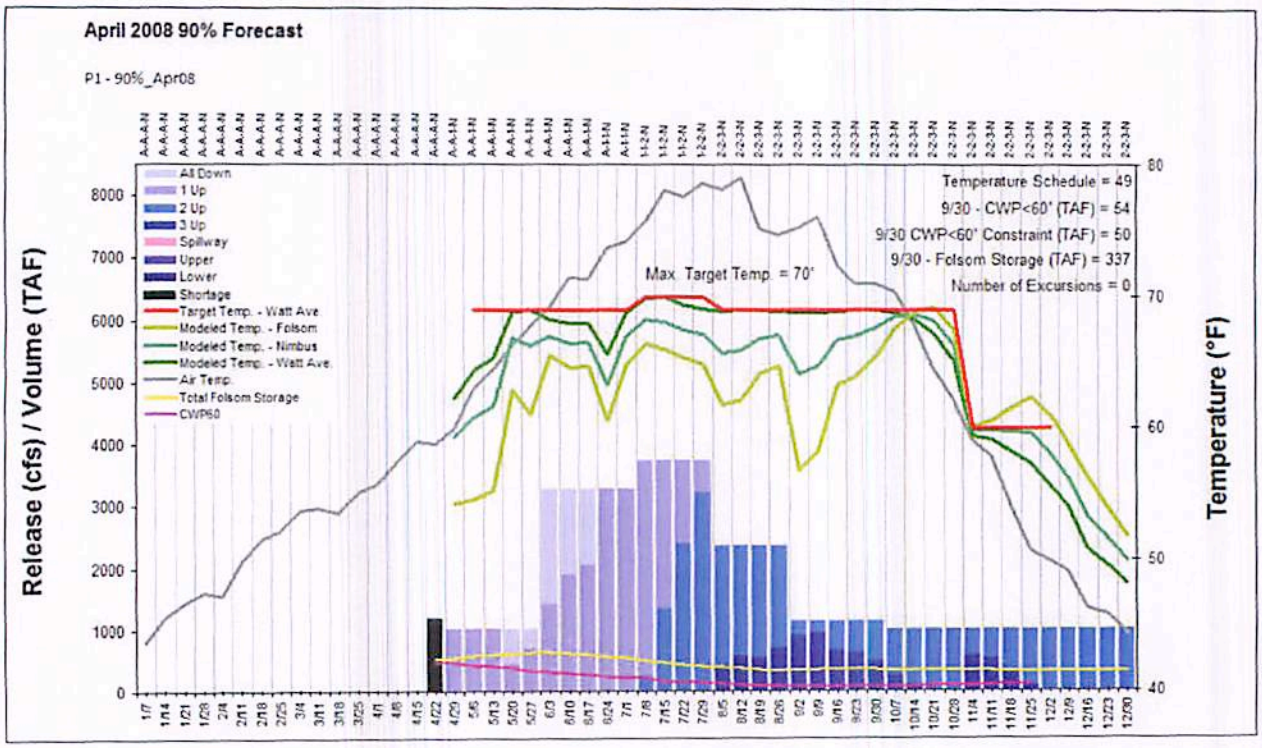

Figure 3(A) – Critical Year (2008) Water Temperature Without Using Folsom Reservoir As First Responder.

Notes:

- The Folsom Reservoir release schedule shown in this figure was issued by Reclamation in their spring 2008 temperature plan.
- End-of-September Folsom Reservoir Storage: 337 TAF
- Lowest attainable ATSP schedule: 49
- Maximum summer water temperature target: 70°F for 4 weeks
- First Responder Volume: None

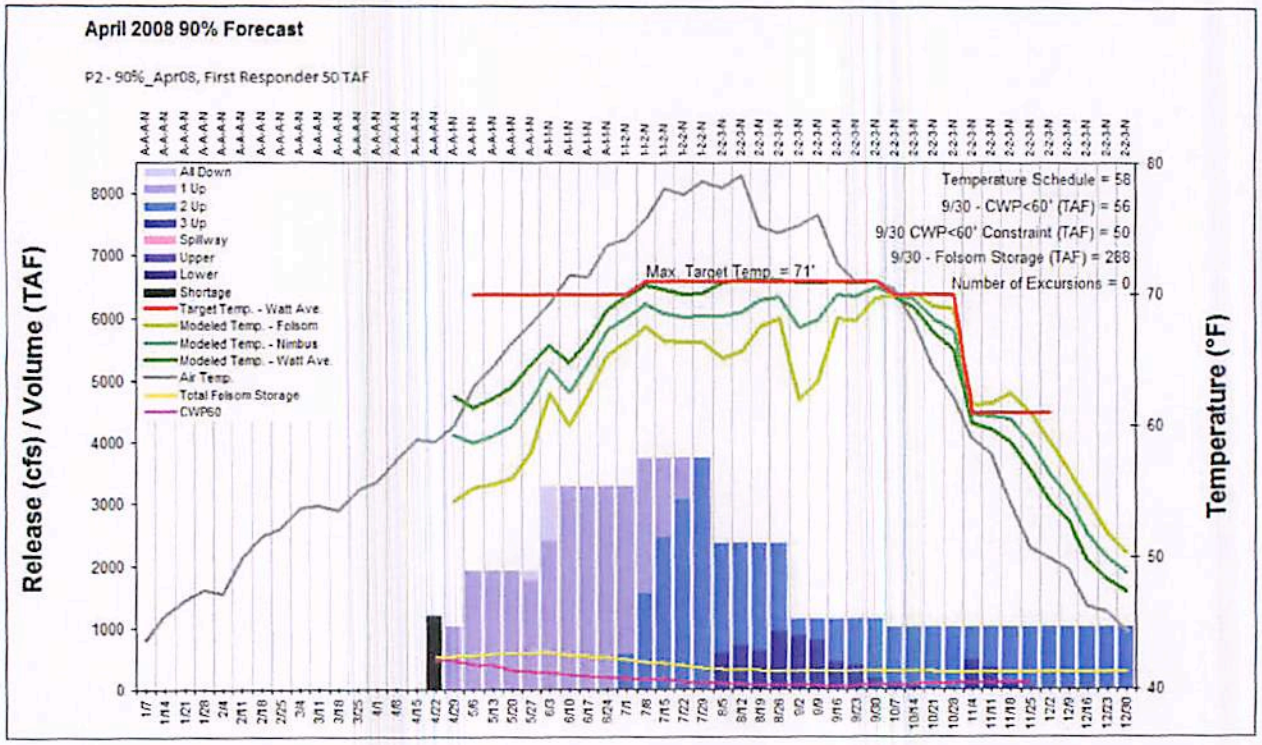

Figure 3(B) – Critical Year (2008) Water Temperature Using Folsom Reservoir As Minimal First Responder.

Notes:

- End-of-September Folsom Reservoir Storage: 288 TAF
- Lowest attainable ATSP schedule: 58
- Maximum summer water temperature target: 71°F for 13 weeks
- First Responder Volume: 50 TAF

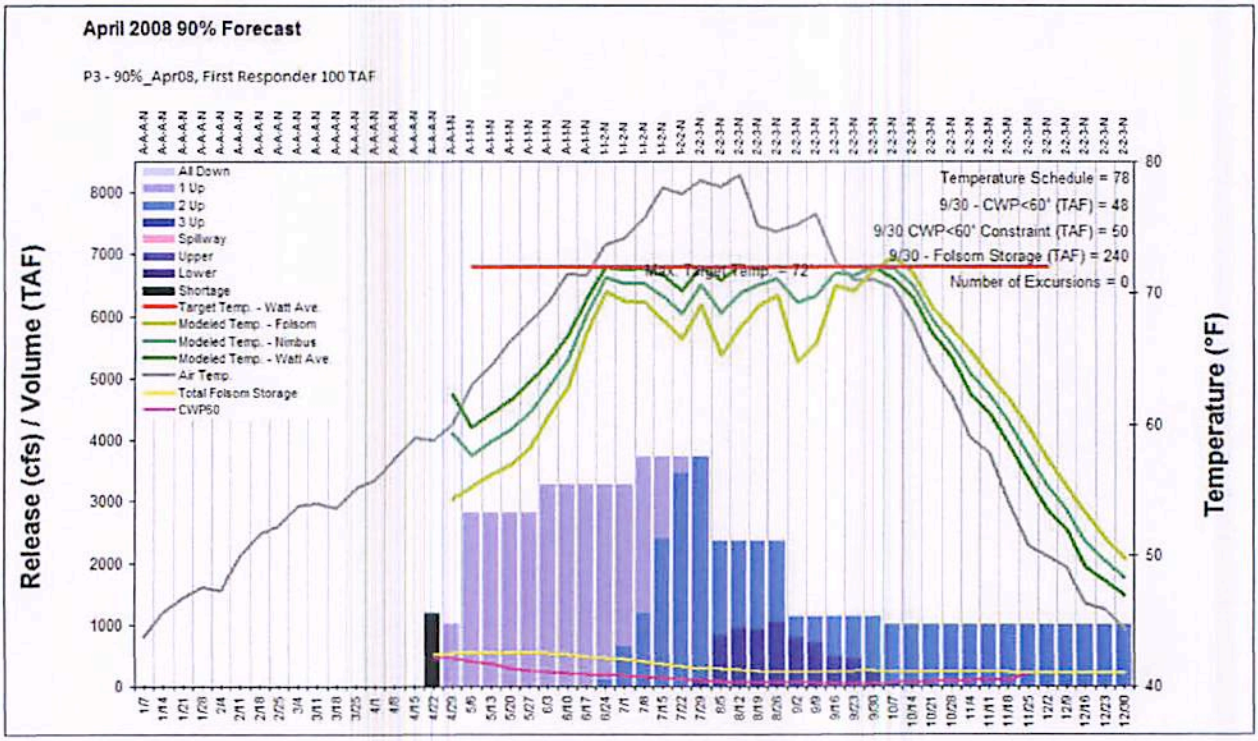

Figure 3(C) – Critical Year (2008) Water Temperature Using Folsom Reservoir As First Responder.

Notes:

- End-of-September Folsom Reservoir Storage: 240 TAF
- Lowest attainable ATSP schedule: 78
- Maximum summer water temperature target: 72°F for entire period
- First Responder Volume: 100 TAF

References

Water Forum Exhibit No. 3

Addendum To The Report Titled "Impacts On The Lower American River Salmonids And Recommendations Associated With Folsom Reservoir Operations To Meet Delta Water Quality Objectives And Demands" with attachment

Water Forum Exhibit No. 4

Appendix 2-D – Summary Of American River Flow Management Standard Summary Of The Flow Management Standard Program For The Lower American River

Water Forum Exhibit No. 5

Water Forum Agreement