Enclosure 1

Detailed Comments on NMFS Draft Proposed RPA Adjustments Document
(Enclosure 1 to NMFS January 19, 2017 Transmittal)
March 22, 2017

General/Summary – The National Marine Fisheries Service (NMFS) provided a draft proposed amendment to the components of the reasonable and prudent alternative (RPA) related to Shasta Dam operations from the 2009 Biological Opinion (BiOp) as the first enclosure to its January 19, 2017 transmittal. As discussed in additional detail below, Reclamation believes that the draft proposed amendments should be analyzed for their feasibility, as well as impacts to Central Valley Project (CVP) and State Water Project (SWP) operations, other legal users of water, and river conditions for other fish species throughout the Central Valley (given that other rivers are impacted by Shasta Dam operations due to the integrated nature of the complete system). Additional detailed comments follow.

Page 10 – The document notes that it is based in part on multiple annual reviews, and in particular the 2015 review. Reclamation requests that there be citations as to which proposed amendments pertain to specific annual review findings.

RESPONSE: Noted. Will include annual review citations in the amendment.

Page 11 – The document notes the amendments are based on "lessons learned" from recent drought conditions. Reclamation recommends changing this terminology to "information gained".

RESPONSE: Noted. Will edit language.

Page 11 – The document refers to a phased approach to issuance of the RPA amendments. Reclamation recommends removal of much of this language, given that the language appears to assume that the amendments would have been formally issued for 2017 operations.

RESPONSE: NMFS finds it important to keep the intent of this language that the proposed RPA amendments will be implemented in a phased approach and that it is subject to further discussion and refinement and that it will be an iterative process. This was agreed to in our meetings prior to and included in our January 19, 2017 letter. Please specify the language you request being deleted and please suggest new language.

Page 20 – The table identifying conceptual objectives contains objectives for "recovery" and "enhancement" in Below Normal and Above Normal/Wet year types. Reclamation believes additional dialog and analysis need to be completed on the meaning, intent, and implementation of the fish management priorities identified for these categories in the table.

In addition, though Reclamation supports the goal of enhancement of the species, Reclamation questions the use of enhancement objectives in the development of an RPA.

RESPONSE: NMFS looks forward to continued discussion with Reclamation on these fisheries management objectives.

Page 20 – The document refers to the ongoing development of temperature-dependent mortality objectives. Though Reclamation supports the concept of the use of biological objectives, Reclamation believes that the scientific basis for specific values contained in the objectives needs to be further refined prior to initial implementation to ensure the values are feasible and meet the purposes of the RPA.

RESPONSE: NMFS looks forward to continued discussion with Reclamation on the temperature-dependent mortality objectives.

Page 20/21/22 - The document identifies spring and fall storage targets for Shasta operations. Reclamation questions the feasibility of meeting these targets, particularly during Dry and Critically Dry years. This will be further explored during this year's evaluation. In addition, the targets will be the subject of further evaluation this year for the potential to cause impacts to the CVP/SWP, other legal users of water, and river conditions for other fish species.

RESPONSE: Based on historical data, some spring and fall storage targets have been able to be achieved. Given that the adverse effects to winter-run in the Sacramento River have not been minimized to avoid jeopardy to the continued existence of the species by Reclamation's operations of the Shasta Division during the drought, different operations need to be implemented in order to achieve the desired outcomes. NMFS looks forward to Reclamation's evaluation of the feasibility of meeting these targets and for the potential to cause impacts to CVP/SWP, other legal users of water, and river conditions for other fish species.

Specific to spring target concepts; Reclamation questions the utility of these spring storage targets in the context of fall/winter/early spring operations. However, Reclamation does believe that spring storage projections would be a useful metric for forecasting temperature management capability in the context of the development of initial allocation decisions, and recommends further discussion and development of that concept under Action I.2.3.

RESPONSE: NMFS looks forward to continued discussion with Reclamation on the utility of spring storage targets in the context of fall/winter/early spring operations.

Page 21 – Specific temperature dependent mortality objectives are provided; as noted above, Reclamation believes that the scientific basis for specific values contained in the objectives needs to be further refined prior to initial implementation to ensure the values are feasible and meet the purposes of the RPA.

RESPONSE: NMFS looks forward to working with Reclamation towards developing refined temperature dependent mortality objectives.

Page 22/23 - Reclamation notes that adjustment of the end of September target of 2.4 MAF will be subject to the previously referenced evaluation.

RESPONSE: Noted

Page 27 - For the initial forecast of deliverable water discussed in Action I.2.3, Reclamation recommends removing the requirements for extensive river temperature modeling and accomplishment of specific storage targets, but rather that projected April/May storage levels be used as a surrogate for this extensive modeling to determine the likelihood to achieve temperature compliance during the temperature management season. This will provide a streamlined method to determine if initial allocations can be issued based on conservative projections of adequate storage and cold water pool going into the temperature management season. The basic concept would be that if April/May storage levels are projected to be in a range that ensures temperature compliance during the temperature management season is highly likely, Action 1.2.3.A would be triggered. If storage levels are projected to fall short, either Action 1.2.3.B or C would be triggered, depending on the specific projected storage level. The ranges for each trigger would be developed based on historic data and additional modeling that could be undertaken this year.

RESPONSE: This comment is essentially suggesting that we keep with the status quo under the current RPA requirements. Water years 2014 through 2016 have demonstrated the 2009 BiOp RPA requirements are not achieving the objective to avoid jeopardy to the continued existence of the species and so we have proposed amendments to achieve the desired outcome. NMFS looks forward to working with Reclamation towards refining RPA Action I.2.3.

Page 28 - Reclamation notes that the revised March through May 15 temperature compliance metric will need to be analyzed during this year's evaluation for potential impacts to the CVP/SWP, other legal users of water, and river conditions for other fish species.

RESPONSE: NMFS looks forward to the results of Reclamation's evaluation to determine the potential impacts of the winter-run holding temperature metric.

Page 28 - For Action I.2.3.A, see comment above regarding revision of the initial forecasting method (related to Page 27). For this action, Reclamation recommends removing requirements for extensive river temperature modeling and accomplishment of specific storage targets in the event projected April/May storage levels indicate the strong likelihood to achieve temperature compliance during the temperature management season.

RESPONSE: NMFS disagrees. The river temperature modeling required in RPA Action I.2.3.A is not above and beyond what is required in RPA Action I.2.3. In fact, if storage target, Keswick release temperature, and side gate date metrics are all met, no further river temperature modeling is required.

Page 29 - For Action I.2.3.B, see comment above regarding revision of the initial forecasting method (related to Page 27). For this action, Reclamation notes the need to analyze the proposed April and May release schedule during this year's evaluation for potential impacts to the CVP/SWP, other legal users of water, and river conditions for other fish species.

RESPONSE: NMFS looks forward to the results of Reclamation's evaluation to determine the potential impacts of April and May release schedule as outlined in RPA Action I.2.3.B.

Page 30 - Reclamation questions the need for defining a specific model run for forecasting purposes, and the underlying basis of the table containing specific flow rates for use with the model run. In addition, this section (Action 1.2.3.B.3) does not appear to conform to the purpose of Action I.2.3.B, which only is designed to guide spring operations prior to development of the formal temperature management plan.

RESPONSE: The specific model run is proposed in order to assess the comparative performance of an alternative operation plan to Reclamation's proposed operation plan in its ability to meet temperature criteria throughout the winter-run and spring-run spawning, egg incubation, and fry emergence season. For example in water years 2014 through 2016, various alternative operation plans were run to assess their ability to meet temperature criteria.

Page 30 - For Action I.2.3.C, see comment above regarding revision of the initial forecasting method (related to Page 27).

RESPONSE: Noted.

Page 32/33 - Reclamation questions the feasibility and effectiveness of meeting a seven day average daily maximum (7 DADM) metric as opposed to a daily average temperature (DAT) metric, which will be further explored as part of this year's evaluation. Reclamation believes that in certain instances, due to the averaging function and lag times associated with the metric's response to actual conditions, this metric will have the effect of driving specific operations that may provide for compliance with the metric, but be undesirable for ecosystem needs under both short term and seasonal approaches. In addition, Reclamation questions the feasibility of meeting the specific revised compliance value and location, particularly during Critically Dry years. The temperature metric, location, and value concepts from the proposal are anticipated to be further explored during this year's system-wide evaluation for their effectiveness, and potential to cause impacts to the CVP/SWP, other legal users of water, and river conditions for other fish species.

RESPONSE: NMFS understands Reclamation's uncertainty with regards to feasibility of meeting 7DADM even though 7DADM is the current metric used to manage water temperature on the Stanislaus River and the metric has the potential of being much more flexible than meeting a daily average metric. The effectiveness of 7DADM metric has been widely adapted for the management of salmonids along West Coast streams and is supported by the best available science. NMFS looks forward to Reclamation's system-wide evaluation.

Page 36 - Reclamation requests the documentation/analysis supporting establishment of post-season survival metrics, and how those relate to the objective of avoiding jeopardy to the continued existence of the species. These metrics do not appear to be discussed in the draft administrative memo. In addition, Reclamation notes that it is not clear how the action would be carried out, and therefore how its benefits or impacts can be evaluated.

RESPONSE: NMFS CCVO is working with the NMFS SWFSC winter-run Chinook life cycle model to develop further refined post-season egg-to-fry survival metrics in order to avoid jeopardy to the continued existence of the species. The egg-to-fry survival at RBDD provides an indication of how well physical metrics such as storage, flow, and temperature affect the survival of the species. This metric was developed to assess the achievement of temperature compliance throughout the water year.

Page 40 - Reclamation notes that adjustment of Wilkins Slough minimum flows should be subject to the previously referenced evaluation.

RESPONSE: Agreed, however it should be highlighted that Reclamation never implemented the required RPA Action I.4 from the 2009 BiOp.

Enclosure 2

Detailed Comments on NMFS Draft Administrative Memorandum Document

(Enclosure 3 to NMFS January 19, 2017 Transmittal)

March 22, 2017

General/Summary – The National Marine Fisheries Service (NMFS) provided a draft administrative memo in support of its draft proposed amendment to the components of the reasonable and prudent alternative (RPA) related to Shasta Dam operations from the 2009 Biological Opinion (BiOp) as the third enclosure to its January 19, 2017 transmittal.

Reclamation is supportive of a shift to biologically based objectives, but as described below, does not believe there is a basis identified in the draft administrative memo document for the particular values identified in the draft proposed amendment. Reclamation believes there are similar issues with limited or absent supporting data and information in the draft administrative memo for the establishment of other compliance metrics and values contained in the draft proposed amendment. Having this information will be critical in achieving compliance with Sections 4004(a)(6)(A) and (B) of the Water Infrastructure Improvements for the Nation (WIIN) Act. In addition, information supporting the feasibility of meeting the proposed operational criteria is limited or absent, as is any information regarding impacts to CVP/SWP operations, other legal users of water, and river conditions for other fish species throughout the Central Valley (given that other rivers are impacted by Shasta Dam operations due to the integrated nature of the complete system).

In developing our comments on the documents, Reclamation worked with CVP stakeholders to learn more about their thoughts and concerns with the documents and concepts. As part of their comments, several of the stakeholders noted significant concerns with the temperature-dependent egg mortality model and the survival estimates used as a major component of the model calibration, which are both outlined in the draft administrative memo. Reclamation also has concerns with the model, which are discussed in the detailed comments section below. Stakeholder comments include concerns with calibration of the mortality model based on uncertainties in the estimates of egg numbers as well as periods of time when out-migrating juveniles are missed due to sampling outages and techniques. They also include concerns on underlying hypotheses of the mortality model, and potential for other factors to be involved with egg and fry mortality as echoed in Reclamation's comments below. Because of the concerns from both Reclamation and various stakeholders with these key components of the NMFS draft proposal, Reclamation recommends that these issues be discussed, analyzed, and resolved.

Additional detailed comments follow.

Page 1; Paragraph 1 – The document states that water temperatures that rose to "sub-lethal and lethal levels" were in part the result of "competing water demands". Reclamation does not believe that water demands resulted in the temperature issues, as there was simply not enough

inflow to the reservoir to support temperature operations during those years. Reclamation recommends deleting reference to "competing water demands".

RESPONSE: NMFS disagrees. Competing water demands include Delta outflow, diversions, and Wilkins Slough navigation criteria. These demands ultimately contributed to a decreased water supply in Shasta Reservoir. Less water supply in Shasta Reservoir resulted in an increase in Sacramento River water temperatures.

Page 1; Paragraph 1 - The document states that the "NMFS Southwest Fisheries Science Center (NMFS-SWFSC) found that temperature dependent mortality alone resulted in the loss of approximately 77% and 85% of the population, respectively". These numbers appear to be estimates based on modeling that has not been peer-reviewed or published. Reclamation recommends revising the statement to clarify those caveats, and notes that additional questions on temperature dependent mortality estimates contained in the document can be found in other comments below.

RESPONSE: The NMFS-SWFSC temperature dependent mortality model has been peer-reviewed and published.

Page 1; Paragraph 2 – The document notes that "severe temperature-related effects were not avoided in 2014 and 2015", and states that the lessons learned during the drought the basis for the adjustment to the RPA Action Suite. Reclamation notes that recently published studies[1][2] based on proxy data such as tree ring histories indicate that for large portions of the state encompassing many components of the CVP/SWP, by some measures the 2014 drought by itself may have been a multicentury-scale event, and the full 2012-2015 drought sequence leading to the conditions in 2014 and 2015 may have been at a multimillennial-scale or beyond. Though the information gained from these events is valuable in evaluating how to manage through future droughts, the low likelihood of a repeat event should be taken into consideration to ensure that an amended or future RPA protects the species within the reasonable bounds of expected future conditions.

RESPONSE: NMFS understands the low probability of this event occurring again, however winter-run Chinook salmon ESU is only one extant population, and it is outside of its historical spawning distribution in an artificially-maintained habitat that is vulnerable to drought and other catastrophes. The currently diminished habitat, abundance, spatial structure, and diversity of the ESU, and the increased frequency and duration of droughts predicted to occur as climate change progresses suggest that SR winter-run Chinook salmon are likely much more vulnerable to drought today than they were historically. As such, the population is determined to be at a moderate risk of extinction. It is Reclamation's legal obligation under the Endangered Species Act for the operation of the Shasta Division to minimize the adverse effects of warm water temperatures for winter-run spawning, egg incubation, and fry emergence in order to avoid jeopardy to the species.

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[1] Robeson, S.M. (2015), Revisiting the recent California drought as an extreme value, Geophys. Res. Lett., 42, 6771-6779, doi:10.1002/2015GL064593

[2] Griffin, D., and K. J. Anchukaitis (2014), How unusual is the 2012–2014 California drought?, Geophys. Res. Lett., 41, 9017–9023, doi:10.1002/2014GL062433

Page 3 – The CalSim-II temperature compliance location and Shasta storage percentages listed rely heavily on the statistical stationarity of model performance which does not include the implementation of the NMFS 2009 or US Fish and Wildlife Service 2008 RPA actions.

RESPONSE: That is correct. The information presented on page 3 is a summary of the information that was provided in the NMFS 2009 BiOp (which does not include implementation of the BiOps).

Page 3/4; Table 1 and supporting discussion: As outlined above, for five of the eight years being cited in the table as having fallen short of the previous storage performance metrics, California was enduring a severe drought with a significantly low return frequency. Using this very short sample period at a time when an extreme event occurred as a measure of the ability to meet storage metrics in the long run is not appropriate.

RESPONSE: NMFS disagrees. Even though California was enduring a severe drought with a significantly low return frequency, the adverse effects of water temperature from Shasta Division operations on winter-run Chinook salmon spawning, egg incubation, and fry emergence were not being avoided or minimized and were jeopardizing the continued existence of the species.

Page 4/5 – The discussion of Reclamation's April/May storage analysis indicates that certain minimum storages must be met in order to meet temperature compliance. This is not the case nor intent of the analysis; the storages merely provide an early indication of the potential to meet certain temperature targets based on past data. Actual performance to any temperature metrics would be dependent on strategies taken during the course of a particular season using the supply available and conditions experienced.

RESPONSE: Noted. Language will be edited to reflect this comment.

Page 5; Footnote 2 – Reclamation notes that work remains to be completed to determine whether the 53° F daily average temperature at CCR performs as a surrogate for a 55° seven day average daily maximum criteria.

RESPONSE: Based 18 years of Sacramento River water temperature data from May 15 to October 31, 53° F DAT at CCR (technically 53.3° F) is an approximate equivalent to a 55° F 7DADM at CCR. NMFS is happy to provide the data and analysis to show this.

Also, it is our understanding that the use of seven day average daily maximum criteria is different from the criteria used by NMFS in assessing temperature- dependent mortality (e.g. daily average temperature), which is generated in predictive models.

RESPONSE: Correct, daily average temperatures is used in the NMFS temperature-dependent mortality model.

Page 7 – The document identifies required spring and storage targets without any analysis for the specific benefits, feasibility, or impacts of meeting these targets, particularly in the year

types identified. In addition, no analysis is provided to show that both the September storage targets and seasonal temperature targets can be met given the spring storage targets.

RESPONSE: The memo clearly outlines the benefits of achieving the spring and fall storage targets (i.e. the ability to meet temperature criteria). These storage targets have been met in the past, so they are feasible and it is not NMFS's duty to analyze the feasibility or impacts of meeting these targets; that is Reclamation's responsibility.

In addition, it should be noted that the use of spring storage targets by year type will require the use of runoff forecasts, which will introduce uncertainty and possibly intra-seasonal operational shifts in the event of variability within the year type, or change of year type while operating through the late winter/early spring operational season.

RESPONSE: Noted, NMFS understands this.

Page 7/8; Table 4 and supporting discussion – As outlined above, for five of the seven years being cited in the table as having fallen short of the temperature performance metrics, California was enduring a severe drought with a significantly low return frequency. Using this very short sample period at a time when an extreme event occurred as a measure of the ability to meet temperature metrics in the long run is not appropriate.

RESPONSE: NMFS disagrees. See previous response.

Page 8; Paragraph 1 – The document notes that a 55° F seven day average daily maximum (or equivalent) metric must be met over the most downstream redd location in every year. Reclamation questions the feasibility of this given that it simply could not be accomplished in years like 2014 and 2015 given the available water supply (as noted on Page 22 of the document), and recommends that other strategies should be developed and employed in severe drought years to maximize survivorship.

RESPONSE: NMFS agrees, the language on page 8 will be edited. The draft proposed RPA I.2.4 does reflect a strategy in severe drought years to maximize survivorship as noted on page 22. Specifically, in critically dry years, <56° F DAT shall be targeted to CCR or the downstream-most winter-run redd, whichever location is further downstream. This temperature management target in critically dry years will require interactive decision making processes to determine the optimal management strategies during extreme conditions. And in dry years, <54° F DAT shall be targeted to the downstream-most winter-run redd.

Page 9; Table 5 – The table identifying conceptual objectives contains objectives for "recovery" and "enhancement" in Below Normal and Above Normal/Wet year types. Reclamation believes additional dialog and analysis need to be completed on the meaning, intent, and implementation of the priorities identified for these categories in the table.

RESPONSE: NMFS looks forward to this discussion.

In addition, though Reclamation supports the goal of enhancement of the species,

Reclamation questions the use of enhancement objectives in the development of an RPA.

RESPONSE: NMFS looks forward to this discussion. ESA Section 7 consultation include both the survival and recovery of the species. Enhancement of low population levels and degraded habitat entails recovery of the species and its critical habitat.

Page 9; Paragraph 1 – Reclamation questions the use of a "newly developed" model which has not yet been subject to peer review or publication as the basis for the development of regulatory actions that have the potential to impact other beneficial uses of the water supply from Shasta Dam. In addition, based on the description, the study focuses on developing estimates of temperature dependent mortality based on modeling of temperature exposure of eggs, and comparing those to field-based fry survival estimates that result from any number of factors affecting survival. Reclamation requests additional discussion/description as to whether other (non-temperature based) factors might play a role in the survival estimates, and how those might factor in to the temperature dependent mortality modeling to produce the most accurate estimate of direct temperature impacts. Reclamation also requests additional discussion regarding access to the models and results summarized in this paragraph.

RESPONSE: The NMFS-SWFSC temperature-dependent mortality model has since been peer reviewed and published in a scientific journal[3]. The temperature-dependent mortality model does take into account non-temperature based mortality that may occur from where the redd is deposited to fry migration at Red Bluff Diversion Dam. Please see cited literature for a more detailed explanation. On April 25, 2017, NMFS-SWFSC held a half-day workshop to demonstrate and discuss their temperature and biological models, including the temperature-dependent mortality model. NMFS looks forward to additional discussion of the model.

Page 10; Paragraph 2 – The document discusses historic temperature dependent mortality as if the values had been formally and accurately determined; the document should clarify that these are estimates based on the previously discussed model, and should be caveated with associated model limitations. Further, it is not clear how these estimates support or link to any of the proposed actions in the draft proposal.

RESPONSE: NMFS will edit language to reflect model limitations and explain how the historical temperature-dependent mortality averages support the proposed temperature-dependent mortality objectives.

Page 10; Paragraph 4 – The document establishes biological objectives, but does not provide a basis for these objectives, and notes (as highlighted in footnote 4) that these estimates are "preliminary and subject to further analysis to understand whether the population can withstand this level of mortality and still be viable." Reclamation believes that the scientific basis for specific values contained in the objectives needs to be further refined prior to initial implementation to ensure the values are feasible and meet the objective of avoiding jeopardy to continued existence of the species.

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[3] Martin, B. T., A. Pike, S. N. John, N. Hamda, J. Roberts, S. T. Lindley, and E. M. Danner. 2016. Phenomenological Vs. Biophysical Models of Thermal Stress in Aquatic Eggs. Ecology Letters 20(1): 50-59.

RESPONSE: NMFS looks forward to working with Reclamation on developing temperature-dependent mortality objectives that will avoid jeopardy to the continued existence of the species and that are based on the best available science.

Page 14; Paragraph 2 through Page 16; Paragraph 2 – The document states that drought conditions "over the last five years have highlighted the uncertainties in Reclamation's SRWQM and its inability to meet the regulatory requirements outlined in the CVP/SWP operations Opinion." It is not clear which regulatory requirements this statement refers to, but under any reference, Reclamation does not believe the model has failed to meet regulatory requirements. If the reference is to the inability to meet temperature objectives in 2014 and 2015, the model is not at fault, but rather the lack of water supply itself (indicating infeasibility of the requirements in certain years). The model has produced information as specified in the current BiOp, thus it is not clear what this statement refers to.

RESPONSE: NMFS will edit to reflect that in 2014, the SRWQM predicted that temperatures would be met for the temperature management season when in fact they were not.

The document states that in order to make accurate forecasts "for the entire season for all of the scenarios, Reclamation needs to have all of the environmental input variables accurate: the reservoir inflows, weather, operations (gate changes, etc.), and reservoir dynamics over a 6-month period." These inputs are independent of the modeling system, and thus do not indicate fundamental flaws with the current modeling system. In addition, uncertainties inherent in these parameters will impact the ability for any modeling system to predict future outcomes.

RESPONSE: NMFS agrees that the model inputs are independent of the modeling system. The intent of this statement is that there are uncertainties associated with inputs into the model. Those uncertainties are then compounded by the uncertainties associated with the model itself.

The document states that the model "has a difficult time reflecting actual release temperature and conditions when the critical reservoir thermocline of about 52°F approaches the elevation of the TCD side gates and/or reservoir outlet works." Reclamation believes this situation represented a new understanding of the operational limitations of the physical infrastructure, not a modeling flaw.

RESPONSE: Noted.

The document describes that given "the significant simplification of the input data (which is derived from a 12-month operations outlook), the unknowns regarding future meteorological conditions, and the fact that the actual TCD does not have infinite adjustability, the model can only realistically provide a broad brush picture of future operations and cannot provide sufficient precision to determine future operations." Reclamation believes that given the complexity of the CVP/SWP, uncertainties inherent in variables such as the weather at timescales of months in the future, and fundamental limitations of simulation modeling, that no model can possibly be capable of "determining future operations" at the resolution and lead times being contemplated by these statements.

RESPONSE: Note that the quoted statement is taken from a March 5, 2015, Reclamation document circulated to the Sacramento River Temperature Task Group entitled "General Process for Running the CVO Sacramento Temperature Model". While there may be some validity to your comment, the Delta Science Program's Independent Science Panel has recommended that the model currently used to predict temperatures on the Sacramento River be replaced to reflect the latest technologies and best available science.

The document concludes that as a result of the perceived limitations in modeling, Reclamation "has historically overestimated their ability to meet the temperature compliance point". Reclamation does not agree with this statement and the supporting values and figures, and believes that if these assertions are to remain a part of an administrative record for any amendments to the RPA, that a focused discussion between the agencies on this subject should occur to ensure that any statements regarding historic compliance issues represent a complete picture of the decisions and factors leading to historic performance.

RESPONSE: NMFS looks forward to this discussion.

The document describes buffers to address uncertainty in modeling, including the joint use of conservative meteorological inputs and hydrologic forecasts. Reclamation notes that though the use of conservativism in forecasting is appropriate given the long lead times being considered in the forecasts as well as the uncertainty in components of the forecasting, the use of these conservative inputs has the potential to increase the joint probability of the overall resultant forecast to a level that is no longer within the realm of reasonability. Instead, Reclamation recommends the two agencies continue to discuss the potential for an alternative mechanism to address early season forecasting, such as the one identified in Enclosure 1 of this response. In addition, Reclamation looks forward to working with NMFS on future modeling improvement opportunities such as those discussed in Enclosure 3 of this response.

RESPONSE: NMFS looks forward to working with Reclamation on future modeling improvement opportunities.

Page 16; Paragraph 3 through Page 19 – The document contains a large amount of data regarding historic flowrates and temperatures, but it is not clear how this information supports the conclusion on page 19 that Keswick releases should be limited, and does not contain any supporting information regarding the specific flow rates contained in Table 10. In addition, this proposed maximum flow schedule does not relate to any specific action in the draft proposed amendment, thus Reclamation would recommend removal of this section of the document. Should a maximum release schedule be considered, Reclamation notes that it would require evaluation for its impacts to CVP/SWP operations, other legal users of water, and river conditions for other fish species.

RESPONSE: The historic and modeled flow releases are the basis for the proposed maximum release flow schedule in order to ensure the temperature compliance metric will be met for the entire temperature management season. NMFS agrees that a maximum release schedule should be evaluated for its impacts to CVP/SWP operations, other legal users of water, and river conditions for other fish species. NMFS spent many months in the fall of 2016 trying to engage

Reclamation to run these sort of operational scenarios but to no avail.

Page 20; Paragraph 2 – With respect to spring holding temperature management, Reclamation questions the feasibility and effectiveness of meeting a seven day average daily maximum (7 DADM) metric as opposed to a daily average temperature (DAT) metric, which will be further explored as part of this year's evaluation. Reclamation believes that in certain instances, due to the averaging function and lag times associated with the metric's response to actual conditions, this metric will have the effect of driving specific operations that may provide for compliance with the metric, but be undesirable for ecosystem needs for both short term and seasonal approaches. The temperature metric, location, and value concepts from the proposal are anticipated to be further explored during this year's system-wide evaluation for their effectiveness, and potential to cause impacts to the CVP/SWP, other legal users of water, and river conditions for other fish species.

RESPONSE: NMFS disagrees that there is any question to the effectiveness of 7DADM metric for adult holding temperature compliance criterion; this is based on the best scientific information available to minimize the adverse impacts of warm water on winter-run Chinook salmon holding. NMFS understands that there may be feasibility issues associated with managing to a new temperature compliance metric. We look forward to the results from the system-wide evaluation.

Page 21, Paragraph 3 – With respect to summer temperature management, Reclamation questions the feasibility and effectiveness of meeting a 7 DADM metric as opposed to DAT metric, which will be further explored as part of this year's evaluation. Reclamation believes that in certain instances, due to the averaging function and lag times associated with the metric's response to actual conditions, this metric will have the effect of driving specific operations that may provide for compliance with the metric, but be undesirable for ecosystem needs for both short term and seasonal approaches. In addition, Reclamation questions the feasibility of meeting the specific revised compliance value and location, particularly during Critically Dry years. The temperature metric, location, and value concepts from the proposal are anticipated to be further explored during this year's system-wide evaluation for their effectiveness, and potential to cause impacts to the CVP/SWP, other legal users of water, and river conditions for other fish species.

RESPONSE: See response above. Temperature compliance metrics must be protective of winter-run spawning, egg incubation, and fry emergence in critically dry water year types. If not, the population and species will go extinct.

In addition, in developing our comments on the document, Reclamation worked with CVP stakeholders to learn more about their thoughts and concerns. As part of their comments, one of the stakeholders noted similar concerns to those raised by Reclamation regarding the temperature compliance concepts. The stakeholder provided an analysis detailing how temperature-related mortality objectives could still be attained at higher temperatures. As part of this year's analyses and stakeholder engagement processes, Reclamation believes the agencies should further explore the concepts being developed by this and other stakeholders.

RESPONSE: NMFS disagrees that the temperature-related mortality objectives could still be attained at higher temperatures, however we are open to exploring further concepts and ideas to reach the same objective.

Page 22; Paragraphs 2 and 3 – Reclamation supports targeting temperature management at a logical location in segments of the river where spawning is occurring, and the use of an operational metric that reduces the likelihood of unintended operations such as those described in the paragraphs above pertaining to the 7DADM metric.

RESPONSE: NMFS thanks you for your comment.

Page 22/23 – The document provides no supporting information for the selection of the less restrictive temperatures in certain year types. Reclamation recommends that as part of any future science workplan (as discussed in Enclosure 3 to this response), the agencies work to establish strategies for drought conditions that will maximize survivorship based on the amount of cold water resources available.

RESPONSE: NMFS looks forward to those discussions.

Page 24 – The document provides no supporting information for the selection of October 15 as a key date for full side gate access. Reclamation suggests this operation should be adaptively managed based on the conditions existing in any particular year.

RESPONSE: NMFS looks forward to those discussions.

Enclosure 3

Detailed Comments on NMFS Draft Science Workplan

(Enclosure 4 to NMFS January 19, 2017 Transmittal)

March 22, 2017

General/Summary – The National Marine Fisheries Service (NMFS) provided a draft science workplan as the fourth enclosure to its January 19, 2017 transmittal of the draft proposed amendment to the components of the reasonable and prudent alternative (RPA) related to Shasta Dam operations from the 2009 Biological Opinion (BiOp). The transmittal refers to the fourth enclosure as a "proposed science workplan". The document identifies itself as a proposed modeling framework. The latter description appears to be more accurate. Reclamation believes that the two agencies should meet and further discuss the need and objectives for the development of a science workplan, and based on a common understanding of what the workplan is intended to accomplish, develop a document that reflects near-term and long-term needs that can leverage partnerships and be sustained.

The science workplan should support ongoing processes involving the entire Central Valley Project (CVP), including but not limited to the reinitiation of consultation (ROC) on the NMFS and US Fish and Wildlife Service Biological Opinions (BiOps), activities under the Central Valley Project Improvement Act (CVPIA), compliance with the Water Infrastructure Improvements for the Nation (WIIN) Act, Bay-Delta Water Quality Control Plan update processes being undertaken by the State Water Resources Control Board, development of supporting information for decisions related to the California WaterFix project, adaptive management processes under the existing BiOps, and various projects related to the species being undertaken by stakeholders including the Collaborative Science and Adaptive Management Program (CSAMP) and the Sacramento River Settlement Contractor efforts. Reclamation believes the need for such a workplan warrants an approach that extends beyond this process to amend the Shasta-related components of the existing NMFS BiOp, and development of the workplan should be undertaken as a parallel but separate process from the amendment process. We believe there is a need to prioritize Shasta-related components of the workplan in support of this amendment process.

In October 2016, Reclamation developed a draft workplan for the development of a revised framework for operational models in support of Sacramento River temperature management. This workplan is geared towards meeting the forecasting needs of Reclamation's operations, and as such, is anticipated to support many of the physical modeling needs associated with activities under the RPA of the NMFS BiOp. Reclamation believes that as a result, some of the efforts outlined in the "Physical Models" section of the proposed framework in the NMFS draft science workplan are duplicative with efforts already underway in this workplan. Reclamation looks forward to working with NMFS to further discuss how we may be able to leverage our respective efforts by focusing on the strengths and expertise of each agency in order to minimize duplication and ultimately meet the needs of both agencies. Specifically, Reclamation envisions an approach that provides for Reclamation taking a lead role in the development of physical/operational modeling, with NMFS focusing more specifically on leading biological

modeling. Both agencies should consider undertaking activities within a large, diverse, and collaborative science enterprise that incorporates other partner agencies, stakeholders, non-governmental organizations, and academia.

RESPONSE: NMFS looks forward to working with Reclamation and stakeholders on developing a science work plan.

Page 3/4 – The document describes work completed on an egg survival model. Based on the description and associated figures, the study focuses on developing estimates of temperature dependent mortality based on modeling of temperature exposure of eggs, and comparing those to field-based fry survival estimates that result from any number of factors affecting survival. Reclamation requests additional discussion/description as to whether other (non-temperature based) factors might play a role in the survival estimates, and how those might factor in to the temperature dependent mortality modeling to produce the most accurate estimate of temperature impacts. Reclamation also reiterates the need to address concerns raised by CVP stakeholders as discussed in Enclosure 2 to this transmittal.

RESPONSE: NMFS looks forward to additional discussion on temperature-dependent and non-temperature dependent mortality of winter-run Chinook spawning, egg incubation, and fry emergence.

Page 6 ("Reservoir" paragraph) – The document states that current monitoring and modeling of water quality in Shasta Reservoir is inadequate, and suggests additional monitoring needs. No data or information is offered to support the statement of inadequacy, nor is information offered as to what needs would be met through additional monitoring. It should be noted that Reclamation does not agree with the statement, and would encourage further dialog on any potential additional needs for expanded in-reservoir monitoring.

RESPONSE: NMFS looks forward to continued discussion with Reclamation on this issue.

Page 6 ("Summary" paragraph) – The document notes the application of the modeling framework in support of other processes such as California WaterFix and meeting Delta water quality standards. This appears to support the concept of a larger process as outlined in our general comment section above.

RESPONSE: Noted.