



State of California – Natural Resources Agency  
DEPARTMENT OF FISH AND WILDLIFE  
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*EDMUND G. BROWN JR., Governor*  
*CHARLTON H. BONHAM, Director*



May 23, 2018

Joseph Yun  
Executive Officer  
California Water Commission  
P.O. Box 942836  
Sacramento, CA 94236-0001

Dear Mr. Yun:

### **RELATIVE ENVIRONMENTAL VALUE OF WATER STORAGE INVESTMENT PROGRAM PROJECTS AND DEPARTMENT FINDINGS**

Thank you for your leadership during this process. As you know, the California Department of Fish and Wildlife (Department) is tasked with the responsibility of making recommendations to the California Water Commission (Commission). I acknowledge the complexity of the process has been challenging for you, Commissioners, the reviewing agencies, and each applicant. No one has tried a competitive approach to water storage on such a scale before. The good news is that the Commission and applicants are as close as ever to adding much needed water storage capacity through a portfolio of different types of projects across a diverse geography.

This competitive approach must adhere to the controlling statute and the implementing regulations. At each step of your process, our Department has always based our recommendations on the plain instructions in the statute and the regulations. All of the current applicants, as members of a broad-based stakeholder advisory group, helped develop these regulations during a two-year dialogue. At the last Commission meeting, the Department's recommendations to the Commission on monetized ecosystem benefits to include in the public benefit ratio calculations were discussed. This package contains our next assignment under the regulations related to our calculation of relative environmental value for the ecosystem improvements of a project and preliminary findings. However, as I describe at the end of this letter, each applicant retains an important obligation to complete due diligence for their projects promptly.

Pursuant to the Water Storage Investment Program (WSIP) regulations, this letter and attachments transmit to California Water Commission (Commission) staff (1) the relative environmental value scores calculated by the California Department of Fish and Wildlife (Department) and (2) the Department's findings on the public benefits claimed by each WSIP project. The WSIP regulations require the Department to calculate a relative environmental value for ecosystem improvements, based on information supplied in each project's application. (Cal. Code Regs. tit. 23, § 6007, subd. (c).) Additionally, if the Department "finds the public benefits as described in a project's application meet all of the requirements of Water Code section 79750 *et seq.* for which the reviewing

agency is responsible, the reviewing agency shall provide to the Commission a written statement confirming the finding.” (Cal. Code Regs., tit. 23, § 6012, subd. (d).) This finding is a “preliminary assessment of public benefits based on information supplied in the application that indicates that a project’s public benefits meet the requirements of Water Code section 79750 *et seq.*” (Cal. Code Regs., tit. 23, § 6012, subd. (a).)

For each ecosystem benefit quantified, project applications were required to identify at least one applicable ecosystem priority listed in section 6007, subdivision (c), of the WSIP regulations. (Cal. Code Regs., tit. 23, § 6003, subd. (a)(1)(Q).) The Department applied the 10 relative environmental value criteria outlined in Table 2 of section 6007, subdivision (c)(1)(A)(1), to score each of the ecosystem priorities identified by the applicant. Based on information supplied in the application, the Department considered information supporting ecosystem benefits including the analytical methods, modeling results, and physical, chemical, or biological information. (Cal. Code Regs., tit. 23, § 6007, subd. (c)(1)(A)(1).) Section 6007, subdivision (c)(1)(A)(2), states the score shall be assigned by evaluating the degree of change between with- and without-project conditions, and the degree to which ecosystem improvements associated with each claimed priority would be provided by a project.

The relative environmental value scores reflect the Department’s critical and thorough evaluations of project applications and include comments to the Commission and its staff that address the many aspects of the projects as proposed. The Department’s analysis contained in this package is consistent with our analysis related to public benefits.

The Department recognizes that the projects in many cases have a long history in water management planning in California, and have additional steps in front of them that will refine the projects, reduce uncertainties, and further inform the Commission’s decisionmaking. The regulations emphasize the preliminary nature of the findings submitted to you today, and the fact that changes may occur after a reviewing agency’s findings. (Cal. Code Regs., tit. 23, § 6012(g).) Moreover, prior to the Commission encumbering funding, each successful applicant must enter into enforceable contracts for public benefits and non-public benefit cost shares, complete feasibility studies and environmental documentation, obtain all required federal, state, and local approvals, and provide extensive additional information to the Commission, as applicable, on items including labor compliance, urban water management plans, agricultural water management plans, and groundwater management plans or GSP(s). (Cal. Code Regs., tit. 23, § 6013(a)(1), (c).)

This letter and attachments represent the completion of the Department’s technical review of WSIP projects for the purpose of contributing toward the maximum conditional eligibility determination of each project that the Commission must make. The Department looks forward to continuing to work with the Commission and project

Mr. Joseph Yun, Executive Officer  
California Water Commission  
May 23, 2018  
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applicants in the next phase of the WSIP.

Sincerely,

A handwritten signature in black ink, appearing to read "C. H. Bonham", with a long horizontal line extending to the right.

Charlton H. Bonham  
Director

Encl: CDFW Findings on WSIP Public Benefits, Relative Environmental Value  
Scores, Technical Review Comments

ec: California Department of Fish and Wildlife

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## **Sites Project – Relative Environmental Value Score**

### **Project Overview**

The Sites Project Authority (Applicant) proposes the Sites Project (Project) that includes a new 1.8 million acre-foot (MAF) reservoir off-stream of the Sacramento River. It would be filled by diverting excess flows from the Sacramento River at existing diversions facilities in Red Bluff and Hamilton City, and a new diversion near Delevan. The primary ecosystem benefits proposed derive from coordinated operations of Sites Reservoir, Shasta Lake, Lake Oroville, and Folsom Lake. Through the use of water stored in Sites Reservoir in substitution for releases from these other reservoirs, storage could be conserved in Shasta Lake, Lake Oroville, and Folsom Lake to increase operational flexibility and to improve river water temperatures for anadromous fish survival. Utilizing this operational design the Applicant claims temperature improvements to the upper Sacramento River that would result in higher rates of salmon survival. Similarly, the Applicant states there would be temperature improvements derived from added water stored in Oroville. The Applicant is also proposing to deliver water to the Yolo Bypass, in order to propagate nutrient rich water lower in the bypass system that would later be flushed to the Delta where smelt could benefit from increased food productivity. Lastly, the Applicant is proposing deliveries of Incremental Level 4 refuge water to National Wildlife Refuges, State Wildlife Areas, and privately managed wetlands in order to improve wetland habitat and provide benefits to species utilizing these habitats.

### **Ecosystem Priorities Identified by the Applicant**

The Applicant has identified the following ecosystem priorities:

- Priority 1 – Provide cold water at times and locations to increase the survival of salmonid eggs and fry.
- Priority 2 – Provide flows to improve habitat conditions for in-river rearing and downstream migration of juvenile salmonids.
- Priority 3 – Maintain flows and appropriate ramping rates at times and locations that will minimize dewatering of salmonid redds and prevent stranding of juvenile salmonids in side channel habitat.
- Priority 4 – Improve ecosystem water quality.
- Priority 5 – Provide flows that increase dissolved oxygen and lower water temperatures to support anadromous fish passage.
- Priority 10 – Enhance the frequency, magnitude, and duration of floodplain inundation to enhance primary and secondary productivity and the growth and survival of fish.
- Priority 11 – Enhance the temporal and spatial distribution and diversity of habitats to support all life stages of fish and wildlife species.
- Priority 14 – Provide water to enhance seasonal wetlands, permanent wetlands, and riparian habitat for aquatic and terrestrial species on State and Federal wildlife refuges and on other public and private lands.
- Priority 15 – Develop and implement invasive species management plans utilizing techniques that are supported by best available science to enhance habitat and increase the survival of native species.
- Priority 16 – Enhance habitat for native species that have commercial, recreational, scientific, or educational uses.

The California Code of Regulations requires the California Department of Fish and Wildlife (Department) to apply 10 Relative Environmental Value (REV) criteria to score each of the priorities that an applicant claims would be provided by a project. (Cal. Code Regs., tit. 23, § 6007, subd. (c)(1)(A)(1).) Based on the information provided in the application, the Department scored each ecosystem priority listed above to determine the ecosystem REV score shown below. To implement REV Criterion 1, the Department has developed a standard calculation to assign points based on the number of ecosystem priorities a project has claimed. For each priority claimed, the Department added 0.375% to a project’s final ecosystem REV score. REV Criterion 2 through 10 were each scored on a scale of 0 to 6. Detailed scores are provided in Table 1. A summary of comments for each Priority-REV combination is provided in Sites Project – Technical Review Comments.

**REV Score Summary**

Total Points Possible	540
Total Points Received	198.4
Additional % for Number of Ecosystem Priorities (REV Criterion 1)	3.8%
<b>Total REV Score</b>	<b>40.5%</b>

## Sites Project – Technical Review Comments

### REV Criterion 1 (Number of different ecosystem priorities claimed)

To implement Relative Environmental Value (REV) Criterion 1, the California Department of Fish and Wildlife (Department) has developed a standard calculation to assign points based on the number of ecosystem priorities a project has claimed. For each priority claimed, the Department added 0.375% to a project's final ecosystem REV score. The Department has applied the standard calculation to each of the projects.

In its application for funding under the Water Storage Investment Program, the Sites Project Authority (applicant) identified ten ecosystem priorities for the Sites Project (Project). The calculation described above resulted in an increase of 3.8% for the Project's ecosystem REV score. The Department applied the other nine REV criteria to each priority identified by the applicant. The Department's evaluation of each priority is described below.

#### **Priority 1: Provide cold water at times and locations to increase the survival of salmonid eggs and fry. Priority 1 – REV Criterion 2 (Magnitude of Ecosystem Improvements) Score = 2.3**

Under this priority the applicant proposed coldwater improvements on the Sacramento River, Feather River, and the American River. The applicant used CALSIM and various temperature models to generate flow and temperature benefits in each of the rivers.

The magnitude of cold water benefits on the Sacramento River were calculated using SALMOD model results. The applicant used the HEC-5Q temperature model to generate temperature data for the Upper Sacramento River, and applied this data as an input into SALMOD. The applicant then used SALMOD to generate annual average production outputs. SALMOD is not a life cycle model and does not account for population changes over time. Rather, the model resets the starting population of fish for each modeled year using the programmed starting populations of each run to calculate production numbers. Because the model does not account for variations in starting populations there is low confidence in the magnitude of the ecosystem improvement as demonstrated by the SALMOD production outputs.

The applicant also identified water temperature improvements on the Feather and American Rivers as a result of the with-Project scenario increasing retained water stored in Lake Oroville and Folsom Reservoir, respectively. The applicant used the RecTemp model to generate temperature data for the Feather River. The modeled temperature improvements generally occur within a currently suitable temperature range for salmonids. As such, the modeled Feather River temperature improvements do not provide any additional benefit. When temperatures without-Project exceed temperature targets, the modeled operations do not decrease temperatures in order to meet established targets and indicate increased temperatures in the summer months across multiple year types and under all climate conditions. The applicant used the American River CE QUAL-W2 Model to generate temperature data for the American River. The modeled temperature improvements indicate a relatively small change of less than 1 degree Fahrenheit across the full simulation period. This change in temperature could potentially benefit steelhead. However, the application does not substantiate or quantify how these changes will benefit the targeted salmonids.

**Priority 1 – REV Criterion 3 (Spatial and temporal scale of ecosystem improvements) Score = 3.0**

The applicant targets temperature improvements for the Sacramento River in the upper portion of the Sacramento River, where the majority of salmonid spawning and egg incubation occurs. The modeled temperature improvements are most prevalent in the driest months of dry and critical years during time periods that may benefit winter run salmon. However, SALMOD outputs also indicate impacts to all runs of salmon depending on the water year type and life stage present due to flow and temperature fluctuations resulting from Project operations.

The applicant proposes the temperature changes on the Feather River in the May to November period will benefit spawning conditions for salmonids. However, the modeled results show that Project operations would not decrease temperatures to within established temperature targets from without-Project scenarios where temperatures fall outside the optimal range for Chinook salmon. Additionally, the modeling results indicate with-Project conditions result in increased temperatures in the summer months across multiple year types and under all climate conditions, in comparison to the without-Project condition.

Proposed American River temperature improvements would affect locations downstream of Nimbus Dam to Watt Avenue and could potentially provide benefits to steelhead during the targeted July through September period. However, the application does not substantiate or quantify how these changes will benefit the targeted salmonids.

**Priority 1 – REV Criterion 4 (Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits) Score = 3.0**

The applicant intends to develop an adaptive management program in partnership with state and federal agencies and utilize existing monitoring programs to collect data. The application describes a general framework to develop specific measures, targets, and thresholds. The application states that potential funding sources for adaptive management and monitoring include revenue generated from water delivery contracts. It is not clear how operational decisions would be made if physical parameters and biological responses fall outside the range of anticipated benefits.

**Priority 1 – REV Criterion 5 (Immediacy of ecosystem improvement actions and realization of benefits) Score = 2.5**

The applicant estimates that temperature benefits would begin to accrue in 2028 and would reach full achievement by 2030. The realization of benefits will not be measurable until 2033-2034 when the cohorts that would benefit from reduced temperatures in 2030 return to spawn. The immediacy and realization of the ecosystem improvement is dependent upon Sites' ability to deliver water in lieu of Shasta Reservoir. In order for in lieu water deliveries out of Sites, the reservoir must have sufficient storage. There is concern that the reservoir may take longer than expected to reach sufficient capacity in order to make deliveries in lieu of Shasta, which could delay the immediacy and realization of benefits.

**Priority 1 – REV Criterion 6 (Duration of ecosystem improvements) Score = 3.3**

The modeling results indicate the proposed temperature changes will continue over the 92 years projected. However, because there is low confidence in this ecosystem improvement, there is low confidence in the duration of the ecosystem improvement.

**Priority 1 – REV Criterion 7 (Consistency with species recovery plans and strategies, initiatives, and conservation plans) Score = 2.8**

The application identified several plans, strategies, initiatives, and conservation plans with which the applicant states the Project is consistent, including Action SAR-1.4 of the NOAA Fisheries Salmon Recovery Plan and three actions specified in the Sacramento Valley Salmon Resiliency Strategy (SVSRS). The SVSRS actions are: (1) increase productivity by improving spawning and incubation conditions (habitat and water quality); (2) increase productivity by increasing juvenile salmonid survival; and (3) support the full range of juvenile and adult migration conditions to maintain life history diversity. The applicant also states the Project would improve the quality of Essential Fish Habitat (EFH). The benefits identified by the applicant under this priority are consistent with the temperature objectives of the NOAA SAR-1.4 action. The first two SVSRS actions are applicable to the water temperature improvements of this priority. The last SVSRS action is associated with juvenile and adult migration conditions and appears to be more applicable to other priorities. The proposed water temperature improvements would potentially contribute to the quality of EFH. However, the ability of the Project to meet the aforementioned actions and objectives is unclear given the low confidence in the ecosystem benefit.

**Priority 1 – REV Criterion 8 (Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values) Score = 2.8**

Sacramento River cold water benefits are targeted to the Upper Sacramento River, where salmonid spawning and incubation is concentrated. The application stated that the ecosystem improvements are adjacent to or hydrologically connected to Turtle Bay Exploration Park East and Anderson River Park, which are located geographically along the Sacramento River. The applicant did not further describe how the proposed ecosystem benefit is hydrologically connected to the conservation areas identified. Proposed cold water improvements on the Feather and American Rivers would occur in the areas where salmonids could benefit; however, the application does not substantiate or quantify how these changes will benefit the targeted salmonids in these respective rivers. No areas managed for conservation values were identified along the Feather or American Rivers.

**Priority 1 – REV Criterion 9 (Efficient use of water to achieve multiple ecosystem benefits) Score = 1.8**

The Project intends to release water stored primarily in Shasta to benefit priorities related to temperature and flow (Priorities 1, 2, 3, 4, 5, and 11). The application describes the potential for the Project to capture and store water that was previously released for ecosystem benefits. According to the application, this water could be stored in an Ecosystem Enhancement Storage Account (EESA) or potentially sold to other water users in order to generate funds to maintain and operate public benefits, including ecosystem benefits. However, there is uncertainty associated with the efficiency and efficacy of recapturing water, because these flows may be required to meet ecosystem needs or downstream regulatory requirements.



**Priority 1 – REV Criterion 10 (Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change) Score = 2.7**

The application states that the Project’s primary environmental uncertainty is climate change, which was assessed using the California Water Commission (CWC) 2030 and 2070 climate assumptions. No further discussion was provided in the application that elucidates how climate change, relevant to this priority, was incorporated into the Project siting, design, or operations.

**Priority 2: Provide flows to improve habitat conditions for in-river rearing and downstream migration of juvenile salmonids.**

**Priority 2 – REV Criterion 2 (Magnitude of Ecosystem Improvements) Score = 1.8**

Proposed flow improvements described in the application amount to approximately a 1.1 - 4.2% change in long term average flow from without-Project conditions depending on the modeled scenario (current, 2030, 2070), and would primarily benefit fall and late-fall run salmon. Ecosystem improvements were quantified using SALMOD, which incorporates the changes in flow proposed by the applicant. SALMOD is not a life cycle model and does not account for population changes over time. Rather, it resets each year using the programmed starting populations of each run to calculate production numbers. For this reason, there is low confidence in the magnitude of the ecosystem improvement as demonstrated by SALMOD production outputs. In addition, SALMOD does not account for impacts resulting from Project-related reductions in Sacramento River flow, downstream of Red Bluff (where the SALMOD modeling domain ends). To account for potential flow-related impacts to salmonids downstream of Red Bluff, the applicant conducted a flow-survival effects analysis. The analysis did not account for cumulative effects of Project diversions on the Sacramento River that may impact migrating salmonids, nor did it account for the variability in survival from reduced flows as presented in the appeal material submitted by the applicant.

**Priority 2 – REV Criterion 3 (Spatial and temporal scale of ecosystem improvements) Score = 1.7**

The applicant proposes to provide flow improvements between November and February in the upper 59 miles of the Sacramento River. The applicant states that the timing of the proposed flow improvements would primarily benefit fall and late-fall run Chinook salmon. The 59-mile extent described is the same spatial extent used in SALMOD. Geographically, this area between Keswick and the Red Bluff Diversion Dam is an appropriate range where fall and late-fall run Chinook salmon could potentially benefit from flow related improvements. However, the Project operations would reduce flows downstream of Red Bluff. These reduced flows may reduce salmon survival and negatively affect in-river rearing and migration.

**Priority 2 – REV Criterion 4 (Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits) Score = 2.3**

See comment for Priority 1 – REV Criterion 4.

**Priority 2 – REV Criterion 5 (Immediacy of ecosystem improvement actions and realization of benefits) Score = 2.0**

The applicant estimates that flow benefits would begin to accrue in 2028 and would reach full achievement by 2030. The realization of benefits would not be measurable until 2033-2034 when the cohorts that benefit from flow improvements in 2030 return to spawn. The immediacy and realization of the ecosystem improvement is dependent upon Sites' ability to deliver water in lieu of Shasta Reservoir. In order for in lieu water deliveries out of Sites, the reservoir must have sufficient storage. There is concern that the reservoir may take longer than expected to reach sufficient capacity in order to make deliveries in lieu of Shasta, which could delay the immediacy and realization of benefits.

**Priority 2 – REV Criterion 6 (Duration of ecosystem improvements) Score = 2.7**

The modeling results demonstrate flow changes would occur as proposed over the 92 years projected. However, the flows provided by the Project would diminish over time (long-term average of 372 cubic feet per second [cfs] under current conditions; 228 cfs in 2030; and 157 cfs in 2070). Moreover, because there is low confidence in the ecosystem improvement, there is lower confidence in the duration of the ecosystem improvement.

**Priority 2 – REV Criterion 7 (Consistency with species recovery plans and strategies, initiatives, and conservation plans) Score = 2.3**

See comment for Priority 1 – REV Criterion 7.

**Priority 2 – REV Criterion 8 (Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values) Score = 2.4**

The applicant targets Sacramento River flow benefits at the upper 59 miles of the Sacramento River. However, Project operations will reduce flow downstream of this extent. The application states that water from the Project could be exchanged with other reservoirs to enhance the reservoir operators' ability to provide quality habitat. The application stated that the ecosystem improvements are adjacent to conservation areas or are hydrologically connected to the Sacramento River Wildlife Area, Nimbus and American River Hatcheries, American River Parkway, and Colusa-Sacramento River State Recreation Area. Geographically, the Sacramento River Wildlife Areas and Colusa-Sacramento River State Recreation Area occur along the Sacramento River while the Nimbus and American River Hatcheries and American River Parkway occur along the American. The applicant provided no further information regarding how the proposed ecosystem benefit is hydrologically connected to the conservation areas identified. Additionally, there are concerns that reductions in flow due to Project operations, could negatively affect hydrologic connectivity along the Sacramento River, potentially reducing floodplain inundation and spill events at various locations, such as the Sutter and Yolo Bypasses, downstream of Project diversions.

**Priority 2 – REV Criterion 9 (Efficient use of water to achieve multiple ecosystem benefits) Score = 1.3**

See comment for Priority 1 – REV Criterion 9.

**Priority 2 – REV Criterion 10 (Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change) Score = 1.8**

See comment for Priority 1 – REV Criterion 10.

**Priority 3: Maintain flows and appropriate ramping rates at times and locations that will minimize dewatering of salmonid redds and prevent stranding of juvenile salmonids in side channel habitat**

**Priority 3 – REV Criterion 2 (Magnitude of Ecosystem Improvements) Score = 1.7**

Proposed flow improvements presented in the application show approximately a 1.1-4.2% change in the long term average flow from without-Project conditions depending on the modeled scenario (current, 2030, 2070), and would primarily benefit fall and late-fall run salmon. Under this priority, the applicant proposes that the added flows would benefit egg incubation by preventing the dewatering of redds and preventing juvenile stranding in side channel habitats during rearing. Although the proposed flow improvements were incorporated into SALMOD and could positively affect the salmon production numbers, the claimed benefits associated with reductions to redd dewatering and stranding could not be accounted for in SALMOD and are therefore the applicant did not quantify them. The applicant states in its Draft EIR/EIS that the river's weighted usable area (WUA), which is the relationship between streamflow and habitat availability for each life stage of salmon, is derived from the Project's CALSIM II modeling. The WUA is calculated by disaggregating CALSIM's monthly flows into average daily flows. This disaggregation of data does not capture the daily variability or change in variability that might otherwise indicate a point in time where a reduction in flow is extreme enough to contribute to redd dewatering or stranding. Because the flow data input into SALMOD is not provided at a scale fine enough to capture potential dewatering or stranding conditions SALMOD is unable to show benefits claimed under this priority. No other modeling or analysis was provided to quantify reductions in redd dewatering or stranding; therefore, the Project-related water elevation of the Sacramento River and its contribution to reductions in redd dewatering and juvenile stranding cannot be substantiated.

**Priority 3 – REV Criterion 3 (Spatial and temporal scale of ecosystem improvements) Score = 1.7**

The applicant proposes to provide flow improvements between November and February in the upper 59 miles of the Sacramento River. The applicant states that the timing of the proposed flow improvements would primarily benefit fall and late-fall run Chinook salmon. The 59-mile extent described is the same spatial extent used in SALMOD. Geographically this is an appropriate range where flows could benefit egg incubation by preventing the dewatering of redds and preventing juvenile stranding in side channel habitats during rearing. However, the application did not demonstrate how Project flows would affect the river elevation and reduce the risk of dewatering or stranding. Additionally, the Project operations would reduce flows downstream of Red Bluff. Reduced flows downstream of Red Bluff may reduce salmon survival and negatively affect rearing and migration.

**Priority 3 – REV Criterion 4 (Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits) Score = 2.3**

See comment for Priority 1 – REV Criterion 4.

**Priority 3 – REV Criterion 5 (Immediacy of ecosystem improvement actions and realization of benefits) Score = 1.8**

See comment for Priority 2 – REV Criterion 5.

**Priority 3 – REV Criterion 6 (Duration of ecosystem improvements) Score = 2.3**

See comment for Priority 2 – REV Criterion 6.

**Priority 3 – REV Criterion 7 (Consistency with species recovery plans and strategies, initiatives, and conservation plans) Score = 2.0**

See comment for Priority 1 – REV Criterion 7.

**Priority 3 – REV Criterion 8 (Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values) Score = 2.0**

The applicant targets the proposed flow benefits at the upper 59 miles of the Sacramento River. Geographically, this is an appropriate range where flows could benefit egg incubation by preventing the dewatering of redds and preventing juvenile stranding in side channel habitats during rearing.

The applicant states that water from the Project could be exchanged with other reservoirs to enhance the reservoir operators' ability to provide quality habitat. The application states that the ecosystem improvements are adjacent to conservation areas or are hydrologically connected to the Sacramento River Wildlife Areas, Nimbus and American River Hatcheries, and the Colusa-Sacramento River State Recreation Area. Geographically, the Sacramento River Wildlife Areas and Colusa-Sacramento River State Recreation Area occur along the Sacramento River, while the Nimbus and American River Hatcheries occur along the American. The applicant did not provide further information regarding how the proposed ecosystem benefit is hydrologically connected with the conservation areas identified.

**Priority 3 – REV Criterion 9 (Efficient use of water to achieve multiple ecosystem benefits) Score = 1.2**

See comment for Priority 1 – REV Criterion 9.

**Priority 3 – REV Criterion 10 (Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change) Score = 1.5**

See comment for Priority 2 – REV Criterion 10.

**Priority 4: Improve ecosystem water quality**

**Priority 4 – REV Criterion 2 (Magnitude of Ecosystem Improvements) Score = 2.3**

The application states that temperature improvements would be realized in the Sacramento, Feather, and American Rivers as a result of conservation of water (primarily in Shasta Lake) facilitated by cooperative operations with Sites Reservoir. The application states that the Project would increase coldwater pool conservation in Shasta Lake, Lake Oroville, and Folsom Reservoir, allowing for improved river temperatures during certain months at specific compliance points, particularly in below normal, dry, and critical water years. Temperature improvements were estimated using the Upper Sacramento River HEC-5Q model for the Sacramento River, the American River CE QUAL-W2 Model for the American River, and the Reclamation Temperature Model (RecTemp) for the Feather River.

The applicant used the HEC-5Q model to demonstrate the proposed temperature improvements generated from the additional storage in Shasta Reservoir. Between Bonnyview and Bend Bridge, during the July through September period in critically dry years, the modeled Sacramento River temperature projections indicate a 0.6 °F change from without- to with-Project conditions under 2030 conditions. The applicant also analyzed a study by Vogel (2015)<sup>1</sup> under this priority and Priority 1, which correlates temperature effects on salmonid eggs and pre-emergent alevins, at various temperature thresholds. The applicant's analysis estimates improved survival of salmonids at various locations within the Upper Sacramento River due to the Project when temperature thresholds have been compromised in dry and critical years. Based on the results of this analysis, the applicant concludes that winter-run Chinook salmon egg and fry mortality between Keswick Dam and Ball Ferry Bridge would be reduced by 7 – 25 percent between September and October of critically dry water years (depending on the location). The relationship between water temperature and mortality of Chinook salmon eggs and pre-emergent fry presented in the Vogel study and used in the applicant's analysis, presents changes in mortality by whole degrees Fahrenheit, which is the level of precision for the model. There is uncertainty in the reduction in mortality due to a change in temperature of less than a whole degree Fahrenheit. Additionally, the Vogel study is specific to winter-run and may not be applicable to fall-run and late-fall-run, which are targeted to benefit under this Priority. The greatest reduction in mortality (25 percent) is shown at the Balls Ferry Bridge location. The application notes this location is 13 miles downstream of where spawning occurs and that no redds with incubating eggs or pre-emergent alevins would be present at this location.

The application proposes American River temperature improvements based on increased water retained in Folsom Reservoir because of Project operations. American River temperature improvements at Watt Avenue, during the July through September Period (in critical years), indicate a -1.4 °F and -0.5 °F change from without- to with-Project conditions under current and 2030 conditions, respectively. The proposed American River temperature improvements could potentially benefit steelhead. However, the application does not substantiate or quantify how these changes would benefit the targeted salmonids.

The application proposes Feather River temperature improvements based on increased water retained in Lake Oroville through Project operations. Oroville's average end-of-May storage is estimated to be improved by 26 and 31 thousand acre feet (TAF) under 2030 and 2070 conditions, respectively. Proposed temperature improvements generated from the additional storage were modeled using RecTemp. Between the Low Flow Channel and Gridley, during the May through November Period in critical years, the modeled Feather River temperature projections indicate a range of change between -0.1 °F to -0.6 °F over the life of the Project. During the October through November Period in critical years, the modeled Feather River temperature projections indicate a range of change between -0.2 °F to -1.1 °F over the life of the Project. The modeled Feather River temperature improvements fall within the existing protective temperature targets for anadromous fish that are met under without-Project conditions, and do not provide any additional benefit.

#### **Priority 4 – REV Criterion 3 (Spatial and temporal scale of ecosystem improvements) Score = 3.2**

The application targets proposed Sacramento River temperature improvements to occur in the upper portion of the Sacramento River, where the large majority of spawning and egg incubation occurs. The

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<sup>1</sup> Vogel, D. 2015. Potential Effects of Central Valley Project Operations on Winter-Run Chinook Salmon Egg Incubation in 2015: A Preliminary Analysis. April.

applicant states that the modeled temperature improvements are most prevalent in dry and critical years during time periods that will most likely benefit winter-run salmon. However, there is low confidence in the percent change in mortality from temperature improvements as discussed under REV Criterion 2.

Temperature modeling results target areas of the Feather River that may benefit salmonids. The modeled temperature improvements generally occur within a currently suitable temperature range for salmonids. As such, the modeled Feather River temperature improvements do not provide any additional benefit. When temperatures without-Project exceed temperature targets, the modeled operations do not decrease temperatures in order to meet established targets and indicate increased temperatures in the summer months across multiple year types and under all climate conditions.

Proposed American River temperature improvements would affect locations downstream of Nimbus Dam to Watt Avenue and could potentially provide benefits to steelhead during the targeted July through September period. However, the application does not substantiate or quantify how these changes would benefit the targeted salmonids.

**Priority 4 – REV Criterion 4 (Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits) Score = 2.8**

See comment for Priority 1 – REV Criterion 4.

**Priority 4 – REV Criterion 5 (Immediacy of ecosystem improvement actions and realization of benefits) Score = 2.6**

See comment for Priority 1 – REV Criterion 5.

**Priority 4 – REV Criterion 6 (Duration of ecosystem improvements) Score = 3.3**

See comment for Priority 1 – REV Criterion 6.

**Priority 4 – REV Criterion 7 (Consistency with species recovery plans and strategies, initiatives, and conservation plans) Score = 2.8**

See comment for Priority 1 – REV Criterion 7.

**Priority 4 – REV Criterion 8 (Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values) Score = 2.8**

The proposed Sacramento River cold water benefits are targeted to occur in the Upper Sacramento River, where spawning and incubation is concentrated. Proposed cold water benefits on the Feather and American Rivers would occur in the areas where salmonids could benefit; however, the application does not substantiate or quantify how these changes would benefit the targeted salmonids in these respective rivers. The application states that water from the Project can be exchanged with other reservoirs to enhance the reservoir operators' ability to provide quality habitat. The application states that the ecosystem improvements are adjacent to or hydrologically connected to the Turtle Bay Exploration Park East, Anderson River Park, Sacramento River Wildlife Areas, Nimbus and American River Hatcheries, American River Parkway, Effie Yeaw Nature Center, and the Colusa-Sacramento River State Recreation Area. Geographically, the Turtle Bay Exploration Park East, Anderson River Park, Sacramento River Wildlife Areas, and Colusa-Sacramento River State Recreation Area occur along the Sacramento River while the Nimbus and American River Hatcheries and American River Parkway, and

Effie Yeaw Nature Center, occur along the American. The applicant did not provide further information regarding how the proposed ecosystem benefit is hydrologically connected to the conservation areas identified. The applicant did not identify any areas managed for conservation values along the Feather River.

**Priority 4 – REV Criterion 9 (Efficient use of water to achieve multiple ecosystem benefits) Score = 1.8**  
See comment for Priority 1 – REV Criterion 9.

**Priority 4 – REV Criterion 10 (Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change) Score = 2.7**  
See comment for Priority 1 – REV Criterion 10.

**Priority 5: Provide flows that increase dissolved oxygen and lower water temperatures to support anadromous fish passage**

**Priority 5 – REV Criterion 2 (Magnitude of Ecosystem Improvements) Score = 1.0**

The application states the Project's flow management would promote more suitable water temperatures and provide increased dissolved oxygen levels for rearing salmonids in the Sacramento River below Keswick Dam. The application states the Project's proposed flow releases, occurring between October and March, would increase dissolved oxygen levels in the upper portion of the Sacramento River. The applicant did not quantify or analyze the change in dissolved oxygen levels resulting from the proposed flows. The applicant references the temperature benefits as described in Priority 1 to support the lowered temperatures under this priority. As discussed in Priority 1 above, there is low confidence in the temperature benefit to salmonids. The application did not include discussion of how the proposed temperature and dissolved oxygen changes would support fish passage.

**Priority 5 – REV Criterion 3 (Spatial and temporal scale of ecosystem improvements) Score = 1.0**

The proposed temperature improvements resulting from the Project's flow management target the upper portion of the Sacramento River. As described in Priority 1 the applicant's modeled temperature improvements are most prevalent in dry and critical years. The applicant associates dissolved oxygen improvements during the periods when flow and temperature benefits are scheduled to occur (primarily between the months of October and March). The timing of proposed flow (and associated water quality benefits) are planned to occur when spawning and egg development life stages are expected in the Upper Sacramento River. By targeting these life stages the benefits to fish passage (as described in this priority) are less impactful because passage benefits could be realized at different times of the year and could encompass the entirety of the river. Because oxygen improvements were not quantified it is not possible to substantiate the spatial or temporal extent of claimed oxygen benefits.

**Priority 5 – REV Criterion 4 (Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits) Score = 1.2**

The applicant intends to develop an adaptive management program in partnership with State and Federal agencies and utilize existing monitoring programs to collect data. The application describes a general framework to develop specific measures, targets, and thresholds. There is no discussion in the application regarding monitoring dissolved oxygen and water temperature and how they would be

adaptively managed. The application states that potential funding sources for adaptive management and monitoring include revenue generated from water delivery contracts. It is not clear how operational decisions would be made if physical parameters and biological responses fall outside the range of anticipated benefits.

**Priority 5 – REV Criterion 5 (Immediacy of ecosystem improvement actions and realization of benefits) Score = 1.5**

The applicant estimates that temperature benefits will begin to accrue in 2028 and will reach full achievement by 2030. The realization of benefits will not be measurable until 2033-2034 when the cohorts that benefit from reduced temperatures in 2030 will return to spawn. The realization of proposed dissolved oxygen level improvements are not described independently from the proposed temperature improvements and cannot be assessed. The immediacy and realization of the ecosystem improvement is dependent upon Sites' ability to deliver water in lieu of Shasta Reservoir. In order for in lieu water deliveries out of Sites, the reservoir must have sufficient storage. There is concern that the reservoir may take longer than expected to reach sufficient capacity in order to make deliveries in lieu of Shasta, which could delay the immediacy and realization of benefits.

**Priority 5 – REV Criterion 6 (Duration of ecosystem improvements) Score = 1.8**

The modeling results demonstrate temperature and flow changes will occur as proposed over the 92 years projected; however, the magnitude of flows will diminish over time. The Department was unable to evaluate the duration of proposed dissolved oxygen benefits because dissolved oxygen levels were not quantified.

**Priority 5 – REV Criterion 7 (Consistency with species recovery plans and strategies, initiatives, and conservation plans) Score = 1.2**

See comment for Priority 1 – REV Criterion 7.

**Priority 5 – REV Criterion 8 (Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values) Score = 1.5**

The Project targets the proposed Sacramento River temperature and dissolved oxygen improvements to occur in the Upper Sacramento River. Although this location would likely benefit from reduced temperatures and increased dissolved oxygen it is not an area that would significantly contribute to fish passage. Fish passage benefits could be realized anywhere in the Sacramento River, yet the Project focuses on the upper 59 miles. The application state that the ecosystem improvements are adjacent to conservation areas or hydrologically connected to the Sacramento River Wildlife Areas, Nimbus and American River Hatcheries, American River Parkway, Stone Lakes National Wildlife Refuge, Vic Fazio Yolo Wildlife Area, Bidwell-Sacramento River State Park, Colusa-Sacramento River State Recreation Area, Brannan Island State Recreation Area and Delta Meadows. Geographically, the Sacramento River Wildlife Areas, Stone Lakes National Wildlife Refuge, Vic Fazio Yolo Wildlife Area, Bidwell-Sacramento River State Park, Colusa-Sacramento River State Recreation Area, Brannan Island State Recreation Area, and Delta Meadows occur along the Sacramento River, while the Nimbus and American River Hatcheries and American River Parkway occur along the American. The applicant provided no further discussion regarding how the proposed ecosystem benefit is hydrologically connected with the conservation areas identified. There is some concern that the Project could negatively affect hydrologic connectivity with certain conservation areas located along the Sacramento River, because reductions in Sacramento River



flows associated with the filling of Sites Reservoir would likely reduce the amount of floodplain inundation and spill events at various bypass locations such as Yolo and Sutter Bypasses.

**Priority 5 – REV Criterion 9 (Efficient use of water to achieve multiple ecosystem benefits) Score = 1.0**

See comment for Priority 1 – REV Criterion 9.

**Priority 5 – REV Criterion 10 (Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change) Score = 1.5**

See comment for Priority 1 – REV Criterion 10.

**Priority 10: Enhance the frequency, magnitude, and duration of floodplain inundation to enhance primary and secondary productivity and the growth and survival of fish.**

**Priority 10 – REV Criterion 2 (Magnitude of Ecosystem Improvements) Score = 2.1**

The applicant proposes to release 40 TAF of water to the Yolo Bypass between August and October in order to increase food production for Delta smelt. Based on the best available science, this proposed action would likely benefit Delta smelt and is consistent with the Delta Smelt Resiliency Strategy (DSRS). The modeled hydrologic data shows the quantity of water available for this benefit could fluctuate dramatically depending on the water year type, and could be as little as 5 TAF in critical years. Therefore, there may be insufficient water available in some years to provide the flows necessary to generate food production benefits. Additionally, the modeling shows a net loss of flows through the Yolo Bypass in all other months outside of the proposed August-October period. There are concerns that the net reduction in flows through the Yolo Bypass may impact the ability for salmon to enter the bypass and could reduce their ability to utilize the bypass for feeding and improved growth.

**Priority 10 – REV Criterion 3 (Spatial and temporal scale of ecosystem improvements) Score = 2.3**

The proposed Yolo Bypass flows would be delivered between August and October through the Colusa Basin Drain, near the Knights Landing Ridge Cut. The timing and location of deliveries are consistent with the DSRS. However, there is concern that in some years there may be insufficient water available to provide the flows necessary to generate food production benefits. The applicant proposes that the benefits of these flow releases would occur as far as the tip of Sherman Island. However, no information is provided to support the spatial extent of claimed benefits.

**Priority 10 – REV Criterion 4 (Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits) Score = 2.4**

See Priority 1 – REV Criterion 4.

**Priority 10 – REV Criterion 5 (Immediacy of ecosystem improvement actions and realization of benefits) Score = 2.8**

The immediacy and realization of the ecosystem improvement is dependent upon Sites Reservoir's ability to deliver water in lieu of Shasta Reservoir. In order for in lieu water deliveries out of Sites, the reservoir must have sufficient storage. There is concern that the reservoir may take longer than expected to reach sufficient capacity in order to make deliveries in lieu of Shasta, which could delay the immediacy and realization of benefits. Specifically, the Project relies on excess rainwater (primarily

occurring during wet years) in order to fill the Reservoir. If climate conditions generate little rainfall, it may take longer than expected for the reservoir to fill and provide the benefits proposed.

The applicant estimates that the proposed Yolo Bypass flow benefits would begin to accrue in 2026 and would reach full achievement by 2030. Because the proposed benefits would be delivered via the existing Colusa Basin drainage canal, these benefits could potentially be delivered prior to the full completion and operation of the Project. However, benefits may not be realized in some year types when available flows are projected to be low.

**Priority 10 – REV Criterion 6 (Duration of ecosystem improvements) Score = 2.7**

The application states that the duration of benefits is expected to be 90 years. No additional information is provided to support the duration of the ecosystem improvement.

**Priority 10 – REV Criterion 7 (Consistency with species recovery plans and strategies, initiatives, and conservation plans) Score = 2.1**

The application states the proposed benefit is consistent with the DSRS. No additional information regarding the proposed benefit's consistency with species recovery plans and strategies, initiatives, and conservation plans was provided. The proposed benefit is consistent with the North Delta Food Web Adaptive Management Project, one of the 13 proposed actions in the DSRS. The reduced flows through the Yolo Bypass could be counterproductive to the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project objectives.

**Priority 10 – REV Criterion 8 (Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values) Score = 2.9**

The location of proposed Yolo Bypass flow releases is consistent with similar actions conducted recently in furtherance of the DSRS. Similarly, the location of food production benefits and food delivery areas are also consistent with previous actions. Although it is possible that proposed benefits could reach as far as the tip of Sherman Island, this occurrence is uncertain due to tidal fluctuations in Cache Slough. No modeling was provided to support the spatial distribution of the food dispersal benefits.

The proposed pulses would flow through several areas adjacent to, and hydrologically connected to, areas protected and managed for conservation values. However, the CALSIM modeling shows a net loss of flows through the Yolo Bypass. There are concerns that the net reduction in flows through the Yolo Bypass may impact the ability for salmon to enter the bypass and could reduce their ability to utilize the bypass for feeding and improved growth, thus negatively influencing connectivity.

The application identified the proposed ecosystem improvement is adjacent to Liberty Island Ecological Reserve, Miner Slough Wildlife Area, Prospect Island, and Brannan Island State Recreation Area.

**Priority 10 – REV Criterion 9 (Efficient use of water to achieve multiple ecosystem benefits) Score = 1.6**

The application states that “this management strategy may not be able to occur annually due to varying water year types.” The applicant did not identify any additional ecosystem benefits that could be achieved through the use of this water.

**Priority 10 – REV Criterion 10 (Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change) Score = 1.9**

See comment for Priority 1 – REV Criterion 10.

**Priority 11: Enhance the temporal and spatial distribution and diversity of habitats to support all life stages of fish and wildlife species.**

**Priority 11 – REV Criterion 2 (Magnitude of Ecosystem Improvements) Score = 1.9**

The applicant proposes to improve the spatial distribution and diversity of habitats of native fishes in the Sacramento River and Yolo Bypass. Sacramento River habitat improvements consist of temperature and flow improvements targeting the Upper Sacramento River. The application states the Project would provide a long-term average increase in flow of 4.4% (372 cfs) near the Colusa diversion. The applicant states that this increase in flow would provide more suitable water temperatures for egg incubation and fry, leading to higher survival rates of these stages. Fall-run, late fall-run, and winter-run Chinook salmon would be the primary beneficiaries of the proposed temperature and flow improvements. Yolo Bypass habitat improvements would be realized from the average annual flow of 42 thousand acre-feet, delivered to the bypass between August and October. The applicant proposes these flows would allow for better growth rates of native fish due to increased food availability.

The Project’s operational changes to water temperature and flow could benefit some runs and/or life stages of salmonids, while impacting other runs and/or life stages. As discussed under Priority 2 - REV Criterion 2, SALMOD results may indicate benefits to some runs in the upper portion of the Sacramento River watershed; however, there may be impacts to other runs downstream of Red Bluff associated with reduced river flows resulting from Project operations. Additionally, the SALMOD modeling outputs indicate reductions in salmon production numbers for some runs of salmon, in varying water year types, associated with changes in both temperature and flow from with Project operations. For example, the SALMOD results indicate that there are net impacts to fall-run Chinook salmon under 2015 climate conditions and to spring-run Chinook salmon under 2030 climate conditions.

**Priority 11 – REV Criterion 3 (Spatial and temporal scale of ecosystem improvements) Score = 1.9**

The proposed temperature and flow improvements target the upper portion of the Sacramento River where the large majority of spawning and egg incubation occurs. The modeled temperature improvements are most prevalent in dry and critical years during time periods that will most likely benefit winter-run Chinook salmon. However, due to potential impacts associated with both temperature and flow changes from Project operations, there is low confidence in the ecosystem improvement.

The proposed Yolo Bypass flows would be delivered between August and October through the Colusa Basin Drain, near the Knights Landing Ridge Cut. The timing and location of deliveries are both appropriate to achieve food production benefits. However, there is concern that in some years there

may be insufficient water available to provide the flows necessary to generate food production benefits. The applicant proposes that the benefits of these flow releases would occur as far as the tip of Sherman Island/San Joaquin River. However, the application included no modeling to support the spatial distribution of these benefits.

**Priority 11 – REV Criterion 4 (Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits) Score = 2.3**

See Priority 1 – REV Criterion 4.

**Priority 11 – REV Criterion 5 (Immediacy of ecosystem improvement actions and realization of benefits) Score = 2.2**

The applicant estimates that temperature benefits would begin to accrue in 2028 and would reach full achievement by 2030. The application describes proposed Yolo Bypass flow benefits as beginning to accrue in 2026 with full achievement by 2030. The realization of benefits would not be measurable until 2033-2034 when the cohorts that benefit from flow improvements in 2030 would return to spawn. The immediacy and realization of the ecosystem improvement is dependent upon Sites' ability to deliver water in lieu of Shasta Reservoir. In order for in lieu water deliveries out of Sites, the reservoir must have sufficient storage. There is concern that the reservoir may take longer than expected to reach sufficient capacity in order to make deliveries in lieu of Shasta, which could delay the immediacy and realization of benefits. In addition, modeling data provided by the applicant shows that flows delivered to the Yolo Bypass would be substantially reduced in some year types; therefore, proposed benefits may not be realized.

**Priority 11 – REV Criterion 6 (Duration of ecosystem improvements) Score = 2.9**

The modeling results demonstrate flow changes would occur as proposed over the 92 years projected. However, as discussed in previous REV criteria, the flows provided by the project would diminish over time. The application states that the duration of Yolo Bypass flow benefits is expected to be 90 years. Due to low confidence in the realization of flow-related benefits from the Project and related impacts to salmonids, there is not high confidence in the duration of flow related ecosystem improvements.

**Priority 11 – REV Criterion 7 (Consistency with species recovery plans and strategies, initiatives, and conservation plans) Score = 2.6**

The application identified several plans, strategies, initiatives, and conservation plans in which they believe their Project is consistent with, including Action SAR-2.17 and SAR-1.4 of the NOAA Fisheries Salmon Recovery Plan, three actions specified in the SVSRS, and the DSRS. The SVSRS actions are: (1) increase productivity by improving spawning and incubation conditions (habitat and water quality); (2) increase productivity by increasing juvenile salmonid survival; and (3) support the full range of juvenile and adult migration conditions to maintain life history diversity. The applicant also states its Project would improve the quality of EFH. The benefits identified by the applicant under this priority are consistent with habitat and distribution components of the NOAA SAR-2.17 and SAR-1.4 actions. Similarly, the actions identified in the SVSRS are applicable to the habitat distribution components of this priority. The proposed food production targets proposed under this priority are consistent with portions of the DSRS. The proposed water temperature and flow improvements would potentially contribute to the quality of EFH. However, the ability of the Project to meet the aforementioned actions

and objectives is unclear given the low magnitude of this ecosystem benefit, as discussed under other REV criteria. There are concerns that reduced flows through the Yolo Bypass could be counterproductive to the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project objectives.

**Priority 11 – REV Criterion 8 (Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values) Score = 2.7**

The Project targets proposed flow and temperature benefits in the upper 59 miles of the Sacramento River, where the large majority of spawning and egg incubation occurs. The location of proposed Yolo Bypass flow releases is consistent with similar actions completed in recent history in furtherance of the DSRS. Similarly, the location of food production benefits and food delivery areas are also consistent with previous actions in the Bypass. The application states that locations downstream from Shasta, Oroville, and Folsom dams have known salmonid populations and that water from Sites Reservoir can be exchanged with these other reservoirs to provide water for habitat improvements. The application stated that the ecological improvements are adjacent to conservation areas or are hydrologically connected to Sacramento River Wildlife Areas, Nimbus and American River Hatcheries, American River Parkway, Effie Yeaw Nature Center, Folsom Lake State Recreation Area, Mather Regional Park, Isenberg Crane Service, Cosumnes River Preserve, Stone Lakes National Wildlife Refuge, Laguna Creek Parkway, Vic Fazio Yolo Wildlife Area, Grizzly Island Wildlife Area, Gray Lodge Wildlife Area, Bobelaine Audubon Sanctuary, Bidwell Mansion State Historic Park, Butte City project, Clay Pit State Vehicular Recreation Area, Lake Oroville State Recreation Area, Bidwell-Sacramento River State Park, Colusa-Sacramento River State Recreation Area, Brannan Island State Recreation Area, and Delta Meadows. The applicant did not provide further information regarding how the proposed ecosystem benefit is hydrologically connected to the conservation areas identified or would augment existing efforts. There are concerns that reductions in flow from the Project's Sacramento River diversions could negatively affect hydrologic connectivity along the Sacramento River and potentially reduce floodplain inundation at various locations downstream of Project diversions, including the Sutter and Yolo Bypasses.

**Priority 11 – REV Criterion 9 (Efficient use of water to achieve multiple ecosystem benefits) Score = 1.7**  
See comment for Priority 1 – REV Criterion 9.

**Priority 11 – REV Criterion 10 (Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change) Score = 2.1**  
See comment for Priority 1 – REV Criterion 10.

**Priority 14: Provide water to enhance seasonal wetlands, permanent wetlands, and riparian habitat for aquatic and terrestrial species on State and Federal wildlife refuges and on other public and private lands.**

**Priority 14 – REV Criterion 2 (Magnitude of Ecosystem Improvements) Score = 3.0**

The applicant proposes to deliver Incremental Level 4 (IL4) water to various wildlife refuges and State Wildlife Areas (SWAs) in the Central Valley. According to modeled projections, the volume of available water for refuges and wildlife areas would vary from 6 TAF to 54 TAF, depending on the water year type and future climate conditions. The Project would primarily benefit the Sacramento, Colusa, and Delevan National Wildlife Refuges (NWRs). The applicant identified several other refuges and wildlife areas as potential recipients. The application provides supporting documentation regarding the effects of water deliveries on refuges. This material states that a 50% reduction in deliveries to the Sacramento, Colusa,

and Delevan NWRs occurring in dry and critically dry years would amount to a loss of 4,658 to 7,762 acres of permanent and seasonal wetlands.

The application states the Project would provide ecosystem benefits associated with increased rice land production. Additional rice land production would result from the availability of Sites agricultural water primarily in dry and critically dry years (approximately 175 TAF). Although rice lands may provide potential ecosystem benefits to waterfowl and giant garter snake, these would only accrue if farmers utilize the agricultural water for rice production. The information in the application does not commit to this use of Project deliveries and the proposed ecosystem benefits in comparison to without-Project conditions were not quantified.

**Priority 14 – REV Criterion 3 (Spatial and temporal scale of ecosystem improvements) Score = 4.0**

According to the applicant, most benefits would occur at the Sacramento, Colusa, and Delevan NWRs, which total 21,382 acres. Refuges in the Mendota Pool and the Tulare Basin could also benefit from deliveries from the Project, as documented in the modeling submitted by the applicant. Deliveries would be made year-round, and the modeling shows allocations in all months except February. The priority worksheet submitted by the applicant states that water for agricultural users would be provided in dry and critically dry years, primarily in April and May, which is consistent with the timing of rice field inundation needs. Ricelands inundation at this time could provide GGS foraging habitat (if GGS are present). Typically, rice is harvested in the fall. If farmers maintain field inundation longer into the season, or refill their fields after harvesting (to aid in the breakdown of vegetation), they could provide waterfowl foraging habitat in the winter when it is most needed. However, it is uncertain how many farmers would utilize the available water for rice production.

**Priority 14 – REV Criterion 4 (Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits) Score = 2.8**

The applicant intends to develop an adaptive management program in partnership with State and Federal agencies and utilize existing monitoring programs to collect data. The application describes a general framework to develop specific measures, targets, and thresholds. The application states that potential funding sources for adaptive management and monitoring include revenue generated from water delivery contracts. It is not clear how operational decisions would be made if physical parameters and biological responses fall outside the range of anticipated benefits. Under this priority, the application indicates that the NWR inventory data collected annually, including bird counts, would be utilized to assess and manage delivery adjustments. Additionally, refuge managers may have some flexibility in the timing of water, which could be incorporated into the adaptive management plan. The application states that the Project would conduct an annual assessment of the acreage of rice planted, in dry and critically dry years. However, there is no discussion on how this information would be applied to inform adaptive management strategies.

**Priority 14 – REV Criterion 5 (Immediacy of ecosystem improvement actions and realization of benefits) Score = 3.3**

See Priority 1 - REV Criterion 5.

**Priority 14 – REV Criterion 6 (Duration of ecosystem improvements) Score = 2.3**

The proposed refuge benefits are modeled to occur for a duration of 92 years. The application states that the duration of benefits would be observed for the duration of the Sacramento, Colusa, and Delevan NWRs' existence. However, the applicant's modeling shows that deliveries may be reduced depending on the water year type and future climate conditions. Similarly, the application states the duration of rice land benefits derived from Sites' water supply would be observed as long as rice production occurs in the Central Valley. However, this statement is based on the assumption that Sites agricultural water would be used primarily for rice production.

**Priority 14 – REV Criterion 7 (Consistency with species recovery plans and strategies, initiatives, and conservation plans) Score = 4.0**

Improving water supply to refuges during dry years is consistent with several recovery plans, strategies, initiatives, and conservation plans identified by the applicant. These plans include the Migratory Habitat Enhancement Plan, North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, Central Valley Joint Venture Implementation Plan, California Wildlife Action Plan, Draft Recovery Plan for the Giant Garter Snake, and the Conservation Plan for the Tricolored Blackbird. Improving water supply to rice lands during dry years is also consistent with many of these plans. Water provided to refuge habitats could potentially provide supplementary benefits linked to many species recovery plans and could also apply to multiple components of specific NWR management plans.

**Priority 14 – REV Criterion 8 (Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values) Score = 5.3**

The application identifies multiple refuges to which the Project could provide with IL4 water deliveries. Refuge water deliveries provide improved habitat for multiple species of plants and wildlife and can improve habitat functionality of adjacent areas due to their hydrologic and spatial proximity to refuge water applications. The refuges identified by the applicant are areas managed for conservation values.

**Priority 14 – REV Criterion 9 (Efficient use of water to achieve multiple ecosystem benefits) Score = 3.8**

In general, water deliveries to refuges can generate multiple habitat and species-specific benefits. The application indicates that there is flexibility available in the timing of refuge deliveries, allowing refuges to target other conservation goals that may occur later in the season. The applicant did not support the assumption that regional water supply provided by the Project would be used to irrigate ricelands.

**Priority 14 – REV Criterion 10 (Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change) Score = 3.5**

The modeling results demonstrate refuge delivery benefits would occur through the year 2122. However, the magnitude of deliveries would decrease slightly in the future. Although deliveries in dry and critical years are reduced relative to other water year types, these deliveries could still prevent the loss of refuge wetland acreage when other sources of refuge water also reduced due to dry year water demands. Besides climate change, the applicant did not discuss any of the other environmental uncertainties identified in the Department's ecosystem priority worksheet under this priority.

**Priority 15: Develop and implement invasive species management plans utilizing techniques that are supported by best available science to enhance habitat and increase the survival of native species.**  
**Priority 15 – REV Criterion 2 (Magnitude of Ecosystem Improvements) Score = 1.5**

Yellow star thistle is an invasive plant present in the Project area and the primary target of this priority. The applicant intends to remove these plants and reestablish native species in an estimated 90 acres between the Golden Gate Dam to Funks Reservoir. There is no baseline mapping of the invasive plant, its density, or the topography of the environment in which it occurs. Without this data, no quantification of the ecosystem improvement between without- and with-Project conditions has been substantiated. The application also states the proposed invasive species management plan will benefit golden eagle. However, no method of quantifying the benefits to eagles was presented in the application.

**Priority 15 – REV Criterion 3 (Spatial and temporal scale of ecosystem improvements) Score = 1.1**

The spatial extent of the ecosystem improvement identified under this priority could not be assessed from the information provided in the application. The application states the estimated 90 acres refers to “the approximate acreage of the valley extending from Golden Gate Dam to Funks Reservoir”. Baseline mapping of existing vegetation was not provided. Similarly, the timing of invasive species removal practices was not provided in the application.

**Priority 15 – REV Criterion 4 (Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits) Score = 1.5**

The application states that the 90 acres would be surveyed monthly during the initial establishment of native prairie and then surveyed annually. No discussion is provided on how this information will be applied to inform measurable objectives, thresholds, or adaptive management strategies. The application states that potential funding sources for adaptive management and monitoring include revenue generated from water delivery contracts.

**Priority 15 – REV Criterion 5 (Immediacy of ecosystem improvement actions and realization of benefits) Score = 1.0**

The application states that the ecosystem benefit would be complete nine years after grant encumbrance. For realization, the application states that “once the area is reseeded the benefit is immediate.” The applicant did not point to supporting documentation. Successful reseeded may take more time than expected due to several potential factors such as weather, irrigation, slope, erosion, wind, or animal disturbance.

**Priority 15 – REV Criterion 6 (Duration of ecosystem improvements) Score = 2.3**

The application states the invasive species management benefits would be maintained for the project life (100 years), and that funding for this ecosystem improvement may come from budgeted mitigation funds or be obtained through grants. There is no additional information provided in the application to support the duration of this improvement.



**Priority 15 – REV Criterion 7 (Consistency with species recovery plans and strategies, initiatives, and conservation plans) Score = 0.5**

The application does not identify any recovery plans, initiatives, or conservation plans with which this proposed benefit would be consistent.

**Priority 15 – REV Criterion 8 (Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values) Score = 1.1**

The application provides a 1995 state map of California grassland habitats, which does not provide any information on the distribution of invasive species targeted for removal. The application states the Project is near the proposed Stone Corral recreation area that will be managed for conservation values. However, there is no map or description of this recreation area in relation to the area that would benefit from invasive species control.

**Priority 15 – REV Criterion 9 (Efficient use of water to achieve multiple ecosystem benefits) Score = 0.0**

The application states “Water for establishing native vegetation will most likely be taken from Holthouse Reservoir, which is a project facility.” The applicant did not point to supporting documentation.

**Priority 15 – REV Criterion 10 (Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change) Score = 1.0**

In response to this ecosystem priority worksheet question, the application states, “Affects choice of native species for re-seeding”. The applicant did not discuss the proposed ecosystem improvement’s resilience nor point to supporting documentation to demonstrate the resilience of this ecosystem improvement.

**Priority 16: Enhance habitat for native species that have commercial, recreational, scientific, or educational uses.**

**Priority 16 – REV Criterion 2 (Magnitude of Ecosystem Improvements) Score = 2.3**

The application states that the Project’s drought contingency actions for the Sacramento, Colusa and Delevan NWRs during dry and critically dry years vary depending on the severity of the reduced water allocations and the timing within the water year when the cutback is finalized. The application states that in recent history (2005-2014), only 43% of Level 2 and Level 4 refuge water was delivered in dry and critical years. These reductions in refuge deliveries have negative impacts on wetland habitats and the species that utilize these habitats. The application states a 50% reduction in deliveries to the Sacramento, Colusa, and Delevan NWRs would amount to a loss of up to 10,867 acres of wetland habitat.

The applicant proposes to provide additional water, with the highest deliveries in wet, above normal, and below normal years, to reduce adverse impacts to seasonal and permanent wetlands and to wetland-dependent wildlife on refuges. According to modeled projections, the volume of available water for refuges and wildlife areas will vary from 6 TAF to 54 TAF, depending on the water year type and future climate conditions. The Project would primarily benefit the Sacramento, Colusa, and Delevan NWRs. However, several other refuges and wildlife areas have been identified as potential targets.

The applicant did not demonstrate how these deliveries will enhance habitat for native species that have commercial, recreational, scientific, or educational uses. The application provides a list of species that occur in the Sacramento NWR Complex refuges that have commercial, recreational, scientific, or educational uses and values. However, the applicant did not point to supporting documentation to establish the commercial, recreational, scientific, or educational use of any of the identified species.

**Priority 16 – REV Criterion 3 (Spatial and temporal scale of ecosystem improvements) Score = 2.5**

Several potential NWRs and SWAs were identified in the application, and most benefits would occur at the Sacramento, Colusa, and Delevan NWRs. Refuges in the Mendota Pool and the Tulare Basin could also benefit from deliveries from the Project, as documented in the modeling. The timing of deliveries would be year-round, and the modeling shows allocations in all months except February. However, the applicant did not point to supporting documentation that establishes the commercial, recreational, scientific, or educational use of any species or habitat under this priority.

**Priority 16 – REV Criterion 4 (Inclusion of an adaptive management and monitoring program that includes measurable objectives, performance measures, thresholds, and triggers for managing ecosystem benefits) Score = 2.3**

See Priority 1 – REV Criterion 4

**Priority 16 – REV Criterion 5 (Immediacy of ecosystem improvement actions and realization of benefits) Score = 2.3**

See Priority 1 – REV Criterion 5

**Priority 16 – REV Criterion 6 (Duration of ecosystem improvements) Score = 1.8**

The proposed refuge benefits are modeled for 92 years. However, the application states that the duration of benefits will be observed for the duration of the Sacramento, Colusa, and Delevan NWRs' existence. Deliveries may be reduced depending on the water year type and future climate conditions. The applicant did not point to supporting documentation to explain how the duration of this benefit is linked to any commercial, recreational, scientific, or educational uses.

**Priority 16 – REV Criterion 7 (Consistency with species recovery plans and strategies, initiatives, and conservation plans) Score = 2.0**

The application identified several recovery plans, strategies, initiatives, and conservation plans that are consistent with improving water supply to refuges during dry years, including the Migratory Habitat Enhancement Plan, North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, California Wildlife Action Plan, Draft Recovery Plan for the Giant Garter Snake, Conservation Plan for the Tricolored Blackbird, and the Central Valley Joint Venture Implementation Plan. The water provided to refuge habitats could potentially deliver supplementary benefits that can be linked to many species recovery plans and apply to multiple components of specific NWR management plans. However, the applicant did not describe how the ecosystem changes proposed by this Project relevant to this priority are consistent with these plans.

**Priority 16 – REV Criterion 8 (Location of ecosystem improvements and connectivity to areas already being protected or managed for conservation values) Score = 2.5**

The application documents multiple refuges that could be provided with IL4 water deliveries. Several potential NWRs and SWAs were identified in the application with most benefits occurring at the Sacramento, Colusa, and Delevan NWRs. Refuges in the Mendota Pool and the Tulare Basin could also benefit from deliveries from the Project as documented in the modeling. Refuge water deliveries provide improved habitat for multiple species of plants and wildlife and can improve habitat functionality of adjacent areas due to their hydrologic and spatial proximity to refuge water applications. The refuges identified are managed for conservation values. Several of the NWRs are hydrologically connected to the Sacramento River, which provides beneficial pathways for water and species movement. The application states that seasonal and permanent wetlands in the Sacramento NWR are managed specifically for habitat enhancement and for the benefit of native species that have commercial, recreational, scientific, or educational uses (including waterfowl, shorebirds, and special-status wildlife species). However, no documentation was provided that quantifies what the added commercial, recreational, scientific, or educational value of any species or habitat would be.

**Priority 16 – REV Criterion 9 (Efficient use of water to achieve multiple ecosystem benefits) Score = 2.8**

In general, water deliveries to refuges can generate multiple habitat and species specific benefits. The application indicates that there is flexibility in the timing of refuge deliveries, allowing refuges to target other conservation goals that may occur later in the season. The application did not describe how the water efficiencies of this benefit are linked to any commercial, recreational, scientific, or educational uses.

**Priority 16 – REV Criterion 10 (Resilience of ecosystem improvements to the effects of changing environmental conditions, including hydrologic variability and climate change) Score = 1.8**

The application states that Project modeling indicates that dry, and critically dry, years will occur 34-38% of time in the Sacramento Valley and 66-69% of time in the San Joaquin Valley. The applicant associates this frequency with the potential wetland losses in the future due to reduced refuge deliveries under without Project conditions. The proposed benefits discussed under this priority indicate the Project's ability to potentially reduce the impacts associated with these reductions. The application states that climate change and associated increased frequency of dry and critically dry years is the primary source of uncertainty. However, the application did not describe how this linked to any commercial, recreational, scientific, or educational uses is resilient.

**Table 1. Relative Environmental Value Scores for the Sites Project**

Priority	REV2	REV3	REV4	REV5	REV6	REV7	REV8	REV9	REV10	REV1	Points Possible	Points Received
P 1	2.3	3.0	3.0	2.5	3.3	2.8	2.8	1.8	2.7	X	54	24.2
P 2	1.8	1.7	2.3	2.0	2.7	2.3	2.4	1.3	1.8	X	54	18.3
P 3	1.7	1.7	2.3	1.8	2.3	2.0	2.0	1.2	1.5	X	54	16.5
P 4	2.3	3.2	2.8	2.6	3.3	2.8	2.8	1.8	2.7	X	54	24.3
P 5	1.0	1.0	1.2	1.5	1.8	1.2	1.5	1.0	1.5	X	54	11.7
P 10	2.1	2.3	2.4	2.8	2.7	2.1	2.9	1.6	1.9	X	54	20.8
P 11	1.9	1.9	2.3	2.2	2.9	2.6	2.7	1.7	2.1	X	54	20.3
P 14	3.0	4.0	2.8	3.3	2.3	4.0	5.3	3.8	3.5	X	54	32.0
P 15	1.5	1.1	1.5	1.0	2.3	0.5	1.1	0.0	1.0	X	54	10.0
P 16	2.3	2.5	2.3	2.3	1.8	2.0	2.5	2.8	1.8	X	54	20.3
<b>TOTAL</b>										REV1 = <sup>1</sup> 3.8%	540	198.4
											<b>TOTAL REV SCORE<sup>2</sup></b>	<b>40.5%</b>

<sup>1</sup>Additional 0.375 percent applied to total REV score for each priority claimed

<sup>2</sup>Total REV Score equals total points received divided by total points possible, plus REV1 percentage addition