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December 6, 2010

Ms. Jeanine Townsend, Clerk to the Board
State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-2000

Re: Comments on the Draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives

Dear Ms. Townsend:

The State Water Contractors' organization ("SWC")[1] and the San Luis & Delta-Mendota Water Authority ("Authority")[2], collectively referred to as the "State and Federal Water Contractors", respectfully submit this comment letter on the draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives ("draft Technical Report"). While the draft Technical Report serves as a useful tool to continue the dialogue on what might be appropriate San Joaquin River flow and southern Delta salinity objectives, it fails to serve its stated purpose: namely, "to provide the Board with the scientific information and tools needed." (Draft Technical Report, p. 1.)

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[1] The SWC represents twenty-seven public agencies that contract with the State of California for water from the State Water Project ("SWP"). These agencies are each organized under California law and provide water supplies to nearly 25 million Californians and 750,000 acres of prime farmland from Napa County to San Diego and points between.

[2] The Authority consists of 29 member agencies, 27 of which contract with the United States Department of the Interior, Bureau of Reclamation (Reclamation), for supply of water from the Central Valley Project (CVP). The Authority's member agencies hold contracts with Reclamation for the delivery of approximately 3.3 million acre-feet of CVP water. CVP water provided to the Authority's member agencies supports approximately 1.2 million acres of agricultural land, as well as 51,500 acres of private waterfowl habitat, in California's Central Valley. The Authority's member agencies also use CVP water for more than 1 million people in the Silicon Valley and the Central Valley.

The State Water Resources Control Board ("State Board") recently issued two notices concerning potential amendments to the 2006 Water Quality Control Plan For The San Francisco Bay/Sacramento – San Joaquin River Delta ("Bay-Delta Plan"), as it relates to San Joaquin River flows (fishery) and southern Delta salinity (agriculture). The first notice, issued October 29, 2010, provided the public with the draft Technical Report and requested comments by December 6, 2010, on (a) whether the content of the draft Technical Report is sufficient to enable the State Board to establish new San Joaquin River flow and southern Delta salinity objectives and a related program of implementation, and (b) whether the State Board should consider additional information and tools to evaluate and establish these new objectives. A workshop on the draft Technical Report is to be held on January 6 and 7, 2011. The second notice, issued November 22, 2010, informed the public that an additional written submittal with respect to the Bay-Delta water quality planning process may be filed on or before February 8, 2011, covering information not necessarily related to the Technical Report, but which, nevertheless, is relevant to the State Board's consideration of the new San Joaquin River flow and southern Delta salinity objectives and a plan for their implementation. According to the second notice, this information could include economic data.

The State and Federal Water Contractors interpret these two notices as separating the Bay-Delta water quality planning process into two phases, the first focusing on the scope and content of the technical data that the State Board and its staff will consider before making their draft regulatory recommendations, and the second focusing on how that data should be interpreted so that the resulting water quality objectives and the program of implementation will meet the legal requirement that the protection of beneficial uses is "reasonable," taking all demands being made on the water, including economics, social impacts, and housing needs into consideration. (Water Code §§ 13000, 13145, and 13241.) In addition, this second phase would also involve the public trust balancing required by the *Audubon* case ((1983) 33 Cal.3d 419, 446).

These comments will focus on corrections and additions to the draft Technical Report that are needed to ensure that the State Board and its staff are considering a complete data set when evaluating how to properly carry out their regulatory obligations. Because any effort to describe the data needed to develop water quality objectives and an effective and fair program of implementation must be grounded on good science, the remainder of this introduction will describe what the State and Federal Water Contractors believe to be the foundation of "good science" at the data gathering and initial analysis stage of the process. That foundation will then be used to describe what additional materials are needed to create an accurate and complete "Technical Report." Our February 8 submittal(s) will build on this foundation and will apply the best available scientific data to it to suggest appropriate regulatory requirements. This overall good science approach is critical to ensuring that the State Board's water quality objectives are lawful, provide reasonable protection, and result in a final policy product that is consistent with, and supported by, the best available scientific data.

Since the 2006 Bay-Delta Plan was adopted, Delta science and the approaches used to evaluate Delta science have both advanced significantly. Considerable new scientific research has been

undertaken and even more is underway related to the interaction between the SWP and CVP and Delta fisheries resources and the effects of other stressors. Additional efforts are assessing the available data in the context of state-of-the-art population abundance models. These data have already played a significant role in the on-going OCAP litigation pending before the United States District Court for the Eastern District of California and should be included in the data sets to be analyzed by the State Board and its staff during its development of lawful water quality objectives.

In addition, the Bay-Delta Conservation Plan participants have spent the last four years refining the way science-based contentions should be examined, compared to contrasting opinions, and finally integrated through what has become known as an "effects analysis." While these activities did not take place within the context of a State Board water quality planning process, the State and Federal Water Contractors believe that the intensive data acquisition and analysis process that was adopted for the BDCP can readily be adapted to, and should be used during, the Bay Delta Plan process.

In its February 8, 2011, submittal(s), the State and Federal Water Contractors will present a more complete exposition of how they believe the State Board should proceed in order to ensure that the best scientific and economic data are utilized to balance the competing beneficial uses of the water involved before new water quality objectives are adopted. That submittal or those submittals will also provide more detail on the legal aspects of the State Board's regulatory process. In keeping with our focus on the adequacy of the Technical Report, the key elements of a successful effects analysis that are closely tied to need to augment and correct the draft Technical Report can be summarized as follows:

1. Ensure that there is a complete presentation of the available information. We recognize that the dispersed nature of the applicable scientific data can make this difficult. However, a failure to locate and consider missing relevant data, particularly if it is critical of prevailing beliefs, can lead to conclusions that would not otherwise be drawn, can result in a biased result, and can lead to management decisions that provide little or no benefits, yet waste valuable water resources. The failure to provide a complete record that includes *all* existing -- even competing – science based views can also impede the peer review process described in paragraph 3 below.[3]

2. Present the analysis in a manner that transparently and rationally explains to the reader why one analysis/conclusion is being chosen over another and provides a logic chain that

[3] In most circumstances, the State and Federal Water Contractors would define the data set as being limited to published science papers, with a preference to those that have been peer reviewed. However, with respect to Delta fishery flow objectives, a body of work exists that has been tested more rigorously most peer reviewed papers. That information is contained in declarations presented in the federal court OCAP litigation, where countervailing declarations were produced, cross examination of the declarants took place, and a judge issued rulings with respect to the adequacy of the scientific data for regulatory purposes. This type of data should be included in the data set and considered by the State Board. It meets the test for being the type of information on which responsible persons are accustomed to rely.

can be followed by those reviewing the product. The lack of such a logic chain was one major criticism of the product produced by the State Board during the Delta Flow Criteria process. The final report simply did not even recognize, much less discuss, all of the data provided by the parties and the experts, nor did it allow a reviewer to understand how certain conclusions were reached in light of other information in the record. In the context of a water quality control plan, this logic chain should enable affected parties to understand (a) the baseline water quality conditions; (b) to the extent (time and amount) those base conditions do not provide reasonable protection of beneficial uses, the cause(s) of that failure; (c) why a certain level of protection would be reasonable, taking into consideration competing demands, including social and economic impacts and the need to provide housing; and (d) why a particular program of implementation is proposed, and how it would remedy that failure.

3. Prior to issuing a draft plan for public review, have the analysis "peer reviewed" by independent experts. There are several key factors that will define whether such a review is, in fact, independent. First, to protect the objectivity of the review process, care must be taken to avoid using, as peer reviewers, the authors of any of the basic studies that underlie the State Board's work product.[4] Second, the scope of the review must not be so constrained as to impede the reviewers' ability to examine the work product as a whole. Finally, the reviewers must be given sufficient time to carry out their review and provided access to the resources (including all of the relevant data) needed to conduct a rigorous review.

SOUTH DELTA SALINITY TECHNICAL ISSUES

I. Section 2.5 – Hydrodynamics Downstream of Vernalis

The discussion of hydrodynamics downstream of Vernalis should include a reference to recent analysis by Dr. Paul Hutton of Metropolitan Water District of Southern California. His April 2008 report "A Model to Estimate Combined Old & Middle River Flows" is attached.

Dr. Hutton's report includes an analysis of the factors that affect the flow split at the Head of Old River under varying conditions of flow and barrier installation. The analysis is based on DSM2 hydrodynamic simulation and is confirmed with flow measurements at Lathrop and Stockton. The analysis portrays a flow split that is more nuanced than suggested by the SWRCB technical report statement "Flow paths downstream of Vernalis are largely affected by export operations of the two major water diverters in the Delta, the USBR and the DWR." Dr. Hutton's analysis shows that (1) net diversions by in-Delta users and South Delta agricultural barriers are important factors and (2) SWP-CVP export pumping has little influence under higher Vernalis

[4] Given the need to ensure independent review, the State and Federal Water Contractors do not support the State Board's use of the University of California Davis science group for any of the review processes. They are the authors of a substantial body of work that will be included within the scientific data set under consideration. It is, therefore, inappropriate to ask them to critique their own or their colleagues' work and expect that review to be considered objective.

flow conditions. According to his analysis, the flow split is approximately 50% of Vernalis flow in the absence of south Delta diversions (SWP-CVP exports and net diversions by in-Delta users). As these diversions increase, the volume of San Joaquin River flow entering Old River increases proportionally. For every 1000 cfs of additional diversion, Old River flows from the San Joaquin River increase approximately 17 cfs and 31 cfs with and without agricultural barriers, respectively.

Dr. Hutton's report also provides a more refined approach to estimate the amount of Old and Middle River flows in comparison to the rough estimation method presented by Contra Costa Water District which was referenced in the technical report. In particular, net In-delta diversions and pumping by Contra Costa Water District can have a major effect on Old and Middle River flows, in addition to tidal conditions. The approach is incorporated in the CALSIM II model.

II. Section 4 – Southern Delta Salinity

The Draft Technical Report identifies the sources of salinity in the southern Delta and includes salinity from the San Joaquin River at Vernalis and evapo-concentration of salt diverted from southern Delta channels. The Draft Technical Report does not identify SWP operations as a source of salinity loading. Nevertheless, prior State Board decisions have asserted that the SWP could be partially responsible for salt loading at Vernalis because it wheels CVP water to CVP users in the San Joaquin Basin under the Joint Point of Diversion. To ensure that these earlier, erroneous statements are not repeated in future water quality and water rights decisions, the Technical Report should include specific data describing the effects of SWP operations on southern Delta salinity conditions.

This is important because the data show that the SWP's influence on salt loading at Vernalis through delivery of SWP water to its contractors is negligible. The only water district tributary to the San Joaquin River that directly receives SWP supplies pursuant to its contract with the State, Oak Flat Water District, has an annual Table A supply of 5,400 acre-feet. Because of hydrologic and regulatory restrictions, actual SWP deliveries to Oak Flat Water District from the SWP averaged only 4,500 acre-feet between 1970 and 2007. This represents about 0.06 % of the total water supplied to the San Joaquin River watershed. In addition to SWP deliveries, some water deliveries through SWP facilities are provided through operation of the Joint Point of Diversion to CVP contract holders and other water users in the San Joaquin River watershed. Since the SWP wheels this CVP water pursuant to State statutory policy requiring DWR to allow others to wheel water in available SWP capacity (Water Code §§ 1810-1814), consistently with Federal statutory policy authorizing the Joint Point of Diversion (P.L. 99-546, October 27, 1986), and in accordance with D-1641 the SWP should not be assigned responsibility for any Delta salinity increases from these uses. Doing so would only penalize the SWP contractors for providing conveyance and transfer benefits for others consistent with these statutory policies.

As to the CVP, it is equally important that the Technical Report include specific data describing the effects of CVP operations on southern Delta salinity conditions, considering separately the effects of in-Delta pumping, operation of reservoirs on or tributary to the San Joaquin River, and

discharges of drain water. It should also recognize the efforts by the Authority and its member agencies to address the salinity loading impacts of discharges of drain water. The Authority has provided and will continue to provide information to the State Board on those efforts.

DWR has done extensive analysis of circulation patterns in the south Delta (DWR 2007a) and their effects, if any, on salinity conditions. These data and their analyses should be included in the Technical Report. DWR's analysis of flow patterns in the southern Delta reached the following conclusions:

> In the South Delta, the natural flow, without exports, is the flow from the San Joaquin River making its way towards the ocean through the San Joaquin, Old and Middle Rivers. The agricultural water quality stations are upstream of Exports and do not naturally receive water from the Sacramento River. Exports pull water that contains a mixture of different sources of water, including the usually fresher Sacramento River, upstream towards the South Delta area but exports are still downstream of the South Delta Water Quality locations and cannot control the salinity at those South Delta upstream stations.

DWR's analysis also indicated that, in the absence of barrier operations, the net effect of SWP and CVP operations for compliance at the southern Delta salinity objectives is *positive*. Water quality in the southern Delta is slightly improved at some locations due to the presence of better quality water from the Sacramento River.

The draft Technical Report's analysis of factors affecting southern Delta salinity also ignores several known key sources of salinity degradation and minimizes the impacts of other sources, such as point sources. While the use of a statistical regression to estimate the degradation downstream of the San Joaquin River at Vernalis may be an acceptable approach for the Old River near Middle River and San Joaquin River at Brandt Bridge stations, it appears to have significant limitations for the Old River compliance location at Tracy Road Bridge. The San Joaquin River Group Authority has, in its submittal, listed several factors that are likely responsible for the lack of a good regression at the Tracy Bridge site. The State and Federal Water Contractors join with the SJRGA in requesting that the State Board include these data in the Technical Report for analysis purposes.

Finally, the draft Technical Report fails to identify the possible presence of additional salinity sources through high salinity groundwater accretions. Although seepage from such accretions was identified by DWR (DWR, 2007b) as a source of salinity degradation, it is completely ignored by the draft Technical Report.

In sum, for these multiple reasons, the relationship between salinity and the Old River at Tracy Road Bridge is significantly less accurate than the other relationships presented in the draft Technical Report and should be considered only as a provisional tool pending future analysis. In particular, the 85% prediction line, while conservative for 16 out of 17 years, significantly under predicts degradation for the most recent year 2009. The utility of this tool for predicting

salinities under current conditions thus appears questionable. In addition, SWP and CVP diversions do not negatively impact these salinity levels.

III. Section 5 – Water Supply Impact Analysis

The technical report describes a methodology for estimating the amount of additional low-salinity flow from within the watershed that will be needed to meet a particular set of southern Delta salinity objective alternatives. By focusing solely on dilution alternatives, the methodology does not consider alternate methods of meeting salinity objectives. The methodology should be expanded to consider source reduction alternatives upstream and downstream of Vernalis.

The mass balance equation presented in the technical report as Equation 5.1 is a highly simplified representation of salt loading in the south Delta and might not be appropriate for the proposed methodology. As discussed in our comments on Section 4, only a small portion of the San Joaquin River flow at Vernalis (and additional low-salinity flow provided to meet a particular objective alternative) reaches Old River at Tracy Road Bridge. Most of the flow either stays in the river or, if diverted at the Head of Old River, flows through Grant Line Canal or Middle River. A comprehensive mass balance that accounts for such flow splits and other factors is attached. The methodology should be revised to address these factors; alternatively, the technical report should demonstrate under what conditions Equation 5.1 is an appropriate simplification.

Finally, the data in Table 5-2 seem questionable. Specifically, values under the "flow objective" column and the "salinity objective" column should sum up to the "total" column. Similar columns appear to sum correctly in Table 5-3.

SAN JOAQUIN RIVER FISH FLOWS

I. The Overall Approach To The Analysis Is Lacking Is Defective

Beneficial uses are the foundation for setting water quality objectives; the State Board is required to tailor the water quality objectives to ensure the beneficial uses are reasonably protected. (Water Code, § 13241; 33 USC § 1331.) The beneficial uses the State Board intended to protect with San Joaquin River flow objectives were clearly explained in the attachment to the Notice of Preparation for Environmental Documentation for the Update and Implementation of the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary: southern Delta Salinity and San Joaquin River Flows (NOP). There, the State Board wrote:

> The State Water Board first established the flow objectives for the San Joaquin River at Vernalis in the 1995 Bay-Delta Plan to protect fish and wildlife beneficial uses. The State Water Board set different objectives for three time periods: February through June, excluding April 15 through May 15 (spring flows); April 15 through May 15 (pulse flows); and October (fall flows). The

> spring flows are intended to provide minimum net downstream freshwater flows in the San Joaquin River to address habitat concerns from reduced flows and water quality degradation. The pulse flows were principally developed to aid in cueing chinook salmon smolt outmigration from the San Joaquin River. The fall flows were developed to provide attraction flows for adult salmon returning to the watershed to spawn.

(Attachment to NOP, p. 9.) The draft Technical Report fails to explain whether the beneficial uses are currently protected, and, if not, what the mechanism(s) are that are impairing the beneficial uses. Instead, the draft Technical Report relies heavily on conclusory statements. For example, the it states: "Scientific information indicates that reductions in flows and changes in the natural flow regime of the SJR basin resulting from water development over the past several decades are impairing fish and wildlife beneficial uses." (Draft Technical Report, p. 34.) However, the draft Technical Report does not explain the scientific support for that conclusion. Instead, it simply points to hydrologic changes attributable to "water development in the basin." (Id.) That is simply not enough. It does not comport with long established and broadly accepted criteria regarding the assessment, interpretation and application of best available scientific information.

Later, section 3.7 cites a number of scientific reports to support a conclusion that more flow will improve species abundance. (Draft Technical Report, p. 49.) But nowhere does the draft Technical Report consider science discussing the mechanisms that might be addressed through increased flow. The draft Technical Report does not answer the question: Does the science suggest increased flows are needed to produce habitat, to aid in cueing, or to provide attraction flows? It does not explain whether the science suggests that a relationship between flows and species abundance exists because the increased flows are mitigating for impacts caused by other factors – i.e., predation. Indeed, this omission from the Draft Technical Report is critical. As discussed in the Draft Technical Report, the National Marine Fisheries Service has already expressed an opinion that, "factors other than flow may be responsible for the variable escapement returns." (*Id.* at 52.) The draft Technical Report should be revised, and for each period during which a flow objective is set, should identify *why* the beneficial use is impaired. It should consider both flow and non-flow related impacts, what is affecting habitat during the spring period, what is impairing cueing for outmigration during the pulse period, and what might be reducing the ability to attract adult salmon returning to the watershed to spawn during the fall.

Another critical component of the science missing from the Draft Technical Report include data and/or analyses that would enable the State Board to consider the cost and benefit of providing increased protection for reasonable beneficial uses and compare the cost or benefit of a particular implementation action to other actions. The tools and analyses needed to allow for that consideration and comparison are "life cycle" based. At a minimum, the State Board must understand the factors that affect the fish served by the beneficial uses and understand how affecting the beneficial use at a particular life-stage will impact later stages of the life history.

II. The Analysis Fails To Consider Important Data and Scientific Reports

A. The Draft Technical Report Should Reference The Science That Shows A Lack Of Impact Of SWP Or CVP Exports On San Joaquin Salmonid Survival

The draft Technical Report acknowledges that "the effects of diversions by the Department of Water Resources [] and U.S. Bureau of Reclamation []" downstream of Vernalis "are not the subject of the State Water Board's current review." However, the State Board raises these effects as "background . . . as [they] relate[] to flows at Vernalis and protection of fish and wildlife beneficial uses . . . ." (Draft Technical Report, p. 30.) To the extent the draft Technical Report presents information that may lead to a conclusion that SWP and CVP exports are relevant to the scientific basis for alternate Vernalis flows--as background or otherwise--it is essential that the Technical Report also acknowledge and include the numerous scientific studies that conclude that there is *no* statistically significant relationship between SWP and CVP export levels and the survival of out-migrating San Joaquin River salmonids.

The relationship, or lack thereof, between SWP and CVP exports and San Joaquin River salmonid survival has been extensively analyzed by scientific experts as part of the ongoing litigation over the 2009 NMFS OCAP biological opinion ("NMFS BiOp"). In addition, a large body of scientific studies, many of which were specifically designed to examine the effect of exports on San Joaquin River salmonids, have been closely analyzed and argued by the parties. The Court has already concluded, in the context of granting Plaintiffs' motion for preliminary injunction, that NMFS's analysis of scientific data regarding exports and San Joaquin River salmonid survival does not provide *any* biological explanation, *whatsoever*, for the imposition of specific export restrictions for the benefit of San Joaquin River salmonids. (PI Ruling, p. 116, ¶¶ 50-51.)

1. Consolidated Salmonid Cases: PI Ruling

In the *Consolidated Salmonid Cases*, the Court reviewed claims that the imposition of export restrictions violated the best available science requirement. The Court determined that NMFS's conclusions regarding the regulation of exports were arbitrary and capricious. In doing so, the Court first addressed NMFS's determination that "because there was a limited amount of water available to increase flows at Vernalis, capping export levels would provide the greatest differential between flows at Vernalis and export levels." The Court concluded that "[t]his reason for controlling exports is unrelated to any direct scientific evidence connecting export levels to fish survival, making the reason arbitrary, capricious, unsupported by reasonable explanation, and not based on the best available science." (PI Ruling, pp. 36-37, ¶¶ 94-95.)

Second, the Court ruled that the specific export restrictions were "a quintessential example of arbitrary action." While declining to find that exports do not have any bearing at all on survival of San Joaquin River salmonids, the court did conclude that the studies relied upon in the NMFS BiOp do not provide *any* biological explanation, *whatsoever*, for the inclusion of the specific

export restrictions in Action IV.2.1. (*Id.*, at pp. 116-117, ¶¶ 50-51.)

2. No Scientific Evidence Links SJR Salmonid Survival To SWP And CVP Exports

In the OCAP BiOp, NMFS acknowledged that "[r]ecent papers examining the effects of exports on salmon survival have been unable to prove a statistically significant reduction in survival related to exports (Newman 2008)." (NMFS BiOp, p. 426.) This is an understatement. In spite of more than two decades of focused research, *no study* has produced any statistical evidence showing a negative relationship between San Joaquin River salmonid survival and SWP/CVP export levels. (Declaration of Brad Cavallo, Doc. 452, ¶ 4.) Rather, a wide variety of statistical analyses--such as those contained in the following studies which are also relied upon in the draft Technical Report for conclusions regarding flow--show either that no relationship could be established, or there is a *positive* relationship:

* Kjelson, Loudermilk, Hood, and Brandes (1990): "*Survival of tagged smolts released under low export conditions was not greater than for those released under high export conditions* (Table 4). This was an unexpected result as we believed conditions for survival should have improved when exports were lowered, since direct losses at the Project facilities were decreased, flow in the mainstem San Joaquin was increased and reverse flows in the Delta were eliminated."

* Brandes and McLain (2001): "To determine if exports influenced the survival of smolts in the San Joaquin Delta, experiments were conducted in 1989, 1990 and 1991 at medium/high and low export levels. *Results were mixed showing in 1989 and 1990 that survival estimates between Dos Reis and Jersey Point were higher with higher exports* whereas in 1991 between Stockton and the mouth of the Mokelumne River (Tables 11 and 12) survival was shown to be lower (0.008 compared to 0.15) when exports were higher. . . . In addition, results in 1989 and 1990 also showed that survival indices of the upper Old River groups relative to the Jersey Point groups were also higher during the higher export period, but overall still about half that of the survival of smolts released at Dos Reis (Table 11)."

* California Department of Fish and Game (2005): "There is *no correlation* between exports and adult salmon escapement in the Tuolumne River two and one-half years later (Figure 24)."

* Mesick, McLain, Marston and Heyne (2007): "*[P]reliminary correlation analyses suggest that the combined State and Federal export rates during the smolt outmigration period (April 1 to June 15) have relatively little effect on the production of adult recruits in Tuolumne River compared to the effect of winter and spring flows.* Furthermore, reducing export rates from an average of 264% of Vernalis flows between 1980 and 1995 to an average of 43% of Vernalis flows and installing the Head of Old River Barrier between 1996 and 2002 during mid-April to mid-May VAMP period did not result in an increase in Tuolumne River adult recruitment (Figures 3 and 17)."

* Newman (2008): "The Bayesian hierarchical model analyzed the multiple release and recovery data, including Antioch, Chipps Island, and ocean recoveries, simultaneously. . . . *There was little evidence for any association between exports and survival, and what evidence there was pointed towards a somewhat surprising positive association with exports.*"

B. The Draft Technical Report Should Include Data Regarding Flow To SWP And CVP Export Ratios

1. Data Do Not Support A Relationship Between Inflow To SWP And CVP Export Ratio And Adult Escapement

In the BiOp, NMFS based its regulation of SWP and CVP exports in large part on data that compared inflow/export ratios to adult escapement two and a half years later. Figure 11 of the technical memorandum attached to the NMFS BiOp as Appendix 5 illustrates this data. While Figure 11 appears to show some correlation between higher inflow to SWP and CVP export ratios and increased adult escapement, it is of limited utility for at least two reasons: (1) by studying flow and SWP and CVP exports together, Figure 11 did not allow the reader to determine whether the increases in adult escapement are attributable to flow alone, or whether they are enhanced by the inclusion of lower export levels; and (2) adult escapement data is obfuscated by poor ocean conditions and commercial harvest, which were not accounted for in Figure 11.

Brad Cavallo analyzed NMFS's Figure 11 data along with data that compared adult escapement to flow alone and found that the San Joaquin River inflow to export ratio data provide a *poorer* fit to observed data than does San Joaquin River inflow alone: "For example, the model describing smolt survival in relation to SJR flows alone (Exhibit 1, bottom) has an r^2 value of 0.73 while the comparable model with the ratio of SJR flows to exports has an r^2 value of only 0.26 (Exhibit 2, bottom)." (Cavallo Decl., Doc. 452, ¶12, Exhibits 1 and 2.)

The Court criticized the utility of the data presented in Figure 11. In the Court's ruling on Plaintiffs' preliminary injunction motion, the Court noted that the adult escapement data in Figure 11 did not attempt to account for either variable ocean conditions or the commercial harvest of salmonids. (PI Ruling, p. 33, ¶ 85.) As a result, the court concluded that Figure 11 constitutes "[h]ighly questionable support for the BiOp's conclusion that exports negatively influence survival. . . ." (*Id.*, at pp. 113-114, ¶ 47.c.)

As a result, adult escapement data comparing inflow-to-export ratios to San Joaquin River salmonid survival does not support the conclusion that SWP and CVP export restrictions will enhance flow with best available scientific data.

2. VAMP Studies

VAMP studies have similarly failed to isolate a relationship between SWP and CVP exports and survival. As the draft Technical Report notes, VAMP was designed "to release fish at specific flows during a 31-day period from approximately mid-April through mid-May under specified

export conditions in order to evaluate the relative effects of changes in Vernalis flow and SWP and CVP export rates on the survival of SJR salmon smolts passing through the Delta." (Draft Technical Report, p. 49.) The framework for the experimental design was developed to address concerns with earlier survival studies conducted during a period when river flows were highly variable and which had contributed some uncertainty in the relationship between river conditions and juvenile salmon survival. (Hanson, Doc. 432, ¶ 4.) VAMP represents the best large-scale experimental study of juvenile salmon survival performed on the San Joaquin River and Delta. (*Id.*)

According to Dr. Hanson, one of the original authors of VAMP, the VAMP data collected from 2000 to 2006 showed a statistically significant relationship between juvenile salmon survival and the ratio of inflow to exports, but this relationship "is strongly influenced by river flow." (Hanson, Doc. 432, ¶ 11.) By contrast, data that isolated the relationship between salmon survival and SWP/CVP exports did *not* find a statistically significant relationship. (Hanson, Doc. 496, ¶¶ 5-6.) On the basis of VAMP data, Dr. Hanson concludes: "*the relationship between flow and export rate on survival . . . has not been established.*" (*Id.*, at ¶ 5, emphasis added.) In short, VAMP data also fail to support the conclusion that SWP and CVP export restrictions will enhance salmonid survival.

C. The Draft Technical Report Should Include Science Which Shows A Lack Of Impact Of Reverse OMR Flows On Delta Fish Species

Section 3.6 of the draft Technical Report reflects the State Board's attempts to reach preliminary conclusions based upon enumerated studies and data related to the relationship between San Joaquin River flows and fall-run Chinook salmon (and steelhead) survival and abundance during the spring months. As part of this effort, Section 3.6 addresses specific "negative ecological consequences" associated with reverse (or negative) flows in Old and Middle Rivers ("OMR"). However, this section of the draft Technical Report illustrates the danger of positing preliminary conclusions from an incomplete data set. In a number of respects, the draft Technical Report fails to include the best available science related to the effects of OMR flows on Delta fish species. By reviewing only a subset of the available data, the Technical Report also misapprehends the significance of the studies cited in the Technical Report on OMR and related issues.

The impact of reverse OMR flows on Delta fish species is one of the seminal issues in the OCAP salmonid and Delta smelt lawsuits. pAs addressed in greater detail below, the federal court thoroughly reviewed the science offered in support of the biological opinions as well as declarations and testimony offered by some of the Country's most preeminent authorities on fisheries biology in opposition to the conclusions reached in the biological opinions. As part of that effort, the Court has opined regarding what is and is not the best available science with respect to OMR flows.[5] Accordingly, while the views of some of the OCAP litigation experts may differ from those of the UC Davis witnesses who are frequently trotted out at State Board

[5] Under the Federal Endangered Species Act, an agency's actions must be based on "the best scientific and commercial data available." 16 U.S.C. § 1536(a)(2).

hearings, it is incumbent on the State Board to understand and fully consider the views of these experts, many of whom are world-renowned in their field. It is also important to consider, as well, the findings and legal conclusions reached by the federal court judge who has developed incomparable judicial expertise in Delta matters through his work over the past 20 years on Delta-related litigation.

1. Consolidated Salmonid Cases: PI Ruling

As part of its disposition of the *Consolidated Salmonid Cases*, the Court reviewed claims that the OMR flow prescriptions found in the NMFS Biological Opinion violated the best available science requirement of the Endangered Species Act. The review included RPA Action IV.2.3 (operable from January 1 to June 15 each year) which limits OMR flows to a level no more negative than -2,500 cfs to -5,000 cfs. The Court reviewed hundreds of pages of expert declarations and live testimony from experts regarding the data and studies relied upon by NMFS to set the OMR flow prescriptions.

After trial, the Court (1) rejected NMFS's use of raw salvage data to justify the OMR flow restrictions of Action IV.2.3 as "*clear scientific error and not the best available science*"; (2) found little to no scientific support for NMFS's imposition of a -5,000 cfs "ceiling" on OMR reverse flows[6]; and (3) strongly challenged the notion that juvenile salmonids behave like neutrally-buoyant particles, similar to those used in the Particle Tracking Model ("PTM") simulations. The Court also noted, approvingly, the conclusion of Dr. Richard Deriso, a nationally recognized bio-statistician that, for spring-run and winter-run Chinook salmon, "there is no statistically significant relationship between the take index and OMR flows." (*Id.*, p. 54, ¶ 125.)

2. State Board Concerns Re OMR Flows

Nonetheless, the draft Technical Report (pp. 51-52) states that OMR reverse flows (1) draw fish, particularly weak swimming larvae and juveniles, to the SWP and CVP pumps; (2) reduce spawning and rearing habitat for native fish species; (3) create a "confusing environment for migrating juvenile salmon leaving the SJR basin;" and (4) reduce the natural variability in the Delta by drawing Sacramento River water across and into the Central Delta. Each of these conclusions needs to be reconsidered after the complete data set is acquired and reviewed. Individually and collectively, these conclusions are inconsistent with scientific papers not included within the Technical Report and with expert declarations submitted in the OCAP litigation that examine, in detail, the relationship between OMR flows and fish survival.

[6] The -5,000 cfs OMR flow limitation ceiling "is based, in large measure, on speculation. It is also based upon BiOp Figures that do not scale salvage to population size. *This is not the best available science and is arbitrary and capricious.*" (*Id.*, p. 123, ¶ 67, emphasis added; see also *id.* pp. 60-62, ¶¶ 139-144.)

3 OMR Reverse Flows Do Not Disproportionately Draw Salmonids To The Pumps

To begin, it is without dispute that juvenile salmonids are strong swimmers. Smolts are not like neutrally buoyant particles that float along passively—the basic assumption of the Particle Tracking Models used in some analyses. Rather, these strong, capable swimmers exhibit complex behavior and actively navigate, choosing preferred conditions of water quality, water velocity, turbulence, or stream morphology. ((Declaration of Steven Cramer ("Cramer Decl."), Doc. 167, paras. 6-8, 14; PI Findings, 45:12-17.)[7] They can, and do, swim against significant currents, and there are many circumstances in which juvenile salmonids do not follow the flow. (PI Findings 45:23-25; Cramer Decl., Doc. 167, paras. 6, 8.) The federal court found that juvenile salmon have a "strong swimming ability", (PI Ruling, p. 118, ¶ 56), and move approximately 3.5 times faster through the water than neutrally buoyant particles. (*Id.*, p. 46, ¶ 108; *id.*, p. 119, ¶ 57).

PTM simulations thus do not accurately represent salmonid movement and behavior. (Cramer Decl., Doc. 167, ¶ 13.) As the Court concluded, "coded wire tag salmon travel through the Delta and reach Chipps Island long before the arrival of most . . . PTM [Particle Tracking Model] particles." (PI Ruling, p. 47, ¶ 110.) Thus, particle tracking modeling can provide only "a very rough approximation of salmonid behavior." (*Id.* p. 119, ¶ 57.)

4. Salmonids Pass Quickly Through the Delta

Adding to the body of science questioning whether salmonids are adversely impacted by negative OMR flows, in-situ studies uniformly show that juvenile salmonids pass quickly through the Delta whether they enter from the Sacramento or the San Joaquin River, and are thus not exposed to OMR reverse flows for attenuated periods. For example, Baker and Morhardt (2001) report that San Joaquin River salmonid smolts pass through the Delta in a median time of 11 days, some arriving at Chipps Island as early as five days after release at the point where the San Joaquin River joins the Delta.[8] According to the authors, "This is in accordance with the *striking difference* between the *passage time of smolts and passive particles*; smolts actively swim toward the ocean." (*Id.*, emphasis added.) Regarding whether or not salmonid smolt behavior follows the movement of water in tidally driven portions of the Delta, they state, "the

[7] The OCAP litigation involves two consolidated actions before the United States District Court, Eastern District of California. One case is *San Luis & Delta-Mendota Water Authority, et al. v. Salazar, et al.*, Case No. 1:09-cv-00407 OWW GSA (commonly referred to as the "Delta Smelt Consolidated Cases"), and the other case is *San Luis & Delta-Mendota Water Authority, et al. v. Locke, et al.*, Case No. 1:09-cv-01053 OWW DLB (commonly referred to as the "Consolidated Salmonid Cases"). Pleadings referenced in this comment letter are those filed in the OCAP litigation.

[8] In one pertinent sample release from Baker and Morhardt (2001) from 1987 (see Figure 5 of that study), 80% of the released salmon smolts were recovered after two weeks, but only 0.55% of the tracer particles were recovered after two months. (*See also* Cavallo Decl., Doc. 254, para. 55.) Thus, while a substantial percentage of the particles ended up at the pumps, the fish did not. DWR conducted a similar study and came to a similar conclusion in 2009. (Cavallo Decl., Doc. 254, para. 55.)

most straightforward model, *that the movement of smolts mirrors the movement of water*, has been shown to be *incorrect*. Smolts and water travel through the Delta at very different rates and end up at very different places." (*Id.*, emphasis added.) (See also Declaration of Brad Cavallo ("Cavallo Decl."), Doc. 452, para. 54.)

Telemetry studies show that salmon smolts spend minutes or hours at channel junctions (Burau et al. 2007) and only a few days migrating through longer Delta reaches (Vogel 2004). (Cavallo Decl., Doc. 452, para. 38.) Consistently, Holbrook et al. (2009) reported that it takes an average of 1.5 days for fish to pass by the Old River junction on the San Joaquin River. (Perry and Skalski 2009 at 17-18; Holbrook et al. 2009, at 11.) According to Cavallo, recent acoustic tagging studies show that salmon smolts spend only days in the vicinity of critical Delta distributaries such as Georgiana Slough and Old River. (Cavallo Decl., Doc. 250, para. 9.)

On the Sacramento River side, Perry and Skalski (2009) reported that most tagged fish pass the Georgiana Slough and Delta Cross Channel junctions on the Sacramento River within 2 to 5 days. (*Id.*) Blake and Horn (2004) state, "[m]odel results using tracers as surrogates for juveniles showed most particles ended up at the pumping plants, yet studies with juveniles showed the majority did not become entrained as the model would have suggested." (See also Cavallo Decl., Doc. 452, para. 56.)

5. Salmonid Salvage Rates

As part of the draft federal salmonid litigation, experts also tested, and rejected, the assumption, reflected in the Technical Report, that salmonid survival rates decrease with increasing exports. On the Sacramento River side, Hanson (2008) calculated "salvage percentage" as the expanded number of coded wire tagged ("CWT") salmon recovered at salvage facilities divided by the total number of CWT fish released (and therefore, potentially vulnerable to entrainment). (Cavallo Decl., Doc. 452, para. 71.) Dr. Hanson analyzed data from 118 Sacramento River basin CWT releases representing more than 14 million juvenile salmon; releases that should be representative of export effects experienced by salmonid smolts migrating volitionally down the Sacramento River. (*Id.*) Dr. Hanson found his method had sufficient statistical power to detect a significant effect regarding fish size and Sacramento River *flow*, while no such relationship was observed for *exports* (Hanson 2008). (*Id.*)

According to Cavallo, if the hypothesis that more negative OMR flows entrain a greater proportion of juvenile salmonids into the central Delta were correct, we would expect "salvage proportion" for CWT fish to increase clearly and substantially with increasing exports. (*Id.*, at para. 72.) However, Exhibits 5 and 6 to the Cavallo declaration (Doc. 250) show there was no pattern of increased "salvage proportion" with increased exports. (*Id.*) In addition, the analysis set forth in Newman (2008) yielded inconclusive results regarding the significance of larger exports on salvage rate. (*Id.*, at para. 73.) As a result, Cavallo concluded that Dr. Hanson's analysis does not support a hypothesis that negative OMR flows draw a greater proportion of salmonid populations into the interior Delta. (*Id.*, at para. 73.)

Cavallo also noted that "Long-term and intensive salmon survival experiments on the [San Joaquin River] illustrate unequivocally that increased South Delta exports are *not* associated with adverse effects on juvenile salmonid survival, and also are *not* associated with decreased adult salmon escapement." (*Id.*, at para. 74.) Consistently, Newman and Brandes (2009) conclude that the model they use ***without*** exports is just as good a predictor of relative survival as the model used ***with*** exports. According to Newman and Brandes (2009), there is "thus apparently scant evidence for a relationship between Θ [relative survival] and exports." (Newman and Brandes (2009) at 20.) (Cavallo, Decl. 452, para. 78.)

The following studies also evaluate potential relationships between OMR reverse flows and salmonid survival, and have reached the conclusion that there is little to no effect:

* Vogel (2004) concluded, based upon a 2004 radio telemetry study, that the "experiments could not explain why some fish moved off the mainstem San Joaquin River into southern Delta channels. Due to the wide variation in hydrologic conditions during the two central Delta studies, it was difficult to determine the principal factors affecting fish migration. Based on limited data from these studies, it may be that a combination of a neap tide, reduced exports, and increased San Joaquin River flows is beneficial for outmigrating smolts, but more research is necessary." (Cavallo Decl., Doc. 452, para. 86.)

* The San Joaquin River Group Authority's "2005 Annual Technical Report," concludes that "Regression of exports to smolt survival without the HORB were weakly or not statistically significant (Figure 5-17) using both the Chipps Island and Antioch and ocean recoveries, but both relationships indicated survival increased as exports increased." (Cavallo Decl., Doc. 452, para. 94.) Moreover, the 2007 annual VAMP technical report states that "[t]he relationship of survival to exports is still difficult to detect based on the data gathered to date . . ." and raises the question of whether such a relationship is in fact "real." (2005 VAMP Annual Technical Report, p.7.)

* The California Department of Fish and Game ("CDFG"), "Final Draft 11-28-05 San Joaquin River Fall-run Chinook Salmon Population Model," found "[t]here is no correlation between exports and adult salmon escapement in the Tuolumne River two and one-half years later (Figure 24)." (See also Cavallo Decl., Doc. 452, para. 95.) CDFG concluded: " The Department evaluated various parameters that have been identified as influencing abundance of escapement of fall-run Chinook salmon into the SJR, such as ocean harvest, *Delta exports* and survival, abundance of spawners, and spring flow magnitude, duration and frequency. The Department found that the ***non-flow parameters have little, or no, relationship to fall-run Chinook salmon population abundance in the SJR***[.]" (Cavallo Decl., Doc. 497, para. 11.)

* On the Tuolumne River, Mesick, McLain, Marston and Heyne, "Draft Limiting Factor Analyses & Recommended Studies for Fall-run Chinook Salmon and Rainbow Trout in the Tuolumne River" February 27, 2007) concluded: "[P]reliminary correlation analyses suggest that the combined State and Federal export rates during the smolt outmigration period (April 1 to June 15) have relatively little effect on the production of adult recruits in the Tuolumne River compared to the effect of winter and spring flows. Furthermore, reducing export rates from an

average of 264% of Vernalis flows between 1980 and 1995 to an average of 43% of Vernalis flows and installing the Head of Old River Barrier between 1996 and 2002 during the mid-April to mid-May VAMP period did not result in an increase in Tuolumne River adult recruitment (Figures 3 and 17)." (Mesick et al. (2007); Cavallo Decl., Doc. 452, para. 96.)

* Brandes and McLain (2001) summarized the results of the export/salmon survival research by observing that "[t]here is no empirical correlation at all between survival in Lower San Joaquin River and the rate of CVP-SWP export." (*See also* Cavallo Decl., Doc. 457, para. 97.) Based upon their review, Brandes and McLain (2001) conclude that "no relationship between export rate and smolt mortality, suitable for setting day-to-day operating levels, has been found." (See *Id.*)

Based upon the above, it is evident that the best available science does *not* support the draft Technical Report's assertion that net OMR reverse flows draw fish into the SWP and CVP export facilities. All of these materials need to be included in the Technical Report

6. OMR Reverse Flows and Reduction of Spawning and Rearing Habitat

The draft Technical Report posits that OMR reverse flows reduce spawning rearing habitat for native species, and that "any fish that enters the central or southern Delta has a high probability of being entrained and lost at the pumps." (Draft Technical Report, p. 51.) The best available science fails to support either of these assertions.

As a preliminary matter, adult salmonids are generally not known to spawn in the Delta, and certainly not within the zone of influence of the pumps. (*See* PI Findings, at pp. 56:18-20, 57:16-18; Second Supplemental Declaration of Steven Cramer, Consolidated Salmonid Cases, at p. 16:2-5 (Feb. 22, 2010) (Doc. 244); *see generally* NMFS, Biological Opinion and Conference Opinion on the Long-Term Operations of the CVP and SWP (June 4, 2009); (Cummins Decl., Doc. 445, para. 29.).) In addition, while longfin smelt are known to spawn in the Delta, longfin generally spend little time post-emergence in the Delta and primarily rear to the west of the Sacramento River and San Joaquin River confluence, in saltier waters. (Randall Baxter et al., Pelagic Organism Decline Report, 2007 Synthesis of Results (Jan 2008) p.5.)

Furthermore, in the *Consolidated Delta Smelt Cases*, the federal court rejected the FWS's assertion that SWP and CVP operations reduce the amount and quality of spawning habitat for Delta smelt because was no analysis or justification of the BiOp's flow restrictions related to critical habitat. (Findings of Fact and Conclusions of Law re Plaintiffs' Request for Preliminary Injunction Against RPA Component 2, *Delta Smelt Consolidated Cases*, No. 1:09-cv-407-OWW-DLB 13:24-114:7, 115:21-25, ¶¶ 55, 59 (May 24, 2010) (Doc. 704).)

There is also little, if any support for the draft Technical Report's overbroad statement that "[a]ny fish that enters the central or south Delta has a high probability of being entrained and lost at the pumps." To the contrary, the federal court has already found that "[t]here are serious questions whether there is support in the record for the general proposition that exports reduce survival of salmonids in the interior Delta." (PI Findings, pp. 63-64, ¶ 146.)

According to Mr. Cavallo, while juvenile salmon mortality rates are certainly higher in the interior Delta than elsewhere, the best available science does not support the idea that exports (and, thus, OMR reverse flows) are a significant contributor to poor salmonid interior Delta survival. (Cavallo Decl., Doc. 250, para. 13.)[9] While Newman and Brandes (2009) did find evidence for a negative association between exports and relative interior Delta survival, the slope coefficient was very low (~0.000025), (Newman and Brandes (2009) at 19). (*Id.*)

The draft Technical Report's citation to Kimmerer and Nobriga (2008) is also unhelpful. The Kimmerer and Nobriga (2008) article is generally related to an application of the Particle Tracking Model. However, as explained by the federal court in its PI Ruling, Kimmerer and Nobriga (2008) ["Investigating Particle Transport and Fate in the Sacramento-San Joaquin Delta Using a Particle Tracking Model"] expressly qualified their analysis by stating: "[w]e do not claim that the specific results presented here represent actual movements of salmon; rather, these results indicate what factors may or may not be important in determining how salmon smolts may move through the Delta." (PI Ruling, p. 46, ¶ 109.) Kimmerer and Nobriga (2008) also state: "We are, furthermore, not inclined to define a 'zone of influence' of the pumps on the basis of our results, since the probability of entrainment depends on time horizon which, in many cases, is too long to be useful for analyzing the movements of larval fish. By the end of the modeled time period, the fish would already have metamorphosed, and their behavior would have become more complex." (Kimmerer and Nobriga (2008), at 18; Cavallo Decl., Doc. 250, para. 8.)

Moreover, as stated above, juvenile salmonids have strong swimming ability and the ability to move volitionally. (Cramer Decl., Doc. 167, para. 14.) This is particularly true of steelhead, which are even larger than fall-run Chinook salmon, when they are traveling through the Delta. (Cummins Decl., Doc. 445, para. 31.) As a result, the draft Technical Report's proposed use of Kimmerer and Nobriga (2008) to support San Joaquin River flows for the benefit of fall-run Chinook salmon and Central Valley steelhead is scientifically untenable.

7. <u>The Claims that Reverse OMR Flows lead to a "confusing environment" for migrating Juvenile Salmon and that the movement of Sacramento River water into the Central Delta reduces natural variability are not Supported</u>

Without citation, the draft Technical Report also asserts that "net OMR flows have led to a confusing environment for migrating juvenile salmon leaving the SJR basin and that the importation of Sacramento River water into the Central Delta reduces its "natural variability. The State and Federal Water Contractors do not dispute that the SWP/CVP operations move Sacramento River water into the central and south Delta; that is the basic structure of the "through Delta" method of operating the projects. Likewise, the State and Federal Water Contractors recognize that this method of moving water across the Delta alters the otherwise existing salinity gradients in certain Delta channels. However, the draft Technical Report does

[9] However, Cavallo noted that Newman (2008) found a relationship, albeit weak, between exports and survival in the interior Delta. (*See* PI Findings, p. 35, ¶ 90; *see also* PI Findings, p. 37, ¶ 92.)

not reference any studies or other data that connects these conditions to adverse fishery impacts derived from confusion out-migrating salmonids or whatever is meant by reduction in natural variability.

This letter has discussed numerous studies, all of which show that neither export pumping nor the reverse OMR flows that result from that pumping have a discernable impact on the survival of downstream migrating salmon or steelhead or the escapement of adults two and one-half years later. If there were population level impact from confusion or from the alleged reduction in natural variability, it would show up in study results discussed in this letter and that are in our should be in the draft Technical Report. In the absence of any such results, the statements in the draft Technical Report are speculation and should be removed.

D. Additional concerns

Finally, there is no support for the statement in the draft Technical Report that "the primary limiting factor for SJR fall-run survival and subsequent abundance is reduced flows during the spring when fry and smolts are completing the rearing phase of their life cycle and migrating from the SJR basin to the Delta. (DFG 2005a, Mesick and Marston 2007, Mesick et al. 2008, Mesick 2009)." (Draft Technical Report, p. 48.)

In the *Consolidated Salmonid Cases*, Cramer testified that poor fall-run Chinook adult returns during 2007 and 2008 could be attributed to a change in ocean conditions and very poor survival in the ocean. (PI Findings, 20:4-7, ¶ 46; PI Hr'g Tr. 111:10-112:2; 117:17-118:2 (Mar. 30, 2010).) The federal court also observed that several factors contribute to the decline of fall-run salmon, including: water temperatures, predators, and non-native species, toxics, increased salinity, alien and invasive species, predators, riparian pumping and in-Delta diversions. (PI Findings, 20:23-21:14, ¶¶ 48, 49.)

The draft Technical Report's implication that reduced spring flows are the *primary* limiting factor for San Joaquin River fall-run survival and abundance is thus unfounded, and overlooks other contributing factors affecting salmonid survival. Not understanding the affect of *other factors* on San Joaquin River fall-run salmonids *before* remedial measures are implemented isolates and compromises the Projects without benefit to the listed species. Therefore, all studies related to the non-flow factors affecting San Joaquin River salmonids need to be included in the final version of the Technical Report.

Thank you for your consideration of these comments.

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References for State Water Contractors and San Luis &Delta-Mendota Water Authority Comments on SWRCB "Draft Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives", dated October 29, 2010

Baker, P.F., and Morhardt., J.E. 2001. Survival of Chinook Salmon Smolts in the Sacramento-San Joaquin Delta and Pacific Ocean. Contributions to the Biology of Central Valley Salmonids 2: 163-182.

Baxter, R., R. Breuer, L. Brown, M. Chotkowski, F. Feyrer, M. Gingras, B. Herbold, A. Mueller-Solger, M. Nobriga, T. Sommer, and K. Souza. 2008. Pelagic organism decline progress report: 2007 synthesis of results. Interagency Ecological Program for the San Francisco Estuary, Technical Report 227.

Blake, A., and Horn, M.J., 2004, Acoustic Tracking of Juvenile Chinook Salmon Movement in the Vicinity of the Delta Cross Channel, Sacramento River, California – 2001 Study Results.

Brandes, P.L. and McLain, J.S. 2001. Juvenile Chinook salmon abundance, distribution, and survival in the Sacramento-San Joaquin Estuary. In: R.L. Brown, editor, Contributions to the biology of Central Valley salmonids. Volume 2. California Department of Fish and Game Fish Bulletin 179:39-136

Burau, J, Blake, A, and Perry, R, 2007, Sacramento/San Joaquin River Delta Regional Salmon Outmigration Study Plan: Developing Understanding for Management and Restoration, December 2007.

California Department of Fish and Game (DFG). 2005b. San Joaquin River Fall-Run Chinook Salmon Population Model. Report to the State Water Resources Control Board.

Cavallo, B, 2010a, Declaration of Bradley Cavallo in Support of Plaintiff-Intervenor California Department of Water Resources' Joinder in Plaintiffs' Motion for Preliminary Injunction, Document 250, February 2010.

Cavallo, B, 2010b, Declaration of Bradley Cavallo in Support of Plaintiff-Intervenor California Department of Water Resources Motion for Summary Judgment, Document 452, August 2010.

Cavallo, B, 2010c, Second Declaration of Bradley Cavallo in Support of Plaintiff-Intervenor California Department of Water Resources Motion for Summary Judgment, Document 497, October 2010.

Cramer, S.P., 2010a, Declaration of Steven P. Cramer in Support of Plaintiffs' Motion for Temporary Restraining Order and Preliminary injunction, Document 167, January 2010.

Cramer, S.P., 2010b, Second Supplemental Declaration of Steven P. Cramer in Support of Plaintiffs San Luis&Delta-Mendota Water Authority and Westlands Water District's Motion for Preliminary Injunction, Document 244, February 2010.

Cummins, K., 2010, Declaration of Kenneth Cummins in Support of Plaintiffs' Motion for Summary Judgment, Document 445, August 2010.

DWR 2007a, *Department of Water Resources Comments to January 16-19, 2007 SWRCB South Delta Salinity Workshop* (Jan. 5, 2007) (http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/sds_srjf/sds/docs/dwr010807.pdf)

DWR 2007b, Sources of Salinity in the South Sacramento-San Joaquin Delta, May 2007

Hanson, C.H., 2008, Declaration of Charles H. Hanson, Ph.D, in Support of Defendant-Intervenor State Water Contractors' Status Report, Document 396, August 2008.

Holbrook, C.M., Perry, R.W., and Adams, N.S. 2009. Distribution and Joint Fish-Tag Survival of Juvenile Chinook Salmon Migrating Through the Sacramento-San Joaquin River Delta, 2008. Geological Survey Open File Report 2009-1204. 30 pages.

Hutton, P, 2008, A Model to Estimate Combined Old & Middle River Flows, 90 pp.

Kimmerer, W. and M. Nobriga. 2008. Investigating particle transport and fate in the Sacramento-San Joaquin Delta using a Particle Tracking Model. San Francisco Estuary and Watershed Science 6(1):Article 4

Newman, K.B. 2008. An Evaluation of Four Sacramento-San Joaquin River Delta Juvenile Salmon Survival Studies. 181 pages.

Newman, K.B., and Brandes, P.L., 2009. Hierarchical Modeling of Juvenile Chinook Salmon Survival as a Function of Sacramento-San Joaquin Delta Water Exports, March 2009.

Mesick, C.F., and Marston, D. 2007. Provisional Draft: Relationships Between Fall-Run Chinook Salmon Recruitment to the Major San Joaquin River Tributaries and Stream Flow, Delta Exports, the Head of the Old River Barrier, and Tributary Restoration Projects from the Early 1980s to 2003.

Mesick, C.F., McLain, J.S., Marston, D., and Heyne, T. 2008. Limiting Factor Analyses & Recommended Studies for Fall-Run Chinook Salmon and Rainbow Trout in the Tuolumne River. California Department of Fish and Game. Prepared for the U. S. Fish and Wildlife Service. Draft Report.

Mesick, C. 2009. The high risk of extinction for the natural Fall-Run Chinook salmon population in the lower Tuolumne River due to insufficient instream flow releases. U.S. Fish and Wildlife Service, Energy and Instream Flow Branch, Sacramento, CA. 4 September 2009. Exhibit No. FWS-50.

Perry R.W., and Skalski, J.R., 2009, Survival and Migration Route Probabilities of Juvenile Chinook Salmon in the Sacramento-San Joaquin River Delta during the Winter of 2007-2009, U.S. Fish and Wildlife Service, July 2009.

San Joaquin River Group Authority (SJRGA). 2006. 2005 Annual Technical Report: On implementation and monitoring of the San Joaquin River Agreement and the Vernalis Adaptive Management Plan.

Vogel, D.A., 2004, Juvenile Chinook Salmon Radio Telemetry Studies in the Northern and Central Sacramento-San Joaquin Delta 2002-2003 Final Report, January 2004.

Wanger, O. 2010, Findings of Fact and Conclusions of Law re Plaintiffs' Request for Preliminary Injunction Against RPA Component 2, *Delta Smelt Consolidated Cases*, No. 1:09-cv-407-OWW-DLB 13:24-114:7, May 2010.

Attachment

This attachment compares equations to estimate tributary flow required to meet a south Delta salinity target based on (1) a full salt load balance (see Eq. 6) and (2) simplifying assumptions made in the draft Technical Report (see Eq. 12).

Full Salt Load Balance

Salinity at a south Delta compliance location (e.g. Old River at Tracy Road Bridge) can be computed as the flow-weighted average of salinity contributions from Vernalis, additional tributary flows needed to meet a salinity target, and local in-Delta sources:

$$EC_c = \frac{F_v EC_v \varnothing_v + F_T EC_T \varnothing_T + F_D EC_D}{F_v \varnothing_v + F_T \varnothing_T + F_D} \quad \textbf{(Eq. 1)}$$

Where:

EC_c = salinity of south Delta compliance location
EC_V = pre-dilution salinity at Vernalis
EC_T = salinity of tributary flows
EC_D = flow-weighted average salinity of local in-Delta sources
F_V = pre-dilution flow at Vernalis
F_T = tributary flow needed to meet target salinity at south Delta compliance location
F_D = local in-Delta flow contributing to salinity at south Delta compliance location
$\varnothing_v$ = fraction of Vernalis flow contributing to salinity at south Delta compliance location
$\varnothing_T$ = fraction of tributary flow contributing to salinity at south Delta compliance location

And:

$\varnothing_v = \varnothing_T = \varnothing$; where $0 \leq \varnothing \leq 1$ **(Eq. 2)**

Arrive at an equation for tributary flow needed to meet a salinity target by substituting Eq. 2 into Eq. 1, algebraically re-arranging terms, and solving for F_T:

$$EC_C (F_v \varnothing + F_T \varnothing + F_D) = F_v EC_v \varnothing + F_T EC_T \varnothing + F_D EC_D \quad \textbf{(Eq. 3)}$$

$$F_T(EC_C \varnothing - EC_T \varnothing) = F_v (EC_v \varnothing - EC_C \varnothing) + F_D (EC_D - EC_C) \quad \textbf{(Eq. 4)}$$

$$F_T = \frac{F_v \varnothing (EC_v - EC_C)}{\varnothing (EC_C - EC_T)} + \frac{F_D (EC_D - EC_C)}{\varnothing (EC_C - EC_T)} \quad \textbf{(Eq. 5)}$$

$$F_T = \frac{F_v (EC_v - EC_C)}{(EC_C - EC_T)} + \frac{F_D (EC_D - EC_C)}{\varnothing (EC_C - EC_T)} \quad \textbf{(Eq. 6)}$$

Simplified Salt Load Balance Assumed in Draft Technical Report

The simplified salt balance assumed in Equation 5.1 of the draft Technical Report can be written as follows:

$$EC_C = \frac{EC_v F_V + EC_T F_T}{F_V + F_T} + K \qquad \textbf{(Eq. 7)}$$

Where:

K = salinity degradation between Vernalis and south Delta compliance location

and other terms were defined previously. Figures 4-2 thru 4-6 present regression equations that estimate salinity at the three south Delta compliance locations as functions of Vernalis salinity. These regression equations can be used to estimate K.

Arrive at an equation for tributary flow needed to meet a salinity target by algebraically re-arranging terms and solving for F_T:

$$(EC_C - K)(F_v + F_T) = EC_v F_v + EC_T F_T \qquad \textbf{(Eq. 8)}$$

$$F_v EC_C - F_v K + F_T EC_C - F_T K = F_v EC_v + F_T EC_T \qquad \textbf{(Eq. 9)}$$

$$F_T (EC_C - K - EC_T) = F_v (EC_v - EC_C + K) \qquad \textbf{(Eq. 10)}$$

$$F_T = \frac{F_v (EC_v - EC_C + K)}{(EC_C - K - EC_T)} \qquad \textbf{(Eq. 11)}$$

$$F_T = F_V \left[\frac{EC_v - (EC_C - K)}{(EC_C - K) - EC_T} \right] \qquad \textbf{(Eq. 12)}$$

Note that the term $(EC_C - K)$ is equivalent to the term EC_{Target} defined in Eq. 5-1 of the draft Technical Report.