Appendix 1A

Comments from Federal Agencies and Responses

This section contains copies of comment letters from federal agencies on the Draft Environmental Impact Statement (EIS) for the Coordinated Long-term Operation of the Central Valley Project (CVP) and State Water Project (SWP). Each comment in the comment letters was assigned a number, in sequential order. The numbers were combined with the agency name (example: NMFS 1). The comments with the associated responses are arranged alphabetically by agency name, and appear in the chapter in that order.

Copies of the comments are provided in Section 1A.1. Responses to each of the comments follow the comment letters, and are numbered in accordance with the numbers assigned in the letters. None of the comments from the Federal agencies included attachments.

1A.1 Comments and Responses

The federal agencies listed in Table 1A.1 provided comments on the Draft EIS.

Table 1A.1 Federal Agencies Providing Comments on the Draft Environmental Impact Statement

Acronym	Commenter
NMFS	National Marine Fisheries Service, National Oceanic and Atmospheric Administration
EPA	U.S. Environmental Protection Agency
Western	Western Area Power Administration, Department of Energy

1A.1.1 National Marine Fisheries Service

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

SEP 29 2015

Mr. Craig Muehlberg
Acting Area Manager
Bay-Delta Office
Bureau of Reclamation
Mid-Pacific Region
801 I Street, Suite 140
Sacramento, California 95814

Re: Cooperating Agency Review of the Draft Environmental Impact Statement for the Coordinated Long-term Operation of the Central Valley Project and State Water Project

Dear Mr. Muehlberg:

NMFS 1

NOAA's National Marine Fisheries Service (NMFS), as a cooperating agency, reviewed the draft environmental impact statement (DEIS) for the coordinated long-term operation of the Central Valley Project (CVP) and State Water Project (SWP), pursuant to the National Environmental Policy Act (NEPA) and associated regulations. The United States Bureau of Reclamation (Reclamation) and its consultants prepared this DEIS in compliance with a court order that required Reclamation to undertake a NEPA analysis of potential impacts to the human environment before accepting and implementing the NMFS' June 4, 2009, Biological Opinion (BO) and reasonable and prudent alternative (RPA). The BO, developed pursuant to the Federal Endangered Species Act, concluded that the coordinated long-term operation of the CVP and SWP is likely to jeopardize the continued existence of listed species and/or destroy or adversely modify designated critical habitats, and prescribed a suite of RPA actions to avoid jeopardy to listed species and destruction or adverse modification of designated critical habitats. Reclamation issued the DEIS for public comment on July 31, 2015.

NMFS commends the preparers of the DEIS documents for assembling and analyzing a mountain of scientific information and data and for exploring environmental effects of the six alternatives, while facing a bewildering array of regulatory requirements, time constraints, and economic, social, legal, and political pressures. Due to the large volume of the DEIS document (more than 6,000 pages) and time constraints, we have focused our review on the adequacy of the science and the validity of the conclusions drawn from that science, with an emphasis on those chapters closely related to NMFS listed species, including Chapter 3 Description of Alternatives, Chapter 4 Approach to Environmental Analyses, Chapter 5 Surface Water Resources and Water Supplies, Chapter 9 Fisheries and Aquatic Resources, and relevant appendices.

The DEIS evaluated long-term (up to 2030) potential effects on the environment that would result from the operation of the CVP and SWP with the implementation of the BO and its RPA actions. These evaluations were made by comparing the potential effects of a total of six alternatives on the environment, *i.e.*, No Action Alternative (NAA), Second Base of Comparison (SBC) that is identical to Alternative 1, and Alternatives 2 to 5. The comparison between the NAA and SBC represents the difference between the assumed full implementation and non-implementation of the RPA, respectively. Differences in reservoir storage, stream flow, water temperature, and listed species between the NAA and SBC may be perceived as the basis by which NMFS developed the RPA actions to avoid jeopardy or adverse modification. However, our review found that the DEIS failed to discern anticipated differences in stream flow, water temperature, and fish abundance and survival between the NAA and SBC. This failure may be caused by: (1) use of the flawed methodology (*e.g.*, models and assumptions) in the DEIS; (2) partial, rather than full, implementation of the RPA actions under the NAA; (3) insufficient RPA actions to avoid jeopardy or adverse modification; or (4) a combination of the above, because most of the modeling results presented in the DEIS were similar between the NAA and SBC, contradicting the overwhelmingly recognized significance of managing flow and water temperature for salmonid species, as discussed in detail in the enclosed review comment. We recommend that Reclamation use the scientific data and information provided in the review comments to reassess (1) streamflow, water temperature, and survival and abundance of listed species under the full implementation of the NMFS 2009 BO and all RPA actions; and (2) streamflow, water temperature, and survival and abundance of listed species under no implementation of the RPA actions. NMFS 2

NMFS appreciates the opportunity to comment on the DEIS. If you have any questions regarding our comment, please feel free to contact Dr. Lee He at li-ming.he@noaa.gov or by phone at 916-930-5615. NMFS 3

Sincerely,

for Maria Rea
Assistant Regional Administrator
California Central Valley Area Office

Enclosure

Copy to File: ARN151422SWR2006SA00268

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Review of the Draft Environmental Impact Statement
for the Coordinated Long-term Operation of the Central Valley Project and State Water Project

NOAA Fisheries West Coast Region
California Central Valley Area Office

September 29, 2015

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Table of Contents

1 Introduction

NMFS 4

NOAA's National Marine Fisheries Service (NMFS) reviewed the draft environmental impact statement (DEIS) for the coordinated long-term operation of the Central Valley Project (CVP) and State Water Project (SWP), pursuant to the National Environmental Policy Act (NEPA) and associated regulations. The United States Bureau of Reclamation (Reclamation) and its consultants prepared this DEIS in compliance with a court order that required Reclamation to undertake a NEPA analysis of potential impacts to the human environment before accepting and implementing the 2009 NMFS Biological Opinion (BO). The BO, developed pursuant to the Federal Endangered Species Act (ESA), concluded that the coordinated long-term operation of the CVP and SWP is likely to jeopardize the continued existence of listed species and/or destroy or adversely modify designated critical habitats, and prescribed a suite of reasonable and prudent alternative (RPA) actions to avoid jeopardy to listed species and destruction or adverse modification of designated critical habitats.

NMFS 5

The DEIS evaluated long-term (up to 2030) potential effects on the environment that would result from the operation of the CVP and SWP with the implementation of the BO and its RPA actions. These evaluations were made by comparing the potential effects of a total of six alternatives on the environment, *i.e.*, No Action Alternative (NAA), Second Base of Comparison (SBC) that is identical to Alternative 1, and Alternatives 2 to 5. The comparison between the NAA and SBC represents the difference between the assumed full implementation and non-implementation of the RPA. Differences in reservoir storage, stream flow, water temperature, and listed species between the NAA and SBC may be perceived as the basis by which NMFS developed the RPA actions to avoid jeopardy or adverse modification. However, our review found that the DEIS failed to discern anticipated differences in stream flow, water temperature, and fish abundance and survival between the NAA and SBC. This failure may be caused by: (1) use of the flawed methodology (*e.g.*, models and assumptions) in the DEIS; (2) partial, rather than full, implementation of the RPA actions under the NAA; (3) insufficient RPA actions to avoid jeopardy or adverse modification; or (4) a combination of the above, because most of the modeling results presented in the DEIS were similar between the NAA and SBC, contradicting the overwhelmingly recognized significance of managing flow and water temperature for salmonid species, as discussed below in detail.

NMFS 6

NMFS commends the preparers of the DEIS documents for assembling and analyzing a mountain of scientific information and data and for exploring environmental effects of the six alternatives, while facing a bewildering array of regulatory requirements, time constraints, and economic, social, legal, and political pressures. Due to the large volume of the DEIS document (more than 6,000 pages) and time constraints, we have focused our review on the adequacy of the science and the validity of the conclusions drawn from that science, with an emphasis on those chapters closely related to NMFS listed species, including Chapter 3 Description of Alternatives, Chapter 4 Approach to Environmental Analyses, Chapter 5 Surface Water Resources and Water Supplies, Chapter 9 Fisheries and Aquatic Resources, and relevant appendices.

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2 General Comments

This DEIS contains 70 files and more than 6,000 pages. Chapter 9 (Fisheries and Aquatic Resources) alone has 470 pages plus more than 1,000 pages of appendices. This long and poorly organized DEIS is difficult to read and follow. We recommend the following to make the EIS more readable and easier to follow. NMFS 7

2.1 Include a Table of Contents for Each Chapter and Appendix

At the beginning of each chapter and appendix, there should be a table of contents that would provide guidance for readers to move through a long chapter or appendix and select which sections to read.

2.2 Include a Meaningful Summary for Each Chapter and Appendix

Each chapter should begin with a sharply focused summary of the main points, results, conclusions, and uncertainties. We recommend using tables or graphs or both in these summaries when appropriate.

2.3 Overview of the Tiered Modeling Approach

It will be more appropriate to provide an overview of the tiered modeling approach in Chapter 4, including all the models used in the DEIS on climate change and related hydrology, water resource optimization, hydrodynamics and water quality (including water temperature), and survival and abundance of fish. The overview should include, but is not limited to, model version, domain, temporal and spatial scale and resolution, uncertainty analysis, calibration, limitations, and aggregation or disaggregation of input data for each model used in the DEIS. The partial overview in the DEIS is currently buried in Appendix 5A.A. NMFS 8

3 Models Used in the DEIS

The DEIS used a series of models with an attempt to predict the effects of project operations on reservoir storage, flow, water temperature, water exports, and survival and abundance of listed fish species. The tiered modeling approach applied the results of climate change models as inputs to a hydrologic model, outputs of which were used as inputs to a water resource optimization planning model (CalSim II). The results of CalSim II were used as inputs to hydrodynamic and water temperature models, which generated outputs for biological models. Many of the models used in the DEIS have limitations in that they are planning tools or are best applied in a comparative sense; this can limit the extent of interpretation of modeling results. Furthermore, the models have a broad range of temporal resolutions from 15 minutes to 1 day to 30 days. The linkage of models with different temporal resolutions could result in propagation of large errors that would influence decisions derived from the modeling results (National Research Council 2010). NMFS previously commented on the application of the CalSim II based modeling approach to effects analysis (National Marine Fisheries Service 2014). Some of those comments are reiterated in this review. NMFS 9

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3.1 Climate Change and Hydrologic Models

The Variable Infiltration Capacity (VIC) hydrologic model was used to generate watershed runoff and streamflow (daily, monthly, or annual) for the major rivers and streams in the Central Valley for the time period of 2011 to 2040. The minimum set of variables that VIC requires the user to supply include: daily total precipitation (rain and/or snow), daily maximum and minimum air temperature, and daily average wind speed. It is unclear on how these input data were derived. Please provide information on how daily precipitation, daily air temperature, and daily wind speed were derived from climate models for the time period of 2011-2040. NMFS 10

It is unclear if an uncertainty analysis for the VIC model was conducted. If so, please provide information and data about the uncertainty analysis for the model. If not, the modeling error from the VIC model is unknown, which should be acknowledged. There should be discussion of the uncertainty the model introduces and the implications of incorporating that uncertainty into the tiered modeling approach. NMFS 11

These VIC-simulated runoff data were then used to adjust the 82-year (1921-2003) "unimpaired flow data." Once the flow data had been adjusted, water year types and other hydrologic indices that govern water operations or compliance were also revised to be consistent with the climate change-incorporated hydrologic regime. The adjusted inflows, key valley floor accretions, water year types, and hydrologic indices were used as input to CalSim II. However, the DEIS did not provide sufficient information about the climate change based "adjustment" for the "unimpaired flow data." How did you use the VIC-simulated flow data from 2011 to 2040 to adjust the flow data from 1921 to 2003? In addition, please provide a summary of the differences between the unadjusted and adjusted unimpaired flow data for the 82 years from 1921 to 2003. NMFS 12

The DEIS presented climate change related changes in figures. Please provide summarized key statistical results in tables for differences between the historical condition and the future climate change incorporated condition for the following data: (1) Inflow time series records for major streams in the Central Valley, (2) Sacramento and San Joaquin valley water year types, and (3) runoff forecasts used for reservoir operations and allocation decisions. NMFS 13

3.2 Water Resources Optimization Model: CalSim II

CalSim II uses linear programming to solve sets of equations that simulate water movement through the CVP-SWP system in accordance with various objective functions and operational constraints. It is a data-driven system simulation planning tool and is not a physical process-based hydrologic model. Use of an optimization algorithm allows a suitable decision to be identified from among all possible and feasible decisions. Most successful applications of optimization that attempt to simulate the behavior of a system have calibrated their objective functions (*i.e.*, set the weights that prioritize the preference for meeting individual constraints) so that the model results correspond to what actually happens or would happen under a particular scenario. NMFS 14

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3.2.1 Calibration and Validation

The DEIS states: "Because it [CalSim II] is not a physically based model, CalSim II is not calibrated…" (page Appendix 5A.A-13). NMFS 15

It is a standard practice to ensure the appropriate use of models through the processes of calibration and testing (National Research Council 2010). Regardless of how possible it is to match the model closely with observed behavior, statistics on the accuracy of the calibration run should be supplied to users to enable them to gauge the likely errors involved with using the model output (Close *et al.* 2003). The calibration and validation phase is especially critical since the outcome establishes how well the model represents the system for the purpose of a study. Thus, this is the "bottom line" of the model application effort, as it determines whether or not the model results can be relied upon and used effectively for decision-making (Duda *et al.* 2012). NMFS recognizes that calibrating a complex, linear programming based model such as CalSim II is challenging, but we also note that others have embarked upon similar efforts, as demonstrated by Draper *et al.* (2003) and Cai and Wang (2006). We reiterate our previous requests that resources be allocated to a calibration/validation effort, allowing for a better alignment between model results and empirical data. Although use of the entire simulation period (82 years) for testing and calibration may not be practical or necessary, a subset of the data for a portion of the simulation period, which had similar operational and other constraints in the system, could be used for calibration to assess the uncertainty of CalSim II simulations.

In the absence of a calibration and validation, CalSim II results should be discussed in the proper context, and, when necessary, evaluated to determine whether trends or anomalies are driven by the limitations of the model. NMFS 16

3.2.2 Monthly Output Data

The DEIS states: "Therefore, reporting sub-monthly results from CalSim II or from any other subsequent model that uses monthly CalSim results as an input is not considered an appropriate use of model results" (page 5A.A-14). NMFS 17

This leads to another major concern about the limitations of the monthly CalSim II modeling results and other modeling results from subsequent models to which the CalSim II results were used as inputs. Monthly data are not useful for analyzing the effects of short-term flow and water temperature variability on anadromous fish species because the impact of water temperature, which is critical to survival, growth, and reproduction of anadromous fish species, can result from exposure time of hours. This could be one of the reasons why the DEIS concluded that there were minimal differences in survival and abundance of winter-run Chinook salmon (winter-run) between the NAA and SBC.

3.2.3 Rules in CalSim II

The DEIS states: "The model has no capability to adjust these rules based on a sequence of hydrologic events such as a prolonged drought, or based on statistical performance criteria such as meeting a storage target in an assumed percentage of years" (page 5A.A-13). NMFS 18

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To our understanding, the rules developed for CalSim II can be changed or updated. Please clarify if CalSim II model developers or users are able to modify those existing rules or add new rules to incorporate new constraints or events into CalSim II. NMFS 18 continued

3.2.4 Mixed Minimum Flow Assumptions Used in CalSim II

It is confusing that the DEIS provided multiple regulatory requirements for minimum instream flows under the same alternative in Clear Creek, Sacramento River, and Stanislaus River (see Table 5A.B.20). For example, under "Minimum flow below Whiskeytown Dam," the "No Action Alternative Assumption" column listed the following assumptions: "Downstream water rights, 1963 Reclamation Proposal to USFWS and NPS, predetermined CVPIA 3406(b)(2) flows, and NMFS BO (June 2009) Action I.1.1." Which one was actually used in CalSim II in this DEIS? Please clarify for Clear Creek and other rivers. NMFS 19

3.3 Delta Hydrodynamics and Water Quality Model: DSM2

It is unclear in the DEIS on the simulation time period of DSM2. Was it simulated for the entire CalSim II simulation period of 82 years from 1921 to 2003? Or was only a portion of the 82 years used for the simulation in DSM2? If the latter, what portion of the 82 years was used, why was that selected, and how does it compare to the full 82 years in terms of distribution of water year types and sequences of extreme years? This should be clearly described in the model overview section. NMFS 20

3.3.1 Meteorological Data Used in DSM2

What meteorological data were used in DSM2 if the simulation period was 82 years? How did you derive some of the meteorological variables that were not readily available but required in DSM2? NMFS 21

3.4 Water Temperature Model: HEC-5Q

The HEC-5Q model was used to generate 6-hour water temperature data in Clear Creek and the Sacramento, American, and Stanislaus rivers. The HEC-5Q model was developed between the late 1970s and early1990s (Willey *et al.* 1996) through the Hydrologic Engineering Center (HEC) of the U.S. Army Corps of Engineers (USACE). However, HEC-5Q is no longer available from and is not supported by the USACE. The Sacramento River Water Quality Model (SRWQM) is a HEC-5Q based water temperature model to simulate Sacramento River water temperatures. Has the SRWQM been updated or recalibrated since its implementation to the Sacramento River in 2005? If so, please provide a summary of updates and recalibration. NMFS 22

For water temperature modeling, HEC-5Q used the concept of equilibrium temperature to calculate the net heat transfer. The equilibrium temperature method is best suited for large time step (*i.e.*, monthly) models because these most closely approximate steady-state conditions (Deas and Lowney 2001). In 2008, the then-CALFED Science Advisory Panel recommended that the latest technology in flow and temperature modeling with smaller time-steps (*e.g.*, one-hour) be NMFS 23

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adopted to better assess biological effects (Deas *et al.* 2008). More recently, there were concerns about the 1-D representation for reservoir dynamics and calibration and uncertainty of the legacy HEC-5Q model (Anderson *et al.* 2013). NMFS 23 continued

HEC-5Q requires daily input data such as flow, water temperature, and meteorological data (*e.g.*, solar radiation, air temperature, dew point, wind speed, atmospheric pressure, wind direction, and cloud cover). Please provide a summary of how these daily input data to HEC-5Q were derived for the 82 years (1921-2003) as water temperature and many of the meteorological variables rarely had records back to 1921. The uncertainty of input data may substantially affect the uncertainty of water temperature output. NMFS 24

Assuming that the monthly flow data from CalSim II were used as input to HEC-5Q, which requires daily data, please explain how the monthly flow data from CalSim II were disaggregated to daily flow data as input to HEC-5Q. NMFS 25

3.5 Salmon Mortality Model

The salmon mortality model, which was developed in the mid-1990s, used daily water temperature data to simulate egg mortality based on egg survival-temperature relationships specified in the model. In the DEIS analyses, daily water temperatures were derived from HEC-5Q and the final output from the mortality model was the annual percent mortality. NMFS 26

Has the salmon mortality model been calibrated? If so, please provide a summary of the calibration process and results.

It is unclear what relationships between egg mortality (or survival) and water temperature were used in the salmon mortality model. Please provide those relationships in a table. Do the relationships used in the model represent the best science available? NMFS 27

3.6 Annual Juvenile Production and Mortality Model: SALMOD

The SALMOD model was used to generate annual juvenile production and mortality for fall-run, late fall-run, spring-run, and winter-run Chinook salmon within the Sacramento River from below Keswick Dam to the Red Bluff Diversion Dam. Was SALMOD, as applied to the Sacramento River in the DEIS, calibrated? If so, please provide a summary of the calibration process and results. NMFS 28

3.7 Winter-run Chinook Salmon Annual Abundance Model: OBAN

The Oncorhynchus Bayesian Analysis (OBAN) is a regression model based on the relationship between the historical winter-run annual abundance (adults or juveniles) and explanatory variables. The explanatory variables include streamflow (monthly), water temperature, Yolo Bypass flow, water export, striped bass abundance, wind stress curl index, and harvest. OBAN uses the Akaike Information Criterion (AIC) to evaluate the best possible set of exploratory variables to predict winter-run abundance. The model has been established using the observed NMFS 29 data for escapement from 1967 to 2008 and for juvenile production from 1995 to 1999 and 2002 to 2007 (Hendrix 2013). However, it is unclear for what years the predicted winter-run abundance was generated in the DEIS analyses. Please clarify. NMFS 29 continued

3.8 Winter-run Chinook Salmon Annual Egg Survival and Escapement Model: IOS

The interactive object-oriented salmon simulation (IOS) model simulates the entire life cycle of winter-run Chinook salmon through successive generations. The model requires daily input data for flow, water temperature, and water export to produce the output – winter-run escapement and egg survival. Was this model, as applied to the winter-run in the DEIS, calibrated? If so, please provide a summary of the calibration process and results. NMFS 30

3.9 Delta Juvenile Survival Model: DPM

The Delta Passage Model (DPM) was used to simulate survival through the Delta of winter-run, fall-run, and late fall-run Chinook salmon. The DPM used limited study results based on late fall-run smolts to represent the relationships between daily flows or exports and juvenile survival rates in the Delta. Was there any uncertainty analysis for the model as applied to the winter-run in the DEIS? If so, please provide a summary of the analysis and results. NMFS 31

3.10 Evaluation of Comparative Differences when Model Accuracy Is Unknown

The accuracy or uncertainty of a model is closely related to comparative results, from which a conclusion of whether or not there is a meaningful difference between two alternatives is drawn. Assuming there were two alternatives - one had an output flow of 100 cfs and the other had 110 cfs, the relative difference was 10 percent. If the model used had a 5 percent error, it may reasonably conclude that the 10 percent difference reflects a meaningful difference and may be statistically significant (Figure A below). However, if the model used had a 40 percent error, it may reasonably conclude that the 10 percent difference may not indicate a meaningful difference and may not be statistically significant (Figure B below). NMFS 32

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NMFS 32 continued

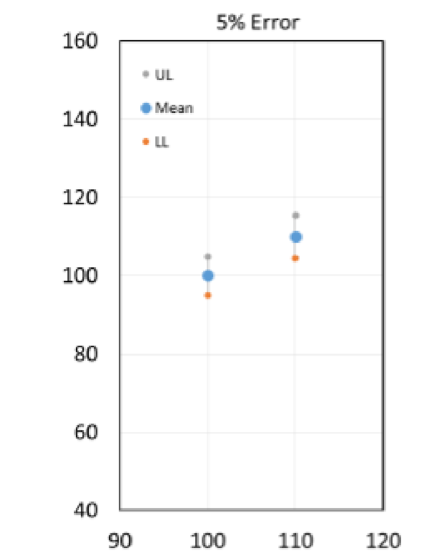

Figure A. Comparing two alternatives using model output with the model error of 5 percent

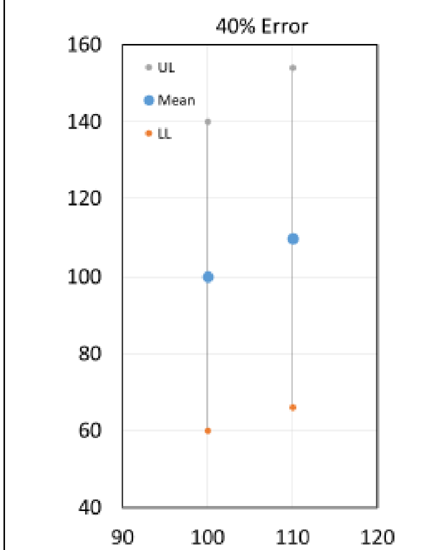

Figure B. Comparing two alternatives using model output with the model error of 40 percent

Since the uncertainty of many models used in the DEIS is unknown, it is reasonable to consider the common realization for evaluating model performance (Table 1). The values in the table attempt to provide some general guidance, in terms of the percent mean errors or differences between simulated and observed values, so that users can gage what level of agreement or accuracy (*i.e.* excellent, good, fair, or poor) may be expected from the model application. The values shown in Table 1 have been derived primarily from Hydrological Simulation Program – Fortran (HSPF) experience and past efforts on model performance criteria; however, they do reflect common tolerances accepted by many modeling professionals (Duda *et al.* 2012).

Table 1. General tolerance ranges (*i.e.*, percent mean errors) for assessing hydrologic and water quality model performance

Variable	Percent Difference Between Simulated and Observed Values			
	Excellent	Good	Fair	Poor
Hydrology/Flow	< 10	10 - 15	16 - 25	> 25
Sediment	< 20	20 - 30	31 - 45	> 45
Water Temperature	< 7	8 - 12	13 - 18	> 18
Water Quality/Nutrients	< 15	15 - 25	26 - 35	> 35
Pesticides/Toxics	< 20	20 - 30	31 - 40	> 40

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We recommend that these recognized model uncertainties be considered in setting thresholds for the relative difference in comparing two alternatives. It should be acknowledged that the output errors for biological models would be expected to be higher than those for physical variables, as biological variables such as escapement or juvenile production are more variable and unpredictable than physical variables. For these reasons, it may need to be improved for the comparative difference of 5 percent for physical variables and 1 percent for biological variables, as stated in the DEIS. NMFS 32 continued

3.11 Error Propagation in the Tiered Modeling Approach

As described in the DEIS, CalSim II modeling results were used as input to DSM2 to find hydrodynamic conditions in the Delta. CalSim II results were also used in water temperature models. Modeled flows and water temperatures were then used as inputs to biological models to assess the effects of alternatives on listed species. In this cascade modeling approach, uncertainties, which never cancel out, will be compounded and propagate, resulting in greater uncertainties. Pijanowski *et al*. (2011) examined how land-use errors from a land change model propagate through to climate (rainfall, temperature, etc.) as simulated by a regional atmospheric model. Results indicate that small errors from the land change model could grow as a "coupling drift" if both were used to forecast into the future; these couplings could create larger combined errors of land–climate interactions. There was no assessment of the propagation of uncertainties from the tiered modeling approach. Error propagation in the modeling approach should be discussed in the EIS. NMFS 33

4 Alternatives in the DEIS

4.1 Not All RPA Actions Were Included in CalSim II for the NAA

The DEIS states that the NAA assumed the full implementation of all RPA actions as described in NMFS 2009 BO. However, many RPA actions were not included in CalSim II for the NAA, resulting in substantial deviations from what should occur under the true NAA. For example, the DEIS states: "For Action I.2.1, which calls for a percentage of years that meet certain specified end-of-September and end-of-April storage and temperature criteria resulting from the operation of Lake Shasta, no specific CalSim II modeling code is implemented to simulate the performance measures identified" (page 5A-9). RPA Action I.1.2, which called for channel maintenance flows in Clear Creek, was not included in CalSim II under the NAA. We think that many water temperature related RPA actions in Clear Creek, Sacramento River, American River, and Stanislaus River, which called for additional coldwater releases from reservoirs to meet specific water temperature requirements, were not included in the NAA because water temperature requirements cannot be represented directly in CalSim II. Therefore, the relative comparisons between the NAA and other alternatives may underestimate the true differences between them. This may be one of the causes that resulted in no difference in most modeling results between the NAA and SBC, as detailed in sections 5, 6, and 7. NMFS 34

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4.2 Proposed San Joaquin River Juvenile Trap and Haul Program

Alternatives 3 and 4 included a proposed trap and haul program for juvenile salmonids entering the Delta from the San Joaquin River. The trap and haul method is intended to assist the migration of juvenile Chinook salmon and steelhead, and hopefully to increase survival rates during their migration through the Delta. However, this method will have unintended consequences for fish populations, which may include altered adult behaviors such as reduced homing, increased straying, and fallback downstream, thereby reducing their survivorship and altering adaptations in the wild. For example, when compared to fish that migrated naturally, transported juveniles had lower survivorship as adults and were less likely to find their way home (Keefer *et al.* 2008). Transported fish are more likely to stray from their home tributary. Alteration of adult homing behavior can have important fitness consequences, and may additionally affect non-target populations when adults enter and breed in non-natal streams. If these lost fish breed with another wild population, the resulting gene flow can reduce that population's evolutionary fitness (Keefer *et al.* 2008). Straying may reduce fitness of wild endemic populations in the short term and is particularly problematic for relatively small wild populations (*e.g.*, steelhead populations in the San Joaquin River basin) currently at moderate to high risk of extinction (Lindley *et al.* 2007). While transportation of juveniles may have short-term juvenile survival benefits, the delayed effects that manifest in adult stages illustrate the need to fully evaluate the success of a trap and haul program throughout the life cycle of salmon and steelhead. In addition to biological concerns regarding a trap and haul program, Reclamation should ensure that a trap and haul program is technologically feasible. For example, what frequency of trapping and hauling, and from which tributaries, would Reclamation need to implement on an annual basis, and how would Reclamation evaluate the success (or lack thereof) of a trap and haul program? Note that NMFS submitted this comment to Reclamation through its July 22, 2015, letter. NMFS 35

4.3 Proposed Salmon Harvest Restrictions

Alternative 4 included by-catch limits of winter-run. As a result of a jeopardy conclusion and associated RPA, NMFS developed and implemented a fisheries management framework for reducing the impact of ocean salmon fishery on winter-run for the Pacific Coast Salmon Fishery Management Plan (National Marine Fisheries Service 2012). The framework consists of two components. The first component specifies that the previous standards for winter-run regarding minimum size limits and seasonal windows south of Point Arena for both the commercial and recreational fisheries will continue to remain in effect at all times regardless of abundance estimates or impact rate limit. The second component is based on the population status of winter-run where, during periods of relatively low abundance, the proposed structure of fishing management measures each year for winter-run south of Point Arena must be equal to or less than the maximum allowable impact rate (MAIR) specified annually. The fishery control rule and tiered approach for managing winter-run impacts in the ocean salmon fishery include: (1) if the geometric mean of the most recent 3 years of spawning return estimates is less than 500, the MAIR is zero percent; and (2) if the geometric mean of the most recent 3 years of spawning return estimates is between 500 and 4,000, the MAIR is between 10 percent and 20 percent, increasing linearly. NMFS is concerned that Alternative 4 proposes a minimum bycatch limit that may preclude the fishery control rule, and therefore ocean harvest management and its NMFS 36

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associated ESA section 7 consultation, including the RPA, from being implemented during years of low winter-run abundance. Note that NMFS submitted this comment to Reclamation through its July 22, 2015, letter. NMFS 36 continued

5 Hydrologic Analyses in the DEIS

Due to time constraints, our review is focused on differences in streamflow, reservoir storage, water export, and OMR flow between the NAA and SBC. Our comments may be applicable to other alternative comparisons in the DEIS. NMFS 37

5.1 Reservoir Storage

Shasta Reservoir is used as an example for examining reservoir storage. As presented in the DEIS "Table 5.13 Changes in Shasta Lake Storage under the NAA as Compared to the SBC," Shasta Reservoir storage was higher under the SBC than that under the NAA. However, most of the percent changes were less than 10 percent, except for August and September in critically dry years. The percent change was about 14 percent for these two months in critically dry years. For critically dry years such as 2014 and 2015, implementing RPA Action Suite I.2 and other management measures would increase the end-of-September reservoir storage under the NAA, but CalSim II did not include those RPA actions or management measures under those critically dry circumstances. NMFS 38

The DEIS did not analyze the Whiskeytown Reservoir storage. We recommend that this analysis be included in the EIS. NMFS 39

5.2 Streamflow

Clear Creek and the Sacramento River are used as examples to examine streamflow. Our comments may be applicable to other streams such as American River, Stanislaus River, and others in the Central Valley. NMFS 40

Monthly Clear Creek flows from the CalSim II simulations under the NAA were identical to those under the SBC except in May. In May, the NAA flows were higher by 28-41 percent compared to the SBC flows (Table 5.19). It is unclear what caused the difference in May or similarity in other months. It could result from assumptions used in CalSim II, which is also unclear as discussed in section 3.2.4. If the higher streamflow in May were caused by pulse flows implemented through RPA Action I.1.1, it would also have been reflected in the streamflow in June when pulse flows were also implemented. In addition, the implementation of RPA Action I.1.5 should have increased streamflows under the NAA as compared to the SBC in September and October. However, they were identical from the CalSim II simulated flows. All of these inconsistencies may indicate the limitations of CalSim II to capture the real-time decisions or components that cannot be incorporated into the model, which could result in misinformation for simulated water temperatures, particularly in September and October for spawning and egg incubation of spring-run Chinook salmon in Clear Creek, while comparing egg mortality between the NAA and SBC. Based on the CalSim II simulated streamflow in September and October, water temperature and egg mortality would be similar between the NAA

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NMFS 40 continued

and SBC. Indeed, the simulated water temperatures were identical as discussed in section 6.2, leading to identical egg mortality between the NAA and SBC in Clear Creek. This is contradictory to what would happen in Clear Creek. We expect that the actual egg mortality would be lower under the NAA (when RPA Actions I.1.1 and I.1.5 are implemented) as compared to the SBC (when no RPA actions are implemented).

NMFS 41

The CalSim II simulated flows for the Sacramento River at Keswick Dam showed meaningful differences only in September for wet or above normal years and in November for all water years except critically dry years. In these cases, the flows under the NAA were higher than those under the SBC, with differences ranging from 21 percent to 33 percent in November and from 48 percent to 78 percent in September. For all other cases, the flows under the NAA were either similar to or lower than those under the SBC. These results seemed contradictory to the expected outcome between implementation and non-implementation of the RPA actions. For example, if RPA Action Suite I.2 were implemented, flows in the Sacramento River would be expected to be higher than those without implementation of the Action Suite, particularly during the months of July to October in drier years.

5.3 Water Exports at the Federal and State Pumping Facilities

NMFS 42

While considering water exports on an annual basis instead of a monthly basis, the average percent difference between the NAA and SBC was 19 percent with a range of 15 percent to 22 percent among water year types. Water exports under the SBC, as compared to the NAA, was increased by about 30 percent in January and February and about 50 percent in April and May. The CalSim II simulated water exports under the SBC were 7.1 million acre feet (MAF) for wet water years and 6.6 MAF for above normal water years. These high-level water exports rarely occurred in the past. Are these high water exports expected to occur in the future?

5.4 Old and Middle Rivers Flow

NMFS 43

The simulated Old and Middle Rivers flows (OMR flows) (absolute values) under the SBC, as compared to the NAA, were increased by about 45 percent in January and February, and by more than 100 percent in April and May. The difference in the simulated OMR flows between the NAA and SBC was about 6,000 cfs in April and May, changing from positive 1,000 cfs under the NAA to negative 5,000 cfs under the SBC. These substantial differences apparently resulted from much higher water exports under the SBC than the NAA and would be indicative of potentially high entrainment of juvenile fish by the water export facilities under the SBC.

6 Water Temperature Analyses in the DEIS

6.1 Water Temperature Objectives

NMFS 44

Water temperature objectives used in the DEIS (Table 9.3) are inconsistent for the same life stages of salmonids. For example, for spring-run Chinook salmon holding, it was 60 °F in the Trinity River, but 56 °F in Clear Creek; for Chinook salmon and steelhead spawning and egg incubation, it was 56 °F in the Trinity River, but 63 °F in Clear Creek; for steelhead juvenile rearing, there were 56 °F, 63 °F, and 65 °F presented in the DEIS Table 9.3. Some of the water

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temperature objectives used in the DEIS (Table 9.3) are also inconsistent with the EPA recommended water temperature criteria for salmonids. The EPA (2013) recommends 56 °F (13 °C) for adult holding, spawning, egg incubation, and fry emergence; 61 °F (16 °C) for juvenile rearing in the upper reaches of a river and 64 °F (18 °C) in the lower reaches (U.S. Environmental Protection Agency 2003). The EPA criteria for salmonids are considered the best available science (National Marine Fisheries Service 2010) and should be used in the EIS. NMFS 44 continued

6.2 Simulated Water Temperature in Clear Creek

It is not surprising that the HEC-5Q simulated water temperature in Clear Creek was identical between the NAA and SBC except for May because it was based on the CalSim II simulated flow. However, even in May, the difference was only 0.6 °F on average, accounting for 1.2 percent difference. This small difference could be caused most likely by the modeling error of the water temperature models used in the DEIS. NMFS 45

The simulated water temperature in Clear Creek rarely exceeded 56 °F - the water temperature criterion for spawning and egg incubation. On the contrary, the measured daily average water temperatures in Clear Creek exceeded 56 °F for 29 days in July, 30 days in August, and 21 days in September from 1997 to 2013 (17 years). This discrepancy between the simulated and measured water temperatures indicates, again, the ill-representation of the modeling processes used in the DEIS. NMFS 46

6.3 Simulated Water Temperature in the Sacramento River

The DEIS concluded that "Overall, the temperature differences between the No Action Alternative and Second Basis of Comparison would be relatively minor (less than 0.5°F) and likely would have little effect on winter-run Chinook Salmon in the Sacramento River" (page 9-159); and "Temperature conditions under the No Action Alternative could be more likely to affect winter-run Chinook Salmon spawning than under the Second Basis of Comparison because of the increased frequency of exceedance of the 56°F threshold from April through August" (page 9-160). This is contradictory to the expected outcome from implementation of the RPA actions. If the RPA Action Suite I.2, including Action I.2.4, were implemented under the NAA, water temperatures between Balls Ferry and Bend Bridge would be lower under the NAA than those under the SBC and would not be in excess of 56 °F from mid-May through September under the NAA. NMFS 47

7 Listed Species Analyses in the DEIS

We used winter-run Chinook salmon as an example to examine the species analyses in the DEIS. Our comments may be applicable to other listed salmonid species analyzed in the DEIS. NMFS 48

7.1 Winter-run Chinook Salmon Escapement

Based on the OBAN model results, the DEIS concluded that "Escapement was generally higher under the No Action Alternative as compared to the Second Basis alternative (Appendix 9I). The median abundance under the No Action Alternative was higher in 19 of the 22 years of NMFS 49

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simulation (1971 to 2002), and there was typically greater than a 25 percent chance that the No Action Alternative values would be greater than under the Second Basis of Comparison (page 9-162). On the contrary, the IOS model, with simulation of 82 years, showed similar escapement results between the NAA and SBC. The median winter-run adult escapement was 3,935 under the NAA and 4,042 under the SBC. Please explain why these two models had very different results. NMFS 49 continued

7.2 Winter-run Chinook Salmon Egg Mortality

The Egg Mortality Model results (Appendix 9C, Table B-4) indicated that the average winter-run egg mortality under the NAA (5.0 percent) was similar to that under the SBC (4.3 percent). The egg mortality was less than 1 percent except for critically dry years. In critically dry years, the egg mortality rate under the NAA was 31.4 percent comparable to 26.0 percent under the SBC. On the contrary, the IOS model indicated much lower overall egg mortality. The IOS median egg mortality was 1.0 percent under the NAA and 1.3 percent under the SBC (page 9-162). These simulated egg mortality results seem too low to be real. NMFS 50

The DEIS concluded, based on SALMOD, that the temperature-related egg mortality was 20 percent higher under the NAA than that under the SBC (page 9-161). Please explain why the NAA resulted in egg mortality rates higher than the SBC. The EIS should also discuss how to interpret these contradictory modeling results in making decisions. NMFS 51

7.3 Winter-run Chinook Salmon Juvenile Mortality in the Sacramento River

Based on the SALMOD results, both temperature- and flow (habitat)-related fry mortality was approximately 19 to 21 percent higher under the NAA as compared to the SBC. The temperature-related juvenile mortality was approximately 17 percent higher under the NAA than that under the SBC (page 9-161). Please explain why the NAA resulted in juvenile mortality higher than the SBC. NMFS 52

7.4 Winter-run Chinook Salmon Juvenile Production

Based on the SALMOD results, the DEIS concluded that "[o]verall, potential juvenile production would [be] the same under the No Action Alternative as compared to the Second Basis of Comparison (Appendix 9D)" (page 9-162). These model results are contradictory to the expected outcome from the NAA (implementation of all RPA actions) as opposed to the SBC (non-implementation of the RPA actions). No OBAN model results for juvenile production were presented in the DEIS. NMFS 53

7.5 Winter-run Chinook Salmon Juvenile Entrainment to the Central and South Delta

Winter-run juvenile entrainment to the Central Delta through Georgiana Slough was similar under the NAA and SBC during January, February, and March when winter-run juveniles are most abundant in the Delta. Winter-run juvenile entrainment to South Delta through Turner Cut, NMFS 54

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Columbia Cut, the Middle River, and the Old River was similar under the NAA and SBC (page 9-163). This is contradictory to the conclusion for winter-run juvenile salvage as discussed in section 7.6. NMFS 54 continued

7.6 Winter-run Chinook Salmon Juvenile Salvage at the Federal and State Fish Collection Facilities

Model results indicated a substantially reduced fraction of winter-run juveniles salvaged under the NAA comparing to the SBC in January and February. This is consistent with simulated water exports and OMR flows as discussed in sections 5.3 and 5.4, respectively, but inconsistent with the simulated juvenile entrainment as discussed in section 7.5. NMFS 55

7.7 Winter-run Chinook Salmon Juvenile Survival through the Delta

The simulated Delta survival rates for winter-run juveniles, based on the OBAN results, ranged from 0.005 to 0.013 for all the alternatives (Figure 9I.9 Delta Survival under the Alternatives and Second Basis of Comparison). It was about 12 percent higher under the NAA as compared to the SBC. However, the simulated Delta survival rate, based on the DPM results, was 0.349 for the NAA and 0.352 for the SBC. The DPM results are contradictory to the recent study results based on a newly developed life cycle model for Central Valley Chinook salmon (Cunningham *et al.* 2015). Cunningham *et al.* (2015) found that higher water export rates lead to reduced survival for Sacramento River Chinook salmon. They estimated that increasing exports by 30 percent above the 1967-2010 average would result in a 39-59 percent reduction in median survival for spring-run Chinook salmon. While results indicated that winter-run survival would be minimally influenced by a 30 percent increase or reduction in future exports, the zero export scenario was predicted to increase survival by 28-91 percent, most appreciably when combined with a cooler and wetter future climate change scenario and positive future marine conditions. Changes to juvenile routing may provide a reasonable explanation for the estimated survival influence of Delta water exports. Higher exports result in greater water diversion into the interior delta where survival has been observed to be substantially lower than that in the Sacramento River mainstem (Perry and Skalski 2010, Perry *et al.* 2013), potentially resulting from an increased encounter rate with predators or prolonged residence in areas with suboptimal feeding opportunities or dissolved oxygen (DO) concentrations. NMFS 56

The following statement is confusing: "The differences in survival, although not consistent across the uncertainty in the parameter values, suggest a high probability of <u>no difference</u> between these two bases of comparison" (page 9-162). Please clarify why there would be no difference when the results showed higher survival rates under the NAA than those under the SBC. NMFS 57

8 Significance of Streamflow and Water Temperature for Salmonids

As discussed in section 7, above, simulated escapement, egg survival, and juvenile production, survival, and entrainment for winter-run under the NAA are either similar to or worse than those under the SBC except for the OBAN model results. The OBAN results indicated higher escapement and higher survival under the NAA than those under the SBC. Considering the fact NMFS 58

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that the NAA represents the full implementation of the NMFS 2009 BO and RPA actions, which were developed for improving the survival, growth, and productivity of listed salmonid species by a suite of measures, including appropriate streamflow and water temperature for the listed salmonids, the simulated results and conclusions derived from those results are contradictory to the overwhelmingly recognized significance of managing flow and water temperature for salmonid species. Provided below is a review of published literature on the importance of streamflow and water temperature for salmonids. The review is not meant to be inclusive, but to reflect the collective science of these two major determinants of energetics and metabolism of stream fishes with consequent strong influences on their survival, growth, and fitness. We recommend that Reclamation consider the scientific data and information provided below to reassess: (1) streamflow and water temperature under the full implementation of the NMFS 2009 BO and RPA, and (2) impacts on listed salmonid species if no RPA is implemented.

NMFS 58 continued

NMFS 59

8.1 Streamflow

Streamflow has been deemed a "master variable." It strongly influences fish and the food web, and it has substantial effects on spawning and rearing habitat quality and availability because of its influence on sediment transport, channel morphology, and streambed substrate characteristics (Poff *et al.* 1997, Trush *et al.* 2000, Bunn and Arthington 2002, Richter 2008, Brown and Bauer 2009, Poff *et al.* 2010, Poff and Zimmerman 2010, Malcolm *et al.* 2012, Richter *et al.* 2012, Webb *et al.* 2013). Zeug *et al.* (2010) found that flow alteration below a dam, compared to habitat loss, was a stronger predictor of extirpation of spring-run Chinook salmon in the Central Valley. The analysis of post-project flow changes suggests that water operations reduced stream flows during a critical period when adult spring-run Chinook salmon were migrating upstream. This substantial change may have contributed to their extirpation because adult spring-run Chinook salmon migration coincides with periods of peak flows or the declining limb of high-flow periods in the pre-project period (Zeug *et al.* 2010).

Numerous studies have revealed that altered flows impact the communities of fish, macroinvertebrate, and riparian vegetation (Nelson and Lieberman 2002, Brown and Bauer 2009, Poff and Zimmerman 2010, Carlisle *et al.* 2011, Kiernan *et al.* 2012, Webb *et al.* 2013). Poff and Zimmerman (2010) reviewed a total of 165 papers that studied flow alteration in terms of magnitude, frequency, duration, timing, and rate of change and their impacts to aquatic biology characterized by taxonomic identity (fish, macroinvertebrate, and riparian vegetation) and type of responses (abundance, diversity, and demographic parameters). They found that 152 papers (92 percent) reported decreased abundance, diversity, or demographic parameters of fish, macroinvertebrate, or riparian vegetation in response to a variety of types of flow alteration (decreased magnitude, duration, or frequency of peak or high flows), whereas 21 papers (13 percent) reported increased values, and these often reflected shifts in ecological organization such as increases in non-native species or non-woody plant cover on dewatered floodplains.

Carlisle *et al.* (2011) assessed flow alteration at 2,888 streamflow monitoring sites throughout the conterminous United States. The magnitudes of mean annual (1980–2007) minimum and maximum streamflows were found to have been altered in 86 percent of assessed streams.

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Biological assessments conducted on a subset of these streams showed that, relative to eight chemical and physical covariates, diminished flow magnitudes were the primary predictor of biological integrity for fish and macroinvertebrate communities, and the likelihood of biological impairment doubled with increasing severity of diminished streamflows. Among streams with diminished flow magnitudes, increasingly common fish and macroinvertebrate taxa possessed traits characteristic of lentic habitats, including a preference for fine-grained substrates and slow-moving currents, as well as the ability to temporarily leave the aquatic environment. Biological impairment was observed in some sites with hydrologic alteration of 0-25 percent (the lowest class of alteration assessed) and in an increasing percentage of sites beyond 25 percent hydrologic alteration.

Richter *et al.* (2012) concluded that daily flow alterations no greater than 10 percent will provide a high level of ecological protection; a high level of protection means that the natural structure and function of the riverine ecosystem will be maintained with minimal changes. Daily flow alterations by 11–20 percent will provide a moderate level of protection; a moderate level of protection means that there may be measurable changes in structure and minimal changes in ecosystem functions. Alterations greater than 20 percent will likely result in moderate to major changes in natural structure and ecosystem functions, with greater risk associated with greater levels of alteration in daily flows (Richter *et al.* 2012).

It has generally been recognized that streamflow influences adult immigration from estuarine environments to main rivers and from main rivers to spawning tributaries (Arthaud *et al.* 2010, Marston *et al.* 2012, Nislow and Armstrong 2012). The latter phase, referred to as the spawning migration, is best treated as part of the spawning process, as it involves the movement to specific spawning locations, often incorporating a search phase that may include both upstream and downstream movements, which are thought to relate to fish selecting a suitable redd location, finding a potential mate, and locating a safe position to spend time until spawning. Nislow and Armstrong (2012) concluded that adult abundance was correlated to daily flows during the spawning migration period. The timing of spawner arrival was found to be a function of flow regime type and, in particular, antecedent hydrological conditions during the pre-spawning period. In wet years, fish entered the stream early in the season and at a consistent rate throughout the spawning period. In dry years, they entered later and often on the back of relatively small increments in flow, increments which in wet years did not stimulate significant arrivals. In years with high mean annual flows, fish migrated further up the stream, resulting in a more even spread of spawning activity. They speculated that low flow conditions at spawning time may, therefore, affect production through a reduction in total adult numbers (Nislow and Armstrong 2012).

Salmonids spawn in areas with specific hydraulic and sedimentary characteristics. Sedimentary conditions are generally considered to be of primary importance, with flow (via its influence on velocity and depth) determining whether conditions over spawning gravels are conducive to spawning. Spawning tends to occur at relatively high flows. Most spawning takes place at flows greater than (2.0–2.4 times) the median flow. Fish spawning in the upper parts of the stream select relatively higher velocities than those in lower parts. Salmonids tend to avoid periods of rapidly varying flows, indicating that rates of flow change need to be considered when developing instream flows for water resources management (Nislow and Armstrong 2012).

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Flows also have a major influence on the growth and survival of juveniles (including fry, parr, and smolt) (Arthaud *et al.* 2010, Nislow and Armstrong 2012, Zeug *et al.* 2014, Michel *et al.* 2015). Michel *et al.* (2015) estimated the outmigration survival of acoustic tagged hatchery-origin late fall-run Chinook salmon smolts for 5 years (2007-2011) using a receiver array spanning the entire outmigration corridor, from the upper Sacramento River, through the estuary, and into the coastal ocean. The first 4 years of releases occurred during below-average streamflows, while the 5th year (2011) occurred during above-average flows. The overall outmigration survival in 2011 was two to five times higher than survival in the other 4 years. The higher survival in the high-discharge year (2011) was due mainly to increased survival in the river region, indicating the importance of streamflow for juvenile survival (Michel *et al.* 2015).

Stream flows in the lower Stanislaus River were a significant driver of the survival, migration, and size of juvenile fall-run Chinook salmon. Greater cumulative flow and flow variability during the out-migration season (from mid-January to late May) promoted higher juvenile survival, higher proportion of pre-smolt migrants, and larger size of smolts (Zeug *et al.* 2014). In a regulated stream in the Salmon River in Idaho, spring stream flows exhibited strong correlations with egg-to-juvenile and egg-to-adult survival rates for spring-run Chinook salmon and were consistently a better predictor of productivity than late summer stream flows. High flows during early rearing were the single best predictor of egg–to-juvenile survival rates (Arthaud *et al.* 2010). Decreased flow magnitude was generally associated with lower growth rates, resulting in 24–50 percent decreases in the size of juvenile salmon and trout under low-flow conditions (Nislow and Armstrong 2012). Smolt migration appears to be highly tuned to characteristics of natural flow regimes. Generally, most smolts outmigrate during the descending limb of the spring hydrograph, and flow is a co-trigger along with temperature and day length initiating migration. Flows must be of sufficient magnitude to aid downstream migration (which to some extent is a passive process), and there is evidence that speed of migration is dependent on flow, with higher flows leading to more rapid downstream migration. Migration speed appears to be a critical determinant of successful migration for smolts. Examples from both Pacific and Atlantic salmonid species have demonstrated that low flows during smolt migration are associated with low smolt survival. This is likely due to several mechanisms. Delays may increase vulnerability to within-river predators. Migratory delays may also cause smolts to lose the physiological and behavioral characteristics that prepare them for life in seawater, as retention of these characteristics has been shown to be time- and temperature-dependent (McCormick *et al.* 1999, Nislow and Armstrong 2012).

Studies have indicated that stream flows impact invertebrate assemblages, which in turn influence the food availability for juvenile salmonids. Yarnell *et al.* (2013) found differences in both benthic macroinvertebrate diversity and density between regulated and unregulated rivers in the Central Valley. Study sites in the unregulated rivers exhibited the highest diversity in hydraulic habitat in space and time and the highest diversity in primary productivity. Conversely, the study sites with the most altered flow regimes exhibited the lowest and least consistent hydraulic diversity and the lowest diversity in primary productivity. These differences between unregulated and altered study sites were observed in both study years, regardless of water year type. For the American River watershed, a positively-correlated relationship occurred

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between the hydraulic diversity and the Ephemeroptera (mayflies)-Plecoptera (stoneflies)-Trichoptera (caddisflies) (EPT) index. The relationship suggests diverse hydraulic niches support diverse benthic macroinvertebrate assemblages (Yarnell *et al.* 2013).

8.2 Water Temperature

Water temperature is an important water quality component because of its enormous significance for all freshwater organisms (McCullough 1999, U.S. Environmental Protection Agency 2003, McCullough *et al.* 2009) and its influence on other aspects of water quality, such as DO solute and pollutant fluxes, toxicity of pollutants, nutrient concentrations, and organic matter and suspended sediment concentrations (Caissie 2006, Webb *et al.* 2008, Olden and Naiman 2010). Water temperature affects the distribution, health, and survival of native salmonids and other aquatic organisms by influencing their physiology and behavior. Water temperature, along with adequate flow, food, oxygen, shelter, and other resources, determines habitat suitability for each species. While community composition is shaped by numerous habitat components, each of which can provide optimal or suboptimal conditions, water temperature is an important aspect of habitat quality. Furthermore, water temperature acts synergistically with other environmental stressors, thereby affecting the ability of individual fish to survive and reproduce, and affecting salmonid population viability.

Salmonid response to water temperatures may be described as lethal, sublethal, and optimal. High water temperatures can pose lethal or sublethal impacts to salmonids at all life stages, including adult migration, pre-spawn holding, spawning, egg incubation, fry emergence, and juvenile rearing and outmigration (McCullough 1999, Poole and Berman 2001, U.S. Environmental Protection Agency 2003, Poole *et al.* 2004, Richter and Kolmes 2005, Jonsson and Jonsson 2009, McCullough *et al.* 2009). Lethal temperatures are those that cause direct mortality. The embryo survival rate for Chinook salmon showed a sharp increase from 2 °C (35.6 °F) to 5 °C (41.0 °F), remained high from 5 °C (41.0 °F) to 13 °C (55.4 °F), and decreased drastically with water temperatures above 13 °C (55.4 °F). The alevin survival rate for Chinook salmon was > 0.9 from 2 °C (35.6 °F) to 14 °C (57.2 °F) and then decreased sharply with water temperatures above 14 °C (57.2 °F) (Velsen 1987, Beacham and Murray 1990). There are temperatures that may not cause mortality to embryos, however, alevins developed in temperatures above 13 °C (55.4 °F) may be subject to higher mortality at the next developmental stage (McCullough 1999).

Sublethal effects affect the distribution, physiology, and behavior of salmonids that may result in higher mortality of the individuals of later life stages. Lethal temperatures may occur in nature and can be locally problematic, but temperatures in the range where sublethal effects occur are widespread and may have the greatest effect on the overall well-being of salmonids (U.S. Environmental Protection Agency 2001). Exposure to water temperatures in the sublethal range results in increased severity of harmful effects, such as decreased juvenile growth that results in smaller fish more vulnerable to predation; increased susceptibility to disease that can lead to mortality, affecting reproduction, inhibiting smoltification; and decreased ability to compete (U.S. Environmental Protection Agency 2003, Richter and Kolmes 2005, Jonsson and Jonsson 2009, McCullough *et al.* 2009). All of these responses, even those not resulting in immediate

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death, can lead to mortality prior to reproduction or reduced fecundity. These impacts would result in reduced productivity of a stock and reduced population size.

Adult fish holding in warm water experience bioenergetics stress and consume their stored energy more rapidly, which may result in reduced spawning success. Prolonged holding in sub-optimal temperatures can result in multiple stresses, such as concurrent thermal stress, disease, and energy depletion. Thermal stress experienced while fish are holding can decrease gamete viability (U.S. Environmental Protection Agency 2001). Warm water can also present thermal barriers to adult and juvenile migration. If enough fish are affected, salmonid population viability may be reduced.

Warm temperatures can alter juvenile growth and development, water quality (*e.g.*, DO), resistance to disease, competitive ability, swimming speed, and predator avoidance (McCullough 1999, Poole and Berman 2001, U.S. Environmental Protection Agency 2001, Richter and Kolmes 2005). Juvenile growth increases with an increase in temperature to an optimum, at which point growth is maximized. This is followed by a rapid decline in growth rate as temperatures increase further. The optimum temperature for growth is dependent on the availability of food. At ration levels lower than the maximum, the optimal temperature for growth is reduced because of the effects of temperature on metabolic rates and the subsequent maintenance metabolic demands for energy inputs (Brett *et al.* 1982). Zeug *et al.* (2014) found a negative relationship between fall-run Chinook salmon smolt size and water temperature in the Stanislaus River. The Stanislaus River is located near the southern range limit of Chinook salmon spawning where water temperatures have frequently exceeded the water temperature criteria for the species.

The DO concentration decreases with increasing water temperature. When fish experience temperature stress, they may also experience some stress from low DO levels. McCullough (1999) concluded that adult migration of Chinook salmon can be impeded when water temperature and DO requirements are not met. Warmer water temperatures often increase the infection rate or virulence of fish pathogens and lessen the ability of a fish to withstand disease. Many important salmonid diseases become virulent above approximately 15.6-16 °C (60.1-60.8 °F) (Richter and Kolmes 2005). Water temperature may also impact food availability, feeding rates, and metabolism (McCullough *et al.* 2009). In addition, water temperature influences the abundance and well-being of organisms by controlling their metabolic processes.

It appears obvious that a single exceedance of a maximum temperature threshold of an extreme magnitude would be sufficient to instantaneously eliminate a species in a particular reach, assuming no coldwater refugia were available and upstream migration was not efficient. However, for less extreme maxima, the cumulative effects of consecutive days of maxima exceeding critical limits may produce negative biological responses, such as cumulative stress leading to death, disease, poor reproductive success, or poor growth. The stressful impacts of water temperatures on salmonids are cumulative and positively correlated to the duration and severity of exposure. The longer a salmonid is exposed to thermal stress, the less chance it has for long-term survival (U.S. Environmental Protection Agency 2001). All these responses, even those not resulting in immediate death, can lead to mortality prior to reproduction or reduced fecundity. There were studies of the influence of cumulative exposure to adverse high

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temperatures in a fluctuating regime in which mortality results from successive thermal cycles. These studies demonstrated that, although a single thermal cycle was not sufficient to produce mortality, accumulated stress from consecutive thermal cycles resulted in mortality. In addition to the seasonal probability of consecutive days of critical maxima, consecutive years with serious cumulative thermal effects over significant portions of a species' range for one or more life stages can lead to dramatic reduction in stock viability (McCullough 1999).

It may be possible for healthy fish populations to endure some of these sublethal, chronic impacts with little appreciable loss in population size. However, for vulnerable fish populations such as the endangered or threatened salmonids of the Central Valley, these sublethal effects can reduce the overall health and size of the population, making the survival and eventual recovery of these listed species more uncertain. It is essential to provide optimal water temperatures to those listed fish species whenever and wherever possible.

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1A.1.1.1 Responses to Comments from National Marine Fisheries Service

NMFS 1: Comment noted.

NMFS 2: The comparison of the No Action Alternative to the Second Basis of Comparison are presented as a combination of both quantitative and qualitative results because the numerical analytical tools cannot simulate all of the 2009 National Marine Fisheries Service (NMFS) Biological Opinion (BO) Reasonable and Prudent Alternative (RPA) actions. In the Final EIS, the presentation of the results of the qualitative analyses and the integrated results of the quantitative and qualitative results have been modified to provide more clarity. Presentation of an alternative analytical approach to consider effects on sturgeon also have been included in the Final EIS.

It should be noted that the results of the impact analyses in the EIS are presented as incremental changes between the alternatives as compared to the No Action Alternative and Second Basis of Comparison for Year 2030 conditions with climate change, sea level rise, and projected population growth. The EIS does not present an analysis of the alternatives as compared to existing conditions. In addition, all of the alternatives, the No Action Alternative, and the Second Basis of Comparison include the implementation of the 2009 NMFS BO RPA actions I.1.3, I.14, I.2.6, I.3.1, I.5, I.6.1, and II.1 and the 2008 USFWS BO RPA Component 4 because these actions were being implemented prior to issuance of the BO and would have been completed without the BOs. Therefore, the analysis in the EIS would not indicate any differences between implementation of the No Action Alternative and the Second Basis of Comparison due to implementation of these actions.

Reclamation has modified the Final EIS in response to comments from NMFS and other commenters; and will use the Final EIS in the development of the Record of Decision.

NMFS 3: Comment noted.

NMFS 4: Comment noted.

NMFS 5: Please see response to Comment NMFS 2.

NMFS 6: Comment noted.

NMFS 7: The summaries of the impact analyses in Chapters 5 through 21 of the Final EIS have been modified to improve clarity; however, the summaries have remained at the end of the chapters. The level of detail in the bookmarks in the chapters has been expanded in the Final EIS.

NMFS 8: The figure from Appendix 5A, Section A, CalSim II and DSM2 Modeling, referred to in the comment has been included in Chapter 4 of the Final EIS. Due to the complexity of the methodologies for the different analytical tools and qualitative analyses, the extent of the analytical coverage with the limitations and uncertainties of each method are presented in Chapters 5 through 21 and in the appendices that provide the modeling methodologies (see Appendices 5A, 6B through 6E, 7A, 8A, 9C through 9O, 12A, and 19A through 19B).

NMFS 9: As discussed in this comment, the analytical tools do have limitations and uncertainties, as discussed in the appendices of the EIS. Some of these limitations are related to the ability to simulate specific conditions or regulatory requirements; and some of the limitations are related to the use of CalSim II with a monthly time step as the basic hydraulic simulation tool. Given the complexity of the system and the number of models used in the analysis, it is not possible to do a statistical error propagation analysis. The acknowledgement of these limitations and uncertainties is the reason that the discussions in the EIS emphasize that the model results in all EIS chapters must be used in a comparative manner to determine the incremental differences between Alternatives 1 through 5 as compared to the No Action Alternative, and between the No Action Alternative and Alternatives 1 through 5 as compared to the Second Basis of Comparison. The model results are not used to project specific physical, biological, or human resource values. By using the models in a comparative manner, the results of the analysis are less affected by the limitations and uncertainties. The quantitative model results are used in conjunction with the qualitative analyses presented in this EIS to consider the comparative results of the entire analyses.

NMFS 10: The VIC model accepts input meteorological data directly from global or national gridded databases or from GCM projections. The discussion of the VIC model has been expanded in Appendix 5A, Section A, CalSim II and DSM2 Modeling, in the Final EIS.

NMFS 11: Section 5A.A.5.4 of Appendix 5A, Section A, discusses the VIC model limitations. A separate uncertainty analysis for the VIC model was not conducted. As described in the response to Comment NMFS 9, the EIS uses the tools in a comparative manner to determine incremental changes between alternatives which reduces the limitations of the models as compared to using the tools for to predict specific values.

NMFS 12: The information requested in this comment is included in the references cited in the EIS. However, the discussion of the VIC model has been expanded in Appendix 5A, Section A, CalSim II and DSM2 Modeling, in the Final EIS.

NMFS 13: The analysis in the EIS is performed assuming climate change conditions at Year 2030. The NEPA analysis does not provide a comparison of conditions under the alternatives, No Action Alternative, and Second Basis of Comparison with existing conditions. Therefore, the analytical tools were not developed to simulate existing conditions.

NMFS 14: A linear-programming solver is used within CalSim to route the flow based on complex regulatory requirements. The weights indicate priorities in the system; such as weights that are used to ensure mass balance and weights to comply with regulatory requirements.

NMFS 15: The CalSim II model is not calibrated and was developed to be used in for comparative analyses, and not to predict values. The model has been peered review in a historical comparison was conducted for CVP and SWP operations in the Historical Operations Study of water years 1975 to 1998 (DWR 2003).

NMFS 16: Section 5A.A.3.5 of Appendix 5A, Section A, CalSim II and DSM2 Modeling, describes the appropriate use of the CalSim II model.

NMFS 17: The CalSim II and DSM2 models cannot simulate daily real-time operations that are based upon real-time observations. The models are appropriate for a NEPA analysis when used in conjunction with qualitative analyses of decisions that are based upon real-time information and other issues that are not included in the numerical models. As discussed in the response to Comment NMFS 2, presentation of the results of the qualitative analyses and the integrated results of the quantitative and qualitative results have been modified in the Final EIS to provide more clarity.

NMFS 18: The paragraph referred to in this comment (see page 5A.A-13 of the Draft EIS) describes that CalSim II model cannot adjust the set of predefined rules that represent the assumed regulations to simulate extreme events, such as a prolonged drought, or to perform statistical performance criteria, such as storage target objectives in an assumed percentage of years. Therefore, the CalSim II model includes logic to represent predefined operational rules, such as policy level decisions, when there is not enough water to meet all needs. Use of the 82-year hydrology in the CalSim II model does provide a range of different hydrologic conditions and sequences. However, due to these limitations, the CalSim II model is considered a planning model and was developed to be used in a comparative manner.

NMFS 19: When more than one regulatory requirement is listed in the assumptions table referred to in this comment, the flows comply with all listed regulations. These regulations may have different requirements at different months. The model operates to the flow requirement that is controlling in each month.

NMFS 20: As shown in Table 5A.B.20, the DSM2 model is run for the 82-year hydrologic period (water years 1922 through 2003).

NMFS 21: DSM2 was not used for any temperature analysis. Therefore no meteorological inputs were necessary. Model inputs used for DSM2 HYDRO and QUAL for Delta hydrodynamics and water quality simulations are provided in Section 5A.A.4.2.3.

NMFS 22: A new calibration was not performed on the HEC-5Q model; however several updates were done as explained in Appendix 6B, Section C.

NMFS 23: Comment noted.

NMFS 24: The information related to model inputs has been modified in Appendix 6B of the Final EIS.

NMFS 25: This information related to disaggregation of monthly flow data has been modified in Appendix 6B of the Final EIS.

NMFS 26: The Salmon Mortality Model has not been calibrated. The development of the Reclamation Salmon Mortality Model was a collaborative and iterative effort by Reclamation, USFWS, and the California Department of Fish and Wildlife (CDFW). This interaction provided quality assurance and data quality assessment for the model. The rationale for use of the model, assumptions, and limitations of the model are described in Appendix L of the 2008 Central Valley Project and State Water Project Operations Criteria and Plan Biological Assessment (2008 BA) which is referenced in the EIS. Appendix L of the 2008 BA is identified as the primary source document for the Reclamation Salmon Mortality Model Analysis in Appendix 9C of the EIS.

NMFS 27: Table L-7 in Appendix L of the 2008 BA provides the salmon mortality criteria and the model mathematics are described on page L-5 of that document and in Hydrologic Consultants, Inc. (1996). In order to utilize the best available scientific data, the model was updated to include data provided by NMFS during preparation of the EIS related to the recent distribution of winter-run Chinook Salmon spawning in the Sacramento River.

Reference is found at Hydrologic Consultants, Inc. 1996. *Water Forum Issue Paper Chinook Salmon Mortality Model: Development, Evaluation, and Application as One Tool to Assess the Relative Effects of Alternative Flow and Diversion Scenarios on the Lower American River.*

NMFS 28: SALMOD has not been calibrated. SALMOD has been applied to several river systems. The SALMOD model and its applications are published in many peer-reviewed journals; and applied to the Sacramento River in multiple efforts. The data and parameters for the Sacramento River were well refined in these applications. The rationale for use of the model, assumptions, and limitations of the model are described in Appendix P of the 2008 BA. Appendix P of the 2008 BA is identified as the primary source document for the SALMOD Analysis in Appendix 9D of the DEIS.

NMFS 29: As indicated on page 9I-10 of Appendix 9I in the EIS, the OBAN model produces forecasts of escapement and delta survival rates for simulation years 1967 to 2002, and incorporates parameter uncertainty in each of these outputs.

NMFS 30: The IOS model was not calibrated to observed escapement. IOS is a simulation model to be used in a comparative manner, and is not meant to be predictive of future or past observations.

NMFS 31: A sensitivity analysis was performed for the DPM model that examines structural and parameter uncertainty. That analysis was reviewed by a multi-agency workgroup including NMFS, USFWS, CDFW and Department of Water Resources (DWR).

NMFS 32: We concur with the statements in the comment regarding challenges associated with evaluating model results given the inherent uncertainty and level of accuracy of the available modeling tools. Because the suite of models used for different analyses in the EIS either use monthly time steps or starts with output from the monthly time step CalSim II model, it was determined that incremental changes between model runs of 5 percent or less were related to the uncertainties in the model processing. Therefore, changes of 5 percent or less in this comparative analysis are considered to be not substantially different, or “similar.”

NMFS 33: Please see the response to Comment NMFS 9.

NMFS 34: The EIS acknowledges that certain operations cannot be captured in the modeling exercise; therefore, effects of some RPA actions that cannot be simulated in the CalSim II and other models, including implementation of fish passage and Shasta performance measures in the No Action Alternative, are analyzed in a qualitative manner. Text has been added in Section 9.4 of Chapter 9, Fish and Aquatic Resources, in the Final EIS to clarify the integrated results of quantitative and qualitative analyses.

NMFS 35: In response to this comment, a detailed description of the analysis of the trap and haul program associated with Alternatives 3 and 4 was added to the Final EIS as Appendix 9O. Text also was added to Section 9.4.1 of Chapter 9 to describe the mechanism for analysis of the trap and haul program. Text revisions to page 9-316 of the Draft EIS describe the potential for unintended consequences associated with the trap and haul program. Use of Keefer et al. 2008 was included in the Final EIS.

NMFS 36: Text was added to page 9-342 of the Draft EIS to provide more clarity related to Alternative 4 assumptions and consistency with NMFS's fisheries management framework for reducing the impact of ocean salmon fishery on winter-run Chinook Salmon for the Pacific Coast Salmon Fishery Management Plan.

NMFS 37: Comment noted.

NMFS 38: As described in response to Comment NMFS 34, impact analysis related to RPA actions that are not included in CalSim II model are qualitatively assessed in Chapter 9. Text has been added in Section 9.4 of Chapter 9, Fish and Aquatic Resources, in the Final EIS to clarify the integrated results of quantitative and qualitative analyses. For example, under the No Action Alternative, benefits that would occur due to inclusion of fish passage and temperature management at Shasta Lake are analyzed qualitatively and described in combination with the quantitative results of the CalSim II and water temperature models.

Storage in CVP and SWP reservoirs is affected by multiple actions in the system. For example, maintaining Old and Middle River flows at certain levels during December through June, increased closure of the Delta Cross Channel under the No Action Alternative as compared to conditions under the Second Basis of Comparison that included requirements per State Water Resources Control Board (SWRCB) Decision 1641 (D-1641), export limitations in April and May based on

San Joaquin Flow at Vernalis, and increased Delta outflow in fall months following wet and above normal years. All of these actions affect project operations and result in increased reservoir releases. These effects include a shift in export patterns from spring to summer months that causes more water to be released from the reservoirs than that is being exported to meet the Delta water quality standards during a season where Delta is more saline, an increased need in supply from the Sacramento River in April and May since San Joaquin River supply is limited, and increased reservoir releases in fall months following wet and above normal years. Therefore, this reduction in flexibility to use available water supply in most efficient way for water supply and water quality needs further limits possibility of meeting storage and temperature performance requirements on upper Sacramento River (e.g., 2009 NMFS BO RPA actions 1.2.1, 1.2.2, 1.2.3, and 1.2.4.).

NMFS 39: Whiskeytown Lake storage is simulated in the CalSim II model; however, the results were was not specifically reported in the EIS because there were no specific analyses related to this water body in Chapter 9, Fish and Aquatic Resources. The analysis focus on conditions in Clear Creek.

NMFS 40: The CalSim II implementation of 2009 NMFS BO RPA Action 1.1.1, and other NMFS BO RPA actions, was determined by a multi-agency process (including NMFS) in 2009. This implementation is described in Section 5A.9.1.1 of Appendix 5A, Section A. It was decided to simulate the pulse flow only in May for the EIS analysis.

For the EIS analysis, a revised flow release pattern from Whiskeytown Dam to reduce thermal stress (2009 NMFS RPA Action I.1.5) was not specifically simulated in the CalSim II model. Text has been added to Chapter 9 to clarify that implementation of the flow release pattern could result in benefits to spring-run Chinook Salmon under the No Action Alternative and Alternatives 2 and 5.

NMFS 41: The implementation of the 2009 NMFS BO RPA actions that can be included in the CalSim II model are described in Section 5A.9 of Appendix 5A, Section A, CalSim II and DSM2 Modeling. The 2009 NMFS BO RPA Action 1.2 is not implemented in the CalSim II model and is analyzed qualitatively in the EIS. Text has been added in Section 9.4 of Chapter 9, Fish and Aquatic Resources, in the Final EIS to clarify the integrated results of quantitative and qualitative analyses. The increase in river flows in fall months of wet and above normal years is due to the 2008 USFWS BO RPA Action 4 (Fall X2). It is important to note that actions that require increased river flows cause reduced storage in upstream reservoirs and the cold water pools.

NMFS 42: As shown in Figures 5.47 and 5.48 of the EIS, historical CVP and SWP water exports have exceeded 7 million acre-feet in wetter years.

NMFS 43: The comment is consistent with the information included in Chapter 5, Surface Water Resources and Water Supplies, in the EIS.

NMFS 44: The water temperature thresholds used in this analysis were based on various objectives, guidance, and criteria previously developed for the California water bodies analyzed in the EIS. For the Trinity River, temperature thresholds were based on the temperature objectives developed for the Trinity River Flow Evaluation by USFWS and the Hoopa Tribe (USFWS 1999), which specified temperatures protective of salmonids in the reaches of the Trinity River downstream of Lewiston Dam. For winter-run Chinook Salmon egg incubation in the Sacramento River, the analysis used the optimum upper temperature as described in the 2009 NMFS BO. The temperature thresholds used for steelhead adult migration, spawning, rearing, and smoltification in the Stanislaus River were based on the criteria presented in the 2009 NMFS BO Action III.1.2. All other temperature thresholds used in the analysis were based on the criteria contained in the Bay-Delta Conservation Plan Draft EIR/EIS and associated environmental documentation (DWR et al. 2013). These temperatures were developed collaboratively with the state and Federal agencies in consideration of appropriate temperature criteria for application in California. The EPA Region 10 *Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards* (EPA 2003) presents temperature guidance that in some instances differs slightly from the thresholds used in the analysis in the EIS. The EPA-recommended metric for these temperature criteria is the maximum 7-day average of the daily maxima.

NMFS 45: The differences in May are not due to modeling error, but rather reflect the influence of spring attraction flows for spring-run Chinook Salmon that are included in the CalSim II model. These spring attraction flows are enough to cause a slight increase in the average monthly flow which results in a slight (0.3°F) decrease in the average monthly water temperature in May. This small difference is below the resolution of the model as explained in Section 9.4.1.2.2 of the Final EIS and water temperatures under the No Action Alternative and Second Basis of Comparison are considered “similar” in the analysis.

NMFS 46: The CalSim II model is used to provide input into the temperature models. The CalSim II model is operated to prioritize meeting flow and water quality criteria with assumptions for air temperatures. The assumptions of air temperatures and real-time operations of the CVP and SWP would not necessarily represent the modeled conditions. Therefore, the CalSim II model results must be considered in a comparative manner and not used for specific values in the comparison of alternatives with the No Action Alternative and Second Basis of Comparison.

NMFS 47: The modeling does not include several items in the 2009 NMFS BO, such as fish passage. As described in response to Comment NMFS 34, impact analysis related to RPA actions that are not included in CalSim II model are qualitatively assessed in Chapter 9. Text has been added in Section 9.4 of Chapter 9, Fish and Aquatic Resources, in the Final EIS to clarify the integrated results of quantitative and qualitative analyses.

NMFS 48: See responses to comments NMFS-54 to NMFS-62.

NMFS 49: IOS and OBAN are two distinctly different modeling approaches using different data and different assumptions. Both IOS and OBAN rely on CalSim II based flows and temperatures as inputs, however, IOS simulates the winter-run lifecycle over the 81 year (1922 – 2002) period whereas OBAN simulates from 1967 – 2002 period. Another important difference is that IOS includes a more detailed representation of the Delta reaches (8 reaches), and a reach specific survival is calculated based on the DSM2 simulated flows in each reach. In contrast, OBAN treats Delta as one reach with Delta survival computed based on just the south Delta exports. Further, IOS assumes a small percentage of the population is affected by entrainment in Delta.

NMFS 50: The methodologies for computing egg mortality in Reclamation Egg Mortality Model and IOS model are different, as discussed or referenced in Appendices 9C and 9H, respectively.

NMFS 51: The modeling does not include several items in the 2009 NMFS BO, such as fish passage. As described in response to Comment NMFS 34, impact analysis related to RPA actions that are not included in CalSim II model are qualitatively assessed in Chapter 9. Text has been added in Section 9.4 of Chapter 9, Fish and Aquatic Resources, in the Final EIS to clarify the integrated results of quantitative and qualitative analyses.

NMFS 52: The modeling does not include several items in the 2009 NMFS BO, such as fish passage. As described in response to Comment NMFS 34, impact analysis related to RPA actions that are not included in CalSim II model are qualitatively assessed in Chapter 9. Text has been added in Section 9.4 of Chapter 9, Fish and Aquatic Resources, in the Final EIS to clarify the integrated results of quantitative and qualitative analyses.

NMFS 53: As described in response to Comment NMFS 34, impact analysis related to RPA actions that are not included in CalSim II model are qualitatively assessed in Chapter 9. Text has been added in Section 9.4 of Chapter 9, Fish and Aquatic Resources, in the Final EIS to clarify the integrated results of quantitative and qualitative analyses.

NMFS 54: The EIS analysis used the junction entrainment analysis (see Appendix 9L) to assess the likelihood of juvenile salmon entering the areas within the Delta where they could be at greater risk of exposure to the export facilities. The analysis in the EIS also examined the potential for salvage of juvenile salmon at the export facilities (see Appendix 9M). One approach assesses a likelihood of routing, whereas the other estimates the number of fish salvaged. While both of these tools address a related issue, they are separate models that rely on different inputs and different assumptions. In addition, that factors that influence routing are different from those that influence salvage. Thus, the results for winter-run Chinook Salmon junction entrainment and salvage analyses are different, but not necessarily “inconsistent.”

NMFS 55: Please refer to the response to Comment NMFS 54.

NMFS 56: The DPM results are not necessarily contradictory to those of Cunningham et al. (2015); the DPM provides estimates of salmonid survival through the Delta and the results of Cunningham et al. (2015) represent survival from egg to adult. They are two distinctly different modeling approaches using different data and different assumptions. There is no reason to expect they should be the same or even similar. Cunningham et al. (2015) developed a stage-structured life history model of summer, spring and winter-run Chinook salmon, fitted this model to available data on salmon stock abundance and environmental conditions, and estimated the impact of the environmental conditions on survival of the different stocks of Chinook salmon. This model was then used to forecast how differences in future climate change, marine conditions or productivity, and water exports would affect the survival of the different stocks of Chinook salmon. They concluded from the model fitting exercise that the estimated effect that water exports from the Sacramento – San Joaquin Delta on juvenile Chinook survival through this region was of importance. However, these export-related covariate effects did not appear at the top of the list of most often included covariates, indicating that while they have substantial potential to explain historical patterns in spring and fall-run Chinook survival, there are other environmental covariates which explain a greater proportion of variation in historical abundance. Moreover, the results presented in the EIS are intended to be used in a comparative context to evaluate the relative differences between alternative scenarios.

NMFS 57: Text on page 9-162 has been revised for clarity.

NMFS 58: The modeling does not include several items in the 2009 NMFS BO, such as fish passage. As described in response to Comment NMFS 34, impact analysis related to RPA actions that are not included in CalSim II model are qualitatively assessed in Chapter 9. Text has been added in Section 9.4 of Chapter 9, Fish and Aquatic Resources, in the Final EIS to clarify the integrated results of quantitative and qualitative analyses.

NMFS 59: The reference material was reviewed and considered in the preparation of the Final EIS.

1A.1.2 U.S. Environmental Protection Agency

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

SEP 29 2015

David G. Murillo
Regional Director
Bureau of Reclamation, Mid-Pacific Region
2800 Cottage Way
Sacramento, CA 95825-1898

Subject: Coordinated Long-Term Operation of the Central Valley Project and State Water Project Draft Environmental Impact Statement, Multiple Counties, California [CEQ# 20150214]

Dear Mr. Murillo:

The U.S. Environmental Protection Agency has reviewed the Draft Environmental Impact Statement (DEIS) for the Coordinated Long-Term Operation of the Central Valley Project and State Water Project. EPA 1
Our review and comments are pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality regulations (40 CFR Parts 1500-1508), and our NEPA review authority under Section 309 of the Clean Air Act.

The DEIS evaluates the impacts of operating the Central Valley Project (CVP) and State Water Project (SWP) with implementation of Biological Opinions (BOs) issued by the US Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) in 2008 and 2009, respectively. Those BOs concluded that continued operation of the CVP and SWP is likely to jeopardize the existence of endangered Delta smelt and Sacramento River winter-run Chinook salmon, and threatened Central Valley spring-run Chinook salmon, Central Valley steelhead, and southern resident killer whales. The BOs identified Reasonable and Prudent Alternatives (RPAs) designed to enable the CVP/SWP to continue operations without jeopardizing those species. The RPAs include pumping restrictions, habitat restoration, specific monitoring and reporting requirements, fish passage improvements, temperature management tools, and gravel augmentation.

EPA supports full implementation of the RPAs, assuming that habitat restoration sites and methods are EPA 2
carefully selected to avoid increasing the production and distribution of methylmercury. The No Action Alternative and Alternative 5 would each fully implement the RPAs; Alternatives 1, 2, 3 and 4 would not implement, or would only selectively implement, them. Because Reclamation did not identify a preferred alternative in the DEIS, we are rating all alternatives and the document. We are rating the No Action Alternative and Alternative 5 as *Environmental Concerns* (EC); and Alternatives 1, 2, 3, and 4 as *Environmental Objections* (EO). We are rating the document as *Insufficient Information* (2) (see enclosed "Summary of EPA Rating Definitions"). While we have concerns about all of the alternatives, as discussed below and in the enclosed Detailed Comments, we believe that Alternatives 1-4, in particular, would not protect aquatic life beneficial uses and would perpetuate the poor habitat conditions that have characterized the past fifteen years of declining resident and migratory fish

EPA 2 continue

populations in the Sacramento and San Joaquin river systems and estuary. Because Alternatives 1, 3, and 4 would implement few, if any, of the measures included in the RPAs, they appear less likely to avoid jeopardy to listed species. Alternative 2 includes the operational RPA actions, but not the important structural improvements, such as fish passage, gravel augmentation, improvements to hatchery operations, or fish collection facility improvements. Alternatives 1-4 introduce possible mitigation measures for water quality and aquatic and terrestrial resources that appear to reflect the BOs and RPAs, but the DEIS provides no details as to how the mitigation would differ from the No Action Alternative. EPA 3

It is important to note that the Delta estuary ecosystem, habitat conditions in the upper watershed rivers, and populations of resident and migratory fish continue to decline, despite the partial implementation of the RPAs that has already occurred, and this decline is expected to continue even as implementation of the RPAs proceeds. The DEIS indicates that, even with full implementation of the RPAs, aquatic life beneficial uses and threatened and endangered fishes may not be fully protected for the duration of the project study period, which ends in 2030: EPA 4

> "*Currently low levels of relative abundance do not bode well for the Delta Smelt or other fish species in the Delta in 2030. Challenges to fish species in the Delta are many, and would continue in the future under the No Action Alternative, including high water temperatures, reduced flows, habitat degradation, barriers, predation, low dissolved oxygen, contamination, entrainment, salvage, poaching, disease, competition, non-native species, and lack of available food*" (page 9-139).

Many of these stressors are a function of the timing, magnitude, and duration of freshwater flow in the Sacramento and San Joaquin rivers, upper tributaries, and estuary. Alleviating them to allow native fishes to persist in the watershed will likely necessitate additional changes to CVP/SWP (including dams) operations and species management. We encourage Reclamation to make full use of the iterative evaluation and adjustment processes outlined in the BOs to further improve conditions in those waters.

We appreciate the opportunity to review and comment on this DEIS, and are available to discuss the recommendations provided. When the FEIS is released for public review, please send one hard copy and one CD to the address above (Mail Code: ENF 4-2). Should you have any questions, please contact me at (415) 972-3873, or contact Jean Prijatel, the lead reviewer for the project. Jean can be reached at (415) 947-4167 or prijatel.jean@epa.gov. EPA 5

Sincerely,

Kathleen H. Johnson, Director
Enforcement Division

Enclosures: Summary of EPA Rating Definitions
EPA Detailed Comments

cc: Kim S. Turner, U.S. Fish and Wildlife Service, Bay-Delta Office
Garwin Yip, National Oceanic and Atmospheric Administration, West Coast Region

2

SUMMARY OF EPA RATING DEFINITIONS*

This rating system was developed as a means to summarize the U.S. Environmental Protection Agency's (EPA) level of concern with a proposed action. The ratings are a combination of alphabetical categories for evaluation of the environmental impacts of the proposal and numerical categories for evaluation of the adequacy of the Environmental Impact Statement (EIS).

ENVIRONMENTAL IMPACT OF THE ACTION

"LO" (Lack of Objections)

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

"EC" (Environmental Concerns)

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

"EO" (Environmental Objections)

The EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

"EU" (Environmentally Unsatisfactory)

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

ADEQUACY OF THE IMPACT STATEMENT

"Category 1" (Adequate)

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

"Category 2" (Insufficient Information)

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analysed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

"Category 3" (Inadequate)

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analysed in the draft EIS, which should be analysed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640, Policy and Procedures for the Review of Federal Actions Impacting the Environment.

U.S. EPA DETAILED COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR COORDINATED LONG-TERM OPERATION OF THE CENTRAL VALLEY PROJECT AND STATE WATER PROJECT, MULTIPLE COUNTIES, CA SEPTEMBER 29, 2015

Aquatic Resources

In 2009, several federal agencies, including Reclamation and EPA, declared that the Sacramento-San Joaquin River Delta ecosystem, part of the larger San Francisco estuary, was in a state of collapse.[1] This declaration was made after several years of sharp population declines in four resident fishes, commonly referred to as the pelagic organism decline (POD), followed by sharp drops in Chinook salmon abundance. Two of the POD fishes were already rare while the other two were formerly the most abundant fishes in the estuary. Low Chinook salmon populations resulted in a multi-year closing of commercial and recreational fishing. EPA 6

Populations of all the species covered by the 2008 Fish and Wildlife Service and 2009 National Marine Fisheries Service Biological Opinions (BOs), as well as several non-listed resident and migratory fishes, have continued to decline since the BOs were finalized. For example, the 2015 summer townet survey for Delta smelt recorded a zero juvenile Delta smelt abundance index.[2]

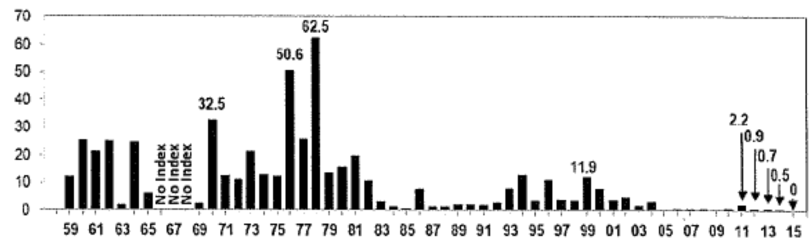

Figure 1. Summer Townet Survey Age-0 Delta Smelt Abundance Indices, 1959-2014

The continued decline of resident and migratory fish populations suggests that the suite of Reasonable and Prudent Alternatives implemented to date, plus commitments[1] to improve protection for aquatic habitat in the San Francisco estuary watershed, have not yet been successful in protecting aquatic habitat, reversing population declines, actually avoiding jeopardy, and/or improving aquatic life beneficial use protection. The pace and severity of the decline highlight the urgent need to move forward with full implementation of the RPAs and, perhaps, additional measures in an adaptive management context to ensure their effectiveness. Alternatives 1, 2, 3 and 4 would discontinue implementation, or would only selectively implement, the Reasonable and Prudent Alternative (RPA) actions identified in the BOs, which are designed to improve riverine and estuarine aquatic habitat to avoid jeopardizing the existence of multiple threatened and endangered species. The DEIS fish analysis for Delta smelt and longfin smelt show that Alternatives 1, 3 and 4 would result in adverse impacts to these species relative to the No Action Alternative. Discontinuation of RPA actions is likely to also negatively impact non-listed fishes that benefit from improved aquatic habitat conditions the RPAs provide. Full EPA 7

[1] California Bay-Delta MOU (http://www2.epa.gov/sites/production/files/documents/baydeltamousigned.pdf); Interim Federal Action Plan (https://www.doi.gov/sites/doi.gov/files/migrated/news/doinews/upload/CAWaterWorkPlan.pdf)
[2] California Department of Fish and Wildlife Memorandum (June 26, 2015) to Scott Wilson from Felipa La Luz regarding 2015 Summer Townet Survey Age-0 Delta Smelt Abundance Index.

EPA 7 continued

implementation of the RPAs, as would occur under the No Action Alternative and Alternative 5, may minimize adverse effects of the CVP/SWP operations on fishes, but may not be sufficient to increase fish populations and improve aquatic life beneficial use protection in the estuary and upper watershed.

> ***Recommendations***: For the No Action Alternative and Alternative 5 in the FEIS, provide a timeline for implementation of the remaining measures in the RPAs and disclose any impacts that the timing of various measures may have on their effectiveness in avoiding jeopardy for subject species. Indicate how changing conditions in the study area would be incorporated into managing operations and implementation of the RPAs. EPA 8
>
> For Alternatives 1, 2, 3, and 4 in the FEIS, provide a detailed description of proposed mitigation measures (page 9-421) that would reduce the anticipated adverse impacts to fish species, including implementing fish passage and coordinating operations between Reclamation, Department of Water Resources, FWS, and NMFS. EPA 9

The DEIS fish impact analysis presents many results that are contrary to the NMFS BO. Alternative 1 describes the project area without the RPAs, and the No Action Alternative (NAA) assumes full implementation of the RPAs. These two alternatives are the most divergent of the 6 alternatives considered; however, the DEIS analysis often concludes that there is little difference between impacts to fish species between Alternative 1 and the NAA. Some fish analyses in the DEIS even suggest that implementing the BO RPAs in the NAA would have slightly greater adverse impacts than not implementing the BO RPAs in Alternative 1. These conclusions are inconsistent with the conclusions in the BOs and the intent of the RPAs. EPA 10

Conclusions of no difference among alternatives in the DEIS' fish analysis rely on analytical tools that are not precise enough to identify such differences, specifically with regard to water temperature. Temperature is an important aquatic habitat element that is a driver of early life stage survival for fish species addressed in the BOs. Temperature criteria for protecting fish are often based on a daily or weekly averaging period; however, available temperature and flow models, including those relied upon for the DEIS' fish analysis, are currently limited to using a monthly time step (page 9-109). Monthly temperature averages mask the biologically meaningful differences among alternatives. For example, a temperature threshold of 56 degrees as a daily average is identified as protective of spawning and egg incubation for several salmonid species; however, the temperature analysis estimates a monthly temperature average, which could include many days that exceed 56 degrees by many degrees. Thus, reliance on monthly averages in the DEIS obscures the daily temperature differences among alternatives. Temperature analyses will not be useful for distinguishing among alternatives until daily temperature and flow models are built and validated using daily observations. EPA 11

The DEIS analysis of impacts to striped bass and American shad is based solely on water temperature; however, changes in salinity gradient impacts, as approximated by Delta outflow or X2, are correlated with striped bass abundance and should be included in the analysis. EPA 12

> ***Recommendations***: In the FEIS, include a discussion about the limitations of the available models and analytical tools in making distinctions between impacts to fish species among the alternatives, particularly with regard to monthly average temperatures. Revise conclusions about the differences, or lack thereof, in impacts to fish species among the alternatives accordingly. EPA 13
>
> Include a discussion of salinity gradient in the impact analysis for striped bass and American shad. EPA 14

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Water Quality Impacts

The water quality discussion in the DEIS includes a description of constituents of concern, water quality standards, and designated beneficial uses in the study area, but does not include a quantitative water quality analysis that is compared to all water quality standards and objectives described. EPA notes that there are many quantitative and qualitative water quality standards that apply to CVP/SWP operations, as described in the Water Boards' Basin Plans and Water Rights Decision 1641. We also observe that no key is provided for Table 6.2 Designated Beneficial Uses within Project Study Area (page 6-12). We have assumed that "E" signifies *existing* and "P" signifies *potential*. EPA 15

> ***Recommendation***: In the FEIS, discuss how each alternative would affect water quality with respect to narrative and numeric water quality objectives, highlight any predictions of exceeded water quality standards, and identify mitigation strategies that would prevent such exceedances. EPA 16

The DEIS discusses how droughts are incorporated into the CalSim model for water supply and quality impact analysis, and acknowledges that drought can and has altered hydrology in the Delta (page 9-139); however, contingency procedures for severe droughts are not discussed in the document. In our existing drought conditions, multiple water quality objectives have not been met for the last two years, resulting in a substantial impact on aquatic life beneficial uses throughout the study area.[3] EPA 17

> ***Recommendations***: In the FEIS, discuss the need to develop drought contingency procedures that protect aquatic life beneficial uses, including the protection of ESA listed species, during drought conditions. Provide a description of the adjustments to the RPAs made during the current drought conditions and report their impacts on covered fishes. EPA recommends that Reclamation commit to include in its ongoing monitoring and reporting program any deviations from the RPAs for drought conditions.

X2

EPA appreciates that the DEIS includes a year-round X2 (2 parts per thousand salinity isohaline) analysis to evaluate Delta outflow, changes to estuarine habitat, and migration conditions. The DEIS does not, however, include an interpretation of the results with respect to aquatic life beneficial use protection, other than to note that the location of X2 is important for aquatic life and water supply beneficial uses (page 6-17). More recently than the 2008 and 2009 BOs, multiple scientific panels have identified the need for more freshwater outflow, signified by a lower X2 position, in the estuary to reverse the decline of several resident and migratory fish.[4] This recommendation is based largely on the EPA 18

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[3] California Department of Fish and Wildlife Memorandum (June 26, 2015) to Scott Wilson from Felipa La Luz regarding 2015 Summer Townet Survey Age-0 Delta Smelt Abundance Index; California Department of Fish and Wildlife Fall Midwater Trawl Indices for Select Fish http://www.dfg.ca.gov/delta/data/fmwt/indices.asp; 95% mortality of 2014 winter-run Chinook salmon juveniles as estimated in NMFS 2015 Juvenile Production Estimate http://www.westcoast.fisheries.noaa.gov/publications/Central_Valley/Water%20Operations/20150116_nmfs_winter-run_juvenile_production_estimate_nr.pdf.

[4] This broad scientific agreement is illustrated in the following reports:
(a) Public Policy Institute of California (2013) Scientist and Stakeholder Views on the Delta Ecosystem "a strong majority of scientists prioritizes habitat and flow management actions that would restore more natural processes within and upstream of the delta" (p. 2). http://www.ppic.org/content/pubs/report/R_413EHR.pdf
(b) State Water Resources Control Board (2010) Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem Flows Report, p.7. "Both flow improvements and habitat restoration are essential to protecting public trust resources [defined as "native and valued resident and migratory species habitats and ecosystem processes" p. 10].
(c) National Academy of Sciences Natural Resource Council Committee on Sustainable Water Management in California's Bay-Delta (2012) Report: Sustainable Water and Environmental Management in California's Bay-Delta "…sufficient

X2-abundance correlations, regardless of the mechanistic knowledge gap.[5] The State Water Resources Control Board D-1641 provides criteria that require reservoir releases from CVP and SWP from February through June to protect aquatic life in the western Delta. The FWS BO includes an additional salinity requirement for September and October in wet and above normal water years. Alternative 5 in the DEIS provides for additional flows in April and May in all water year types beyond those provided in SWRCB D-1641 and the FWS BO. EPA 18 continued

As an editorial note, the X2 analysis is referenced to the wrong appendix in Chapter 6 of the DEIS (page 6-86).

> ***Recommendations***: In the FEIS, include a discussion of the impacts of Delta outflow, as documented by X2 location, on aquatic life beneficial uses, utilizing the references provided above and including relative impacts from each of the alternatives. Update the text to reflect that the X2 tables are in Appendix 5A, Section C, not appendix 6E as stated in DEIS Chapter 6.

Selenium

EPA is in the process of updating its national recommended chronic aquatic life criterion for selenium in freshwater and revising selenium water quality criteria for San Francisco Bay to reflect the latest scientific information, which indicates that toxicity to aquatic life is driven by dietary exposures. These criteria may be lower than the threshold used in comparison in the DEIS. EPA 19

The selenium water quality analysis in the DEIS concludes that there would be minimal difference in estimated selenium water column and fish tissue concentrations among the project alternatives. However, average selenium concentrations in sturgeon tissue for all alternatives are near to or slightly exceed the low toxicity 5 mg/kg threshold established by Presser and Luoma[6] (see Table 6D.17 Summary of Annual Average Selenium Concentrations in Whole-body Sturgeon). FWS also uses a lower threshold of 4 mg/kg for sensitive species such as sturgeon and salmon.[7] This suggests that all alternatives have the potential to adversely impact fish tissue concentrations by establishing conditions that enhance selenium exposure and uptake in sensitive species such as sturgeon.

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reductions in outflow due to diversions would tend to reduce the abundance of these organisms ["these organisms" = 8 Bay Delta aquatic species at various trophic levels]." Page 60 and "Thus, it appears that if the goal is to sustain an ecosystem that resembles the one that appeared to be functional up to the 1986-93 drought, exports of all types will necessarily need to be limited in dry years, to some fraction of unimpaired flows that remains to be determined." Page 105

(d) California Department of Fish and Wildlife (2010) Quantifiable Biological Objectives and Flow Criteria "…current Delta water flows for environmental resources are not adequate to maintain, recover, or restore the functions and processes that support native Delta fish." Page 1 in Executive Summary

[5] National Academy of Sciences Natural Resource Council Committee on Sustainable Water Management in California's Bay Delta (2012) Report: Sustainable Water and Environmental Management in California's Bay-Delta "*…this implies that sufficient reductions in outflow due to diversions would tend to reduce the abundance of these organisms*." Page 60 and "*Thus, it appears that if the goal is to sustain an ecosystem that resembles the one that appeared to be functional up to the 1986-93 drought, exports of all types will necessarily need to be limited in dry years, to some fraction of unimpaired flows that remains to be determined.*" Page 105

[6] Toxicity thresholds are those reported in Presser and Luoma (2013) Low = 5 mg/kg, dw and High = 8 mg/kg, dw. Presser (2010) Ecosystem-scale Selenium Modeling in Support of Fish and Wildlife Criteria Development for the San Francisco Bay-Delta Estuary, California. Administrative Report December. Reston, Virginia: U.S. Geological Survey; Ecosystem-scale Selenium Model for the San Francisco Bay-Delta Regional Ecosystem Restoration Implementation Plan. San Francisco Estuary and Watershed Science 11(1):1-39. http://www.escholarship.org/uc/item/2td0b99t

[7] lower FWS threshold of 4mg/kg dw in Lemly, A.D. 1996. Selenium in aquatic systems. In: W.N. Beyer, G.H. Heinz and A.W. Redmon-Norwood, eds., Environmental contaminants in Wildlife: Interpreting tissues concentrations. CRC Press, Lewis Publishers, Boca Raton, Florida. p. 427-445.

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EPA 19 continued

The CVP supplies irrigation water for agricultural lands that discharge irrigation return water with high concentrations of selenium. A pending prohibition to discharge in 2019 will take effect if selenium loads from some of these lands are not sufficiently reduced to protect aquatic life and meet selenium standards in the San Joaquin River.[8] We encourage Reclamation to work with its CVP partners to improve selenium source control and reduce fish impacts in the Delta and San Francisco Bay.

> ***Recommendation***: In the FEIS, identify measures that could reduce the selenium load coming into the San Joaquin River from agricultural lands through source control, such as meeting or exceeding the selenium load reductions outlined in the 2009 Agreement for the Continued Use of the San Luis Drain (Appendix C).[9]

Mercury

EPA 20

EPA agrees that restoring wetlands and floodplains in and near the Delta is an essential component of reviving the Estuary's health; however, nearly all the locations targeted for habitat restoration in the Delta have been, or are at risk of being, contaminated with mercury from historical mining sources and ongoing air deposition from industry. Sport fish in the Delta are already burdened with higher concentrations of mercury than anywhere else in the State[10] and the presence of this powerful neurotoxin in the food web poses a threat to public health and the ecosystem as a whole. For this reason, health advisories have been issued for the Delta and several upstream rivers.

The NMFS BO requires floodplain restoration in the lower Sacramento River Watershed. The DIES identifies the Yolo Bypass as a restoration area with high potential to improve juvenile salmonid survival to the ocean by restoring access to, and improving, rearing habitat that has substantial food resources and is safe from predators, relative to the mainstem Sacramento River. The Bay Delta Conservation Plan DEIS, however, says that the Yolo Bypass may contribute up to 40% of the total methylmercury production in the entire Sacramento watershed (p. 25-63). The State Water Board has also observed that, when the Yolo Bypass is flooded, it becomes the dominant source of methylmercury to the Delta, and that restoration activities could exacerbate the existing mercury problem.[11] The current DEIS discloses that, for all alternatives, values for mercury concentrations in largemouth bass throughout the study area "exceed the threshold of 0.24 milligram/ kilogram wet weight (mg/kg ww) for mercury" (page 6-86).

EPA strongly supports restoration of aquatic habitat in the Delta, however caution must be exercised to ensure that it does not result in unintended consequences that adversely affect water quality. Minimizing the formation and mobilization of methylmercury in wetlands is critical.

> ***Recommendation:*** In the FEIS, explain how habitat restoration locations and methods will be selected to avoid methylmercury production that cannot otherwise be reduced or mitigated.

[8] California Central Valley Water Board (2010) Resolution R5-2010-0046 Amendment to the Water Quality Control Plan for the Sacramento and San Joaquin River Basins for the control of Selenium in the Lower San Joaquin River Basin, Attachment A, p. 1 http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/resolutions/r5-2010-0046_res.pdf
[9] http://www.waterboards.ca.gov/centralvalley/water_issues/grassland_bypass/gbp_2010_2019_use_agree.pdf
[10] SWAMP- Surface Water Ambient Monitoring Program http://www.waterboards.ca.gov/water_issues/programs/swamp/rivers_study.shtml
[11] Alpers, C.N., Fleck, J.A., Marvin-DiPasquale, M., Stricker, C.A., Stephenson, M., and Taylor, H.E., Mercury cycling in agricultural and managed wetlands, Yolo Bypass, California: Spatial and seasonal variations in water quality: Science of The Total Environment, Volume 484, 15 June 2014, Pages 276–287 http://dx.doi.org/10.1016/j.scitotenv.2013.10.096; Ackerman, J. "Agricultural Wetlands as Potential Hotspots for mercury bioaccumulation: experimental evidence using caged fish" Environmental Science and Technology 2010, 44, 1451-1457. Draft Bay Delta Conservation Plan DEIS http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/periodic_review/docs/periodicreview2009.pdf

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Pesticides

The discussion of "Other pesticides" (page 6-24) in the DEIS does not include pyrethroid pesticides. They are mentioned briefly in "other sources of toxicity" in the Sacramento River Region description of existing conditions/existing environment; however this is insufficient discussion of this group of pesticides as water quality stressors. EPA 21

> ***Recommendation***: In the FEIS, include a description of pyrethroid pesticides, their sources, and their role as water quality stressors in the study area.

Mitigation Measures

The DEIS provides a very brief description of mitigation measures for each of the action alternatives, particularly in the water quality, aquatic resources, and terrestrial resources chapters. Mitigation for Alternatives 1, 2, 3, and 4 would include provisions that appear similar to the No Action Alternative and the BOs (aquatic resources page 9-421; water quality page 6-118; terrestrial biological resource page 10-89), including fish passage and coordinating operations with FWS, NMFS, and the Department of Water Resources. The mitigation measures are not well described, their expected effectiveness is not disclosed, and they are not identified as commitments. EPA 22

> ***Recommendation***: In the FEIS, further define the mitigation measures and explain how those for Alternatives 1, 2, 3, and 4 are similar to or different from the No Action Alternative and BOs. Provide an analysis of the measures' predicted effectiveness in mitigating impacts from the Alternatives.

Climate Change

EPA appreciates the consideration that the DEIS gives to the impacts that climate change will have on the operations of the CVP/SWP. The DEIS explains that the project's study period only extends to 2030 because climate change, sea level rise, and other factors will likely impact operations in that timeframe and will necessitate new consultations with FWS and NMFS (page 1-12). The FWS and NMFS BOs and RPAs include fish passage at several dams, and the DEIS acknowledges that improving passage to provide access to additional cold water habitat will be particularly important, considering anticipated climate change scenarios (page 9-117). EPA 23

The DEIS references the California Climate Change Portal 2007 as the source for potential effects of a warming climate in California and references the climate change analysis conducted for the Bay Delta Conservation Plan DEIS for its modeling. The current DEIS briefly summarizes climate change impacts at several points in the document, but does not provide a summary of the climate change and sea level rise assumptions in the discussion of any of the alternatives. While much of this information is available in appendices, the descriptions of alternatives in Chapter 3 would benefit from a discussion of the assumed changes to snow pack, seasonal flows, and sea level.

On December 24, 2014, the Council on Environmental Quality released revised draft guidance for public comment that describes how federal departments and agencies should consider the effects of greenhouse gas emissions and climate change in their NEPA reviews.[12] The revised draft guidance supersedes the draft greenhouse gas and climate change guidance released by CEQ in February 2010. The new draft guidance explains that agencies should consider both the potential effects of a proposed action on climate change, as indicated by its estimated greenhouse gas emissions, and the implications of climate EPA 24

[12] www.whitehouse.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf

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EPA 24 continued

change for the environmental effects of a proposed action. Neither the 2010 nor the 2014 guidance are included in the regulatory framework section of the DEIS.

> ***Recommendations***: In the FEIS, we recommend including a summary discussion of climate change assumptions for each alternative. We also recommend adding a description of CEQ's draft guidance for greenhouse gas emissions and climate change impacts to the regulatory requirements section of the FEIS. EPA recommends that Reclamation enhance its consideration of future climate scenarios by including a review the U.S. Global Change Research Program[13] assessments to assist with identification of potential project impacts that may be exacerbated by climate change and to inform consideration of measures to adapt to climate change impacts.

EPA 25

Groundwater

The DEIS describes beneficial impacts on groundwater resources under Alternatives 1, 3, and 4 because they would provide more water deliveries than would the No Action Alternative (page 7-125-133). It states that increases in surface water supplies as a result of these alternatives would result in diminished use of groundwater; however, no documentation is provided to support this assumption.

The assumption that groundwater use would decrease with increased water deliveries under Alternatives 1, 3, and 4 is used to conclude that, under the other alternatives, including No Action, groundwater quality would diminish, overdrafts from groundwater basins would occur more frequently, and irreversible subsidence would occur. On the contrary, EPA believes it is reasonable to expect that provision of more water could result in more water being used, including as much groundwater as allowed, rather than in strict substitution of surface water for groundwater. Without management of groundwater resources, it is not clear that the pressure on groundwater resources would be diminished as a result of Alternatives 1, 3, and 4.

The DEIS discusses the California Sustainable Groundwater Management Act, which requires the formation of Groundwater Sustainability Plans by 2020 or 2022. Sustainable groundwater operations must be achieved within 20 years following completion of the plans. The DEIS analysis assumes that the groundwater users will have developed their plans by 2030, and may begin to plan, design, and build facilities and operations to achieve compliance with those plans; however, the analysis also assumes that the plans will not be implemented by the end of the study period, and does not account for reductions in groundwater use that will be associated with those plans (page 7-109).

> ***Recommendations:*** Explain the basis for the assumption that increases in surface water supplies would result in diminished use of groundwater. Discuss the likelihood and potential impacts of increased use of surface water supplies for aquifer storage and recovery.
>
> Consider development of a mitigation measure to address management of groundwater resources in the interim period before implementation of the Groundwater Sustainability Plans.

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1A.1.2.1 Responses to Comments from U.S. Environmental Protection Agency

EPA 1: Comment noted.

EPA 2: The Final EIS has been modified to address the comments from the U.S. Environmental Protection Agency (EPA), as described under comments EPA – 8, 9, 13, 14, 16 through 22, 25, and 28. The commenter's support is acknowledged for inclusion of the 2008 U.S. Fish and Wildlife Service (USFWS) and 2009 National Marine Fisheries Service (NMFS) biological opinions, including the Reasonable and Prudent Alternative (RPA), in the No Action Alternative and Alternative 5. USEPA's opposition to alternatives that do not include full implementation of the RPAs is acknowledged, including Alternatives 1, 2, 3, and 4.

EPA 3: This comment addresses mitigation measures related to water quality, aquatic resources, and water temperature impacts presented in the EIS. The discussion of mitigation measures in each of the applicable resource chapters has been expanded in the Final EIS.

Chapter 6: Surface Water Quality Mitigation Measures

Water quality conditions under the No Action Alternative are assumed to be compliant with State Water Quality Control Board existing water quality requirements and identified Total Maximum Daily Load criteria in the Year 2030 with climate change and sea level rise conditions. The results of the salinity modeling, as presented in Appendix 6E, Analysis of Delta Salinity Indicators, of the EIS, indicate that salinity would increase substantially under Alternatives 1, 3, and 4 as compared to the No Action Alternative. It should be noted that even though the models operate the CVP and SWP in accordance with salinity and other water quality requirements, operational decisions made with real-time monitoring data can account for many factors that cannot be simulated by the best available models used by Reclamation and DWR due to the uncertainty inherent in the models used for planning studies.

Under all alternatives, Reclamation and DWR would continue to monitor Delta water quality conditions and adjust operations of the CVP and SWP in real-time as necessary to meet water quality objectives. However, considering real-time changes in surface water flows, discharges from point and non-point sources to surface waters, and continuous CVP and SWP operational decisions it is likely that water quality degradation could occur (as projected in the EIS water quality models) that may not be addressed through real-time operations. In those instances, mitigations measures could be considered to reduce the incremental adverse changes in water quality attributable to implementation of the alternatives as compared to the No Action Alternative. Mitigation measures related to salinity and other water quality constituents would include increased salinity monitoring in time and location, use of the additional monitoring data with updated short-term models to improve salinity forecasts, and development of related operational relationships that would modify real-time CVP and SWP operations (within Reclamation's discretion under federal and state agency requirements, including

California water right permits) based on short-term projected changes in Delta hydrodynamic conditions.

Chapter 9: Fish and Aquatic Resources

The results of the temperature modeling, as presented in Appendix 6B, Surface Water Temperature Modeling, of the EIS, indicate that high water temperatures downstream of CVP reservoirs would cause adverse impacts to fisheries during some lifestages, as described in Chapter 9, Fish and Aquatic Resources under the No Action Alternative and Alternatives 1 through 5. It should be noted that even though the models operate the CVP and SWP in accordance with temperature requirements, operational decisions made with real-time monitoring data account for many factors that cannot be simulated by the best available models used by Reclamation and DWR due to uncertainty inherent in the models used for planning studies. In addition, the No Action Alternative and Alternative 5 include fish passage programs around the CVP dams to reduce the effects of these high temperatures. Therefore, the adverse effects of high temperatures under Alternatives 1 through 4, which do not include fish passage, would be greater than under the No Action Alternative. Mitigation measures related to high temperatures would include increased water temperature monitoring in time and location, use of the additional monitoring data with updated short-term models to improve temperature forecasts, and development of related operational relationships that would modify real-time CVP and SWP operations (within Reclamation's discretion under federal and state agency requirements, including California water right permits) based on short-term projected changes in surface water temperatures downstream of CVP reservoirs. Mitigation measures also could include implementation of fish passage programs, as described in the No Action Alternative and Alternative 5.

EPA 4: Reclamation has and will continue to participate in the on-going process of working with the USFWS, NMFS, and other agencies to develop and implement real-time actions based upon real-time monitoring data to address identified challenges for threatened and endangered fish species, as described in the BOs and other regulatory requirements issued by state agencies, such as State Water Resources Control Board.

EPA 5: Comment noted.

EPA 6: It is acknowledged that the condition of aquatic resources has deteriorated over the past 7 years and it is likely that the current drought in California has undoubtedly resulted in profound effects on aquatic resources, especially on those species with already declining populations. Both the drought and the resultant management actions have contributed to this condition. A brief discussion of the current drought has been added to Section 9.3 of Chapter 9, Fish and Aquatic Resources.

EPA 7: The 2008 USFWS BO and the 2009 NMFS BO considered if the coordinated long-term operation of the CVP and SWP would jeopardize the continued existence of the listed species (as analyzed in this EIS); or adversely modify critical habitat associated with these species. The RPAs contained in the

BOs provide actions to modify the operations in order to avoid jeopardy of listed species or adverse modifications or destruction of critical habitat. As noted in the comment the RPA may not be sufficient to increase fish populations and improve aquatic life beneficial use protection in the estuary and upper watershed beyond the ESA Section 7(a)(2) threshold.

The Purpose and Need for this EIS (see Chapter 2, Purpose and Need) did not include the objective of increasing fish populations or improving aquatic life beneficial use protection; therefore, this concept was not included in the development of the alternatives.

EPA 8: The latest status for the 2009 NMFS BO RPA actions is presented in the RPA Summary Matrix of the NMFS Long-term Operations BiOp RPA that can be found on the Delta Science Program website at http:/www.deltacouncil.ca.gov/science-program-event-products (dated October 13, 2014). Reporting requirements for the 2008 USFWS RPA actions are addressed in the Smelt Working Group Annual Report, also available at the aforementioned website. Please refer to these documents for the status of the RPA actions.

EPA 9: As described in response to Comment EPA 3, the final EIS includes additional details in the description of the mitigation measures in each resource chapter that includes mitigation measures.

EPA 10: The presentation of the results of the qualitative analyses and the integrated results of the quantitative and qualitative results have been modified to provide more clarity in the Final EIS. Presentation of an alternative analytical approach to consider effects on sturgeon also have been included in the Final EIS.

EPA 11: The 2009 NMFS BO recommendations is for real-time operations. The same level of temporal analysis cannot be captured in an impact analysis study. The Draft EIS uses average monthly temperatures to provide a comparison on ability of operations considered under alternatives to meet temperature objectives for species. As described in Section 5A.A.3.6, temperature modeling is subsequent to CalSim II modeling that simulates operations on a monthly basis. As mentioned in Section 5A.A.3.5, regarding CalSim II model results and model results interpretations dependent on CalSim II, there are certain components in the model that are downscaled to daily time step (simulated or approximated hydrology) such as an air-temperature-based trigger for a fisheries action, the results of those daily conditions are always averaged to a monthly time step (for example, a certain number of days with and without the action is calculated and the monthly result is calculated using a day-weighted average based on the total number of days in that month), and operational decisions based on those components are made on a monthly basis. Therefore, reporting sub-monthly results from CalSim II or from any other subsequent model that uses monthly CalSim results as an input is not considered an appropriate use of model results.

It is acknowledged that temperature operations in real-time would be dependent on daily variations of meteorological conditions, reservoir operations, fish presence, and other external factors such as prolonged drought. It is unfortunately not possible to capture all of these on a daily basis in a model. Therefore, the Draft EIS uses model results in a comparative manner to provide a trend analysis rather than interpreting these results as absolute effects, which would be speculative. This level of detail is deemed appropriate for a NEPA analysis.

Changes in water temperature depend on upstream reservoir storage, monthly flow patterns, and the needs of species for each month and each life stage. Detailed discussion of such changes are provided in the EIS.

EPA 12: The comment is consistent with the impact analysis presented in Chapter 9, Fish and Aquatic Resources.

EPA 13: Due to the complexity of the methodologies for the different analytical tools and qualitative analyses, the extent of the analytical coverage with the limitations and uncertainties of each method are presented in Chapters 5 through 21 and in the appendices that provide the modeling methodologies (see Appendices 5A, 6B through 6E, 7A, 8A, 9C through 9O, 12A, and 19A through 19B).

EPA 14: The text has been modified in Section 9.4 of Chapter 9, Fish and Aquatic Resources, in the Final EIS to address the relationship of salinity gradients and abundance of Striped Bass and American Shad.

EPA 15: The water quality requirements specifically associated with CVP and SWP operations are included in Appendix 3A, No Action Alternative: Central Valley Project and State Water Project Operations, of the EIS. The Final EIS text in Sections 6.3.1.2 and 6.3.3.4 of Chapter 6, Surface Water Quality, have been modified to include references to Appendix 3A. The footnotes for Table 6.2 based upon the Regional Water Quality Control Board and State Water Resources Control Board references were inadvertently deleted in the Draft EIS, and have been included in the Final EIS.

EPA 16: As noted in the Appendix 5A Section B, all the alternatives are required to meet the SWRCB D-1641 water quality objectives. The CalSim II modeling of the Alternatives only includes a portion of the water quality objectives, namely: Emmaton, Jersey Point, Rock Slough and Collinsville. CalSim II adjusts SWP and CVP operations to comply with these specific D-1641 standards. CalSim II, however, is a model with a monthly time-step, whereas a number of SWRCB D-1641 standards are described in shorter time-steps. It relies on the ANN model to mirror DSM2 modeled flow-salinity relationships in the Delta. To refine CalSim II simulation results on a shorter time-step, and to account for other localized model assumptions (e.g. tide), the DSM2 model, which utilizes a 15 minute time-step and more Delta-specific assumptions, also is used.

DSM2 salinity results were compared to the SWRCB D-1641 objectives, and the results are presented in the Appendix 6E. In general, SWRCB D-1641 Delta salinity standards are met in all alternatives except for few dry and critical years where there is no stored fresh water available for release The differences in salinity between alternatives mostly point to results of other operations beyond meeting the SWRCB D-1641 salinity standards; such as whether or not reservoirs are releasing to meet 2008 USFWS BO Action 4 (Fall X2), Delta Cross Channel operations, or whether or not south Delta exports are allowed in a particular month. As a result, changes in salinity for each location in Delta shows wide month to month variation between alternatives. Please refer to Appendix 6E for detailed comparison of salinity between the alternatives, and comparison to the SWRCB D-1641 objectives.

The variation in the monthly time-step of CalSim II and 15-min time-step of DSM2 can create an unintended consequence of CalSim II correctly adjusting modeled reservoir releases and exports in order to maintain compliance over a monthly average, while DSM2 potentially reporting an exceedance over part of the month. Therefore, DSM2 results in these cases may be viewed as a system failure to meet SWRCB D-1641 standards. However, in these cases, this is a modeling anomaly.

It should be noted that many of the modeling results showing exceedance of SWRCB D-1641 standards reported in Appendix 6E are the result of the mismatch in modeling time-step, known shortcomings in the ANN model to mirror DSM2 modeled flow-salinity interaction, and/or CalSim II model's limited ability to simulate real-time operational adjustments to avoid exceedance of the objectives in shorter time-steps. Many of the exceedances reported could potentially be eliminated by fine-tuning the reservoir storage, flows and/or exports in real-time. DWR and USBR plan to meet the SWRCB D-1641 standards while operating SWP and CVP facilities and any changes to SWRCB D-1641, as adopted by the SWRCB. Actual operations are continuously adjusted to respond to reservoir storages, river flows, exports, in-Delta demands, tides, and other factors to insure compliance to regulatory requirements to the extent possible.

EPA 17: Droughts have occurred throughout California's history, and are constantly shaping and innovating the ways in which Reclamation and DWR balance both public health standards and urban and agricultural water demands while protecting the Delta ecosystem and its inhabitants. The most notable droughts in recent history are the droughts that occurred in 1977, 1982, and the ongoing drought. More details have been included in Section 5.3.3 of Chapter 5, Surface Water Resources and Water Supplies, in the Final EIS to describe historical and on-going actions by federal and state agencies, including Reclamation and DWR, in response to drought conditions. Reclamation continues to be committed preparation of drought contingency plans and procedures with its federal and state partners, and include ongoing monitoring and reporting actions, as part of its drought response actions.

EPA 18: The discussion of the relationship of Delta outflow and aquatic life conditions are presented in Section 9.4 of Chapter 9, Fish and Aquatic Resources.

The reference in Section 6.4.3.1.1 of Chapter 6, Surface Water Quality, has been modified to refer to Appendix 5A, Section C. Several similar modifications have also been completed in this chapter.

EPA 19: It is acknowledged that USFWS and some other entities use 4 mg/kg threshold per Lemly (1996) as a conservative benchmark for whole-body selenium concentrations to be protective for avoidance of reproductive effects in sensitive fish species; this benchmark was used in the EIS for evaluation of alternatives when comparing results for trophic level four (TL-4) fish such as salmonids based on the Delta-wide model. Both the 4 mg/kg threshold and the low-effects benchmark used for sturgeon (5 mg/kg threshold per Presser and Luoma 2013) are well below the whole-body criterion element of the freshwater ambient water quality criterion (AWQC) proposed by EPA (2015) as a protective concentration for fish (8 mg/kg whole body), including special-status species such as salmonids and green sturgeon. In addition, Chapter 5 (by DeForest and Adams 2011) in the updated edition of Environmental Contaminants in Biota: Interpreting Tissue Concentrations supports use of 8.1 mg/kg as a protective benchmark for reproductive effects. The analysis provided by EPA (2015) in Section 6.3 of the draft AWQC indicates the proposed criterion (8 mg/kg whole body) would be protective for juvenile salmonids as well as for reproductive effects.

Reclamation is actively engaged with the Grassland Area Farmers who discharge subsurface agricultural drainage waters through the Grassland Bypass Project, which is a significant source of selenium to the San Joaquin River and to the Delta. Reclamation and the Grassland Area Farmers are continuing to reduce the amount of agricultural drainage water produced in the Grassland Drainage Area, preventing the discharge of this water into local Grassland wetland water supply channels, and improving the quality of water in the San Joaquin River. The Grassland Bypass Project is based upon an agreement between Reclamation and the San Luis and Delta-Mendota Water Authority to use a 28-mile segment of the San Luis Drain to convey agricultural subsurface drainage water from the Grassland Drainage Area to Mud Slough (North), a tributary of the San Joaquin River. An extensive monitoring program (e.g., San Francisco Estuary Institute [SFEI] 2013) continues to document the effectiveness of actions such as source control and other measures being taken by the Grassland Area Farmers.

The FEIS will include a summary of the actions the Grassland Area Farmers have implemented toward reducing discharge of subsurface drainage waters to the San Joaquin River; these are described in Chapter 2 of SFEI 2013). These activities have included the Grassland Bypass Project and the San Joaquin River Improvement Project, formation of a regional drainage entity, newsletters and other communication with the farmers, a monitoring program, using State Revolving Fund loans for improved irrigation systems, installing and using drainage recycling systems to mix subsurface drainage water with irrigation supplies under strict limits, tiered water pricing and a tradable loads programs.

References

DeForest, D.K., and W.J. Adams. 2011. Selenium accumulation and toxicity in freshwater fishes. Pp. 193-229 In Beyer, W.N., and J.P. Meador (Eds.) *Environmental Contaminants in Biota: Interpreting Tissue Concentrations, Second Edition.* CRC Press.

U.S. Environmental Protection Agency (USEPA). 2015. *Draft Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater 2015*. Office of Water. EPA 822-P-15-001. July.

San Francisco Estuary Institute. November 2013. *Grassland Bypass Project Annual Report 2010-2011*.

EPA 20: The minimization and mitigation of restoration-related mercury methylation will be accomplished primarily through implementation of project-specific mercury management plans for each restoration project. Site-specific factors that determine methylation potential can be more accurately assessed, efforts can be coordinated with ongoing research, and the best approaches to restoration design and adaptive management can be implemented.

For each restoration project, a project-specific methylmercury management plan would be developed and would include a brief review of available information on levels of mercury expected in site sediments/soils based on proximity to sources and existing analytical data, a determination if sampling for characterization of mercury concentrations and/or post-restoration monitoring is warranted, a plan for conducting the sampling, if characterization sampling is recommended, and a determination of the potential for the restoration action to result in increased mercury methylation. If a potential for increased mercury methylation under the restoration action is identified, the plan will also include identification of any restoration design elements, mitigation measures, adaptive management measures that could be used to mitigate mercury methylation, and the probability of success of those measures including uncertainties, and conclusion on the resultant risk of increased mercury methylation, and if appropriate, consideration of alternative restoration areas.

EPA 21: The descriptions of pyrethroid pesticides are included in both Sections 6.3.1.7.3 and 6.3.3.1.1 of Chapter 6, Surface Water Quality of the EIS. These descriptions have been expanded and similar information was added to the affected environment description for the lower San Joaquin Valley in Section 6.3.3.2.1.

EPA 22: As described in response to Comment EPA 3, the final EIS includes additional details in the description of the mitigation measures in each resource chapter that includes mitigation measures.

EPA 23: Detailed information related to climate changes and sea level is presented in Appendix 5A, Section A, CalSim II and DSM2 Modeling. A summary of this information is included in Chapter 3, Description of Alternatives, of the Final EIS.

EPA 24: The Council on Environmental Quality's 2014 Draft Guidance on the consideration of the effects of climate change and greenhouse gas (GHG) emissions is included in Section 4A.1.20 of Appendix 4A, Federal and State Policies and Regulations, in the Draft EIS.

Estimation of changes in greenhouse gas (GHG) emissions are included in Chapter 16, Air Quality and Greenhouse Gas Emissions, of the EIS. As described in Section 16.4.2.1 of Chapter 16, the primary man-made processes that result in GHG emissions include burning of fossil fuels for transportation, heating and electricity generation, agricultural practices, and industrial practices. Additional information related to the effects of changes in GHG emissions on climate change, as included in Section 16.5.3 of Chapter 16 of the Final EIS, indicate that potential for GHG emissions and associated climate change would be similar under Alternatives 1 through 5 as compared to the No Action Alternative because the amount of land in agricultural production and municipal land uses would be similar under all of the alternatives. The amount of net electrical generation from CVP and SWP facilities would be similar or greater than under the No Action Alternative; therefore, the need for additional use of fossil fuels for electricity generation would be similar or less than under the No Action Alternative.

Section 16.4.2.3.1 of Chapter 16 in the Final EIS also includes a discussion of a review of findings from the U.S. Global Change Research Program National Climate Assessment related to potential changes in GHG emissions.

EPA 25: The analysis in the EIS assumes that water supplies and uses for non-CVP and non-SWP water users would be the same under the No Action Alternative, Second Basis of Comparison, and Alternatives 1 through 5. The analysis also assumes that projected land uses and population growth would occur as projected in the current land use plans for 2030; and would be the same under the No Action Alternative, Second Basis of Comparison, and Alternatives 1 through 5. Therefore, the surface water and groundwater supply analyses in the EIS focused on changes to users of CVP and SWP water supplies at the Year 2030. It is possible that water use by non-CVP and non-SWP water users could change in response to other factors, including water transfers or water uses not involving Reclamation or DWR.

Historically, as described in Section 12.3 of Chapter 12, Agricultural Resources, agricultural water users of CVP and SWP water supplies have prioritized use of surface water as compared to groundwater because of the increased cost of and generally poorer quality of groundwater as compared to water rights and CVP and SWP water supplies. As described in Section 7.3 of Chapter 7, Groundwater Resources and Groundwater Quality, when CVP and SWP water deliveries have increased in past years, groundwater elevations also have increased as agricultural water users reduce groundwater use.

Many of the municipal water users, especially SWP water users in southern California, operate their water supplies within adjudicated basins. Therefore, increased groundwater withdrawals would not necessarily be possible on a long-term basis in these areas; and other water supplies, such as recycle water, would be used.

No mitigation measures were included in the EIS for groundwater conditions because groundwater pumping would be similar or decrease and groundwater elevations would be similar or rise under Alternatives 1 through 5 as compared to the No Action Alternative. The Second Basis of Comparison does not comply with the definition of the No Action Alternative under the NEPA guidelines. Therefore, mitigation measures have not been considered for changes under Alternatives 1 through 5 and the No Action Alternative as compared to the Second Basis of Comparison. The EIS analysis was conducted with assumed conditions for Year 2030; and did not analyze sequential changes that could occur prior to 2030. However, it is assumed that changes between Alternatives 1 through 5 as compared to the No Action Alternative conditions that would occur between now and 2030 also would not result in long-term adverse impacts. Section 7.4.2 of the EIS does describe potential increased groundwater elevation declines as compared to the existing conditions. It is understood that in any one year with drought conditions, water users may make short-term choices that could involve more crop idling than increased use of groundwater. However, the analysis of water use in Chapters 5, 7, and 12 of the EIS represent long-term operation assumptions that would occur by 2030.

1A.1.3 Western Area Power Administration

Department of Energy
Western Area Power Administration
Sierra Nevada Region
114 Parkshore Drive
Folsom, CA 95630-4710

SEP 30 2015

Bureau of Reclamation
Bay-Delta Office
Attention: Mr. Ben Nelson
801 I Street, Suite 140
Sacramento, CA 95814-2536

Dear Mr. Nelson:

Western Area Power Administration (Western) has reviewed the draft environmental impact statement titled, "*Coordinated Long-Term Operation of the Central Valley Project and State Water Project*," and is forwarding the following comments for your review and consideration. Western 1

Western understands and appreciates the complexity of preparing this document as the time and effort associated with developing reasonable and prudent alternatives which meet the needs of the biological resources while balancing the institutional and regulatory context with the operational and physical capabilities of the Central Valley Project (CVP) is a significant undertaking. In reviewing the document in its entirety, Western would like to bring to your attention our concern that the potential impacts associated with implementing any of the proposed alternatives could in fact be more significant on the hydropower function than what is currently being estimated by Reclamation. Western 2

For example, the impact analysis concludes that compared to the base case, the decrease in net generation between the alternatives is relatively inconsequential. Western observes that net generation as defined by Reclamation in the document, also includes the energy component required by the CVP to meet energy pumping requirements. Western is responsible for marketing the net hydropower generation after the project energy use requirements have been satisfied. Western is thus concerned that given the specter of natural climatic variations in precipitation, as well as impacts from climate change, when Reclamation goes forward and implements the many individual actions that may be associated with each alternative, the net amount of hydropower generation available to be marketed in excess of the CVP's project energy use pumping requirements could be lower than what is currently represented in the report.

Western understands and supports the need for authorized project beneficiaries of the CVP to assume their environmental stewardship responsibilities associated with the construction and operation of the project. Western is concerned that given the project's history, that the amount of hydropower available to be marketed and its reliability have steadily eroded, impacting its price competitiveness compared with other alternative resources.

Western remains ready, willing, and able to work closely with Reclamation staff in the future as individual actions/solutions are implemented to minimize impacts to the hydropower function to the extent practicable. Western 3

We appreciate this opportunity to provide you with our comments. Should you have any comments and/or concerns, please do not hesitate to contact us at your earliest convenience.

Sincerely,

FOR

Sonja Anderson
Power Marketing Manager

1A.1.3.1 Responses to Comments from Western Area Power Administration

Western 1: Comment noted.

Western 2: The EIS alternatives include consistent climate change conditions without consideration of potential regulatory or operational changes due to climate conditions in the future. Potential climate-related operational changes are currently unknown and it would be speculative to develop such assumptions for a NEPA analysis. Similarly, due to unique nature of each drought period, assuming a prescriptive "drought operation" would also be considered speculative. The Draft EIS acknowledges these uncertain conditions that cannot be quantitatively analyzed at this point; and attempts to qualitatively assess the effects of changes from current affected environment to conditions in 2030 in Section 8.4.2 of Chapter 8, Energy. The impact analysis compares conditions under the Alternatives 1 through 5 to the No Action Alternative; and under the No Action Alternative and Alternatives 1 through 5 to the Second Basis of Comparison. This comparative approach eliminates effects of future uncertainty that cannot be modeled because the uncertainty would occur under all compared alternatives.

Western 3: Comment noted.

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