Action Suite I.2. Shasta Operations

Introduction to Shasta Operations: Maintaining suitable temperatures for egg incubation, fry emergence, and juvenile rearing in the Sacramento River is critically important for survival and recovery of the winter-run ESU. The winter-run ESU has been reduced to a single population, which has been blocked from its historical range above Shasta Dam. Consequently, suitable temperatures and habitat for this population must be maintained downstream of Shasta Dam through management of the cold water pool behind the dam in the summer. Maintaining optimum conditions for this species below Shasta is crucial until additional populations are established in other habitats or this population is restored to its historical range. Spring-run are also affected by temperature management actions from Shasta Reservoir.

The effects analysis in this Opinion highlights the very challenging nature of maintaining an adequate cold water pool in critically dry years, extended dry periods, and under future conditions, which will be affected by increased downstream water demands and climate change. This suite of actions is designed to ensure that Reclamation uses maximum discretion to reduce adverse impacts of the projects to winter-run and spring-run in the Sacramento River by maintaining sufficient carryover storage and optimizing use of the cold water pool. In most years, reservoir releases through the use of the TCD are a necessity in order to maintain the bare minimum population levels necessary for survival (Yates *et al.* 2008, Angilletta *et al.* 2008).

The effects analysis in this Opinion, and supplemental information provided by Reclamation, make it clear that despite Reclamation's best efforts, severe temperature-related effects cannot be avoided in some years. The RPA includes exception procedures to deal with this reality. Due to these unavoidable adverse effects, the RPA also specifies other actions that Reclamation must take, within its existing authority and discretion, to compensate for these periods of unavoidably high temperatures. These actions include restoration of habitat at Battle Creek that may be support a second population of winter-run, and a fish passage program at Keswick and Shasta dams to partially restore winter-run to their historical cold water habitat.

Objectives: The following objectives must be achieved to address the avoidable and unavoidable adverse effects of Shasta operations on winter-run and spring-run:

1) Ensure a sufficient cold water pool to provide suitable temperatures for winter-run spawning between Balls Ferry and Bend Bridge in most years, without sacrificing the potential for cold water management in a subsequent year. Additional actions to those in the 2004 CVP/SWP operations Opinion are needed, due to increased vulnerability of the population to temperature effects attributable to changes in Trinity River ROD operations, projected climate change hydrology, and increased water demands in the Sacramento River system.

2) Ensure suitable spring-run temperature regimes, especially in September and October. Suitable spring-run temperatures will also partially minimize temperature effects to

naturally-spawning, non-listed Sacramento River fall-run, an important prey base for endangered Southern Residents.

3) Establish a second population of winter-run in Battle Creek as soon as possible, to partially compensate for unavoidable project-related effects on the one remaining population.

4) Restore passage at Shasta Reservoir with experimental reintroductions of winter-run to the upper Sacramento and/or McCloud rivers, to partially compensate for unavoidable project-related effects on the remaining population.

Action 1.2.1 Performance Measures.

Objective: To establish and operate to a set of performance measures for temperature compliance points and End-of-September (EOS) carryover storage, enabling Reclamation and NMFS to assess the effectiveness of this suite of actions over time. Performance measures will help to ensure that the beneficial variability of the system from changes in hydrology will be measured and maintained.

Action: The following long-term performance measures shall be attained. Reclamation shall track performance and report to NMFS at least every 5 years. If there is significant deviation from these performance measures over a 10-year period, measured as a running average, which is not explained by hydrological cycle factors (*e.g.,* extended drought), then Reclamation shall reinitiate consultation with NMFS.

Performance measures for EOS carryover storage at Shasta Reservoir:

- 87 percent of years: Minimum EOS storage of 2.2 MAF
- 82 percent of years: Minimum EOS storage of 2.2 MAF and end-of-April storage of 3.8 MAF in following year (to maintain potential to meet Balls Ferry compliance point)
- 40 percent of years: Minimum EOS storage 3.2 MAF (to maintain potential to meet Jelly's Ferry compliance point in following year)

Measured as a 10-year running average, performance measures for temperature compliance points during summer season shall be:

- Meet Clear Creek Compliance point 95 percent of time
- Meet Balls Ferry Compliance point 85 percent of time
- Meet Jelly's Ferry Compliance point 40 percent of time
- Meet Bend Bridge Compliance point 15 percent of time

Rationale: Evaluating long-term operations against a set of performance measures is the only way to determine the effectiveness of operations in preserving key aspects of life history

and run time diversity. For example, maintaining suitable spawning temperatures down to Bend Bridge in years when this is feasible will help to preserve the part of winter-run distribution and run timing that relies on this habitat and spawning strategy. This will help to ensure that diversity is preserved when feasible. The percentages are taken from those presented in the CVP/SWP operations BA, effects analysis in the Opinion, and NMFS technical memo on historic Shasta operations.

Action I.2.2. November through February Keswick Release Schedule (Fall Actions)

Objective: Minimize impacts to listed species and naturally spawning non-listed fall-run from high water temperatures by implementing standard procedures for release of cold water from Shasta Reservoir.

Action: Depending on EOS carryover storage and hydrology, Reclamation shall develop and implement a Keswick release schedule, and reduce deliveries and exports as detailed below.

Action I.2.2.A Implementation Procedures for EOS Storage at 2.4 MAF and Above

If the EOS storage is at 2.4 MAF or above, by October 15, Reclamation shall convene a group including NMFS, USFWS, and CDFG, through B2IT or other comparable process, to consider a range of fall actions. A written monthly average Keswick release schedule shall be developed and submitted to NMFS by November 1 of each year, based on the criteria below. The monthly release schedule shall be tracked through the work group. If there is any disagreement in the group, including NMFS technical staff, the issue/action shall be elevated to the WOMT for resolution per standard procedures.

The workgroup shall consider and the following criteria in developing a Keswick release schedule:

1) Need for flood control space: A maximum 3.25 MAF end-of-November storage is necessary to maintain space in Shasta Reservoir for flood control.

2) Need for stable Sacramento River level/stage to increase habitat for optimal spring-run and fall-run redds/egg incubation and minimization of redd dewatering and juvenile stranding.

3) Need/recommendation to implement USFWS' Delta smelt Fall X2 action as determined by the Habitat Study Group formed in accordance with the 2008 Delta smelt Opinion. NMFS will continue to participate in the Habitat Study Group (HSG) chartered through the 2008 Delta smelt biological opinion. If, through the HSG, a fall flow action is recommended that draws down fall storage significantly from historical patterns, then NMFS and USFWS will confer and recommend to Reclamation an optimal storage and fall flow pattern to address multiple species' needs.

If there is a disagreement at the workgroup level, actions may be elevated to NMFS Sacramento Area Office Supervisor and resolved through the WOMT's standard operating procedures.

Rationale: 2.2 MAF EOS storage is linked to the potential to provide sufficient cold water to meet the minimum Balls Ferry Compliance point in the following year, and it is achievable approximately 85 percent of the time. Based on historical patterns, EOS storage will be above 2.4 MAF 70 percent of the time. The 2.4 MAF storage value provides a reasonable margin above the 2.2 level to increase the likelihood that the Balls Ferry Compliance Point will be reached while also implementing fall releases to benefit other species and life stages. Therefore, in these circumstances, actions should target the fall life history stages of the species covered by this Opinion *(i.e*., spring-run spawning, winter-run emigration). The development of a Keswick release schedule is a direct method for controlling storage maintained in Shasta Reservoir. It allows Reclamation to operate in a predictable way, while meeting the biological requirements of the species. The B2IT workgroup has been used in the past to target actions to benefit fall-run during this time of year using b(2) resources, and, because of its expertise, may also be used by Reclamation to develop this flow schedule. In the past, the B2IT group has used the CVPIA AFRP guidelines to target reservoir releases. Over time, it may be possible to develop a generic release schedule for these months, based on the experience of the work group.

Action I.2.2.B Implementation Procedures for EOS Storage Above 1.9 MAF and Below 2.4 MAF

If EOS storage is between 1.9 and 2.4 MAF, then Reclamation shall convene a group including NMFS, USFWS, and CDFG, through B2IT or other comparable workgroup, to consider a range of fall actions. Reclamation shall provide NMFS and the work group with storage projections based on 50 percent, 70 percent, and 90 percent hydrology through February, and develop a monthly average Keswick release schedule based on the criteria below. The monthly release schedule shall be submitted to NMFS by November 1.

Criteria for the release schedule shall include:

1) Maintain Keswick releases between 7000 cfs and 3250 cfs to reduce adverse effects on mainstem spring-run and conserve storage for next year's cold water pool.

2) Consider fall-run needs per CVPIA AFRP guidelines, through January, including stabilizing flows to keep redds from de-watering.

3) Be more conservative in Keswick releases throughout fall and early winter if hydrology is dry, and release more water for other purposes if hydrology becomes wet. For example, release no more than 4,000 cfs if hydrology remains dry.

The Keswick release schedule shall follow this or a similar format, to be refined by the workgroup:

	October forecast based on EOS storage	50% hydrology		70% hydrology		90% hydrology	
		Projected storage MAF	Planned release CFS	Projected storage MAF	Planned release CFS	Projected storage MAF	Planned release CFS
Monthly average Keswick release	November						
	December						
	January						
	February						

Reclamation, in coordination with the work group, shall review updated hydrology and choose a monthly average release for every month (November, December, January, February), based on the release schedule. In the event that the updated hydrology indicates a very dry pattern and consequent likely reduction in storage, the work group may advise Reclamation to take additional actions, including export curtailments, if necessary to conserve storage

If there is a disagreement at the work group level, actions may be elevated to NMFS and resolved through the WOMT's standard operating procedures.

Rationale: It is necessary to be reasonably conservative with fall releases to increase the likelihood of adequate storage in the following year to provide cold water releases for winter-run. This action is intended to reduce adverse effects on each species without compromising the ability to reduce adverse effects on another species. A work group with biologists from multiple agencies will refine the flow schedule, providing operational certainty while allowing for real-time operational changes based on updated hydrology. Over time, it may be possible to develop a generic release schedule for these months, based on the experience of the work group.

Action I.2.2.C. Implementation and Exception Procedures for EOS Storage of 1.9 MAF or Below

If the EOS storage is at or below 1.9 MAF, then Reclamation shall:

1) In early October, reduce Keswick releases to 3,250 cfs as soon as possible, unless higher releases are necessary to meet temperature compliance points (see action I.2.3).

2) Starting in early October, if cool weather prevails and temperature control does not mandate higher flows, curtail discretionary water deliveries (including, but not limited to agricultural rice decomposition deliveries) to the extent that these do not coincide with temperature management for the species. It is important to maintain suitable

temperatures targeted to each life stage. Depending on air and water temperatures, delivery of water for rice decomposition, and any other discretionary purposes at this time of year, may coincide with the temperature management regime for spring-run and fall-run. This action shall be closely coordinated with NMFS, USFWS, and CDFG.

3) By November 1, submit to NMFS storage projections based on 50 percent, 70 percent, and 90 percent hydrology through February. In coordination with NMFS, Reclamation shall: (1) develop a monthly average Keswick release schedule similar in format to that in Action I.2.2.B, based on the criteria below and including actions specified below; and (2) review updated hydrology and choose a monthly average release for every month, based on the release schedule. November releases shall be based on a 90 percent hydrology estimate.

Criteria and actions:

1) Keswick releases shall be managed to improve storage and maintained at 3,250 cfs unless hydrology improves.

2) November monthly releases will be based on 90 percent hydrology.

3) Consider fall-run needs through January as per CVPIA AFRP guidelines, including stabilizing flows to keep redds from dewatering.

4) Continue to curtail discretionary agricultural rice decomposition deliveries to the extent that these do not coincide with temperature management for the species, or impact other ESA-listed species. It is important to maintain suitable temperatures targeted to each life stage. Depending on air and water temperatures, delivery of water for rice decomposition may coincide with the temperature management regime for spring-run and fall-run. This action shall be closely coordinated with NMFS. USFWS, and CDFG.

5) If operational changes are necessary to meet Delta outflow, X2, or other legal requirements during this time, then:

    a) CVP/SWP Delta combined exports shall be curtailed to 2,000 cfs if necessary to meet legal requirements while maintaining a 3,250 cfs Keswick release (or other planned release based on biological needs of species); and
    b) if it is necessary to curtail combined exports to values more restrictive than 2000 cfs in order to meet Delta outflow, X2, or other legal requirements, then Reclamation and DWR shall, as an overall strategy, first, increase releases from Oroville or Folsom; and
    c) in general, Reclamation shall increase releases from Keswick as a last resort.
    d) Based on updated monthly hydrology, this restriction may be relaxed, with NMFS' concurrence.

6) If the hydrology and storage have not improved by January, additional restrictions apply – see Action I.2.4.

Rationale: Per actions I.2.3 and I.2.4 below, Reclamation is required to meet 1.9 MAF EOS. The BA's CALSIM modeling shows that during a severe or extended drought, 1.9 EOS storage may not be achievable. In this circumstance, Reclamation should take additional steps in the fall and winter months to conserve Shasta storage to the maximum extent possible, in order to increase the probability of maintaining cold water supplies necessary for egg incubation for the following summer's cohort of winter-run.

Assessment of the hydrologic record and CALSIM modeling shows that operational actions taken during the first year of a drought sequence are very important to providing adequate storage and operations in subsequent drought years. The biological effects of an extended drought are particularly severe for winter-run. Extended drought conditions are predicted to increase in the future in response to climate change. While it is not possible to predict the onset of a drought sequence, in order to ensure that project operations avoid jeopardizing listed species, Reclamation should operate in any year in which storage falls below 1.9 MAF EOS as potentially the first year of a drought sequence. The CVP storage system is likely to recover more quickly in the winter and spring months if additional storage conservation measures are taken in the fall and winter.

The curtailments to discretionary rice decomposition deliveries and combined export curtailment of 2,000 cfs are necessary to conserve storage when EOS storage is low. These actions were developed through an exchange of information and expertise with Reclamation operators.

This action is consistent with comments from the Calfed Science Peer Review panel. That panel recommended that Shasta be operated on a two-year (as opposed to single year) hydrologic planning cycle and that Reclamation take additional steps to incorporate planning for potential drought and extended drought into its operations.

Action I.2.3. February Forecast; March – May 14 Keswick Release Schedule (Spring Actions)

Objective: To conserve water in Shasta Reservoir in the spring in order to provide sufficient water to reduce adverse effects of high water temperature in the summer months for winter-run, without sacrificing carryover storage in the fall.

Actions:

1) Reclamation shall make its February 15 forecast of deliverable water based on an estimate of precipitation and runoff within the Sacramento River basin at least as conservative as the 90 percent probability of exceedence. Subsequent updates of water

delivery commitments must be based on monthly forecasts at least as conservative as the 90 percent probability of exceedence.

a) Reclamation shall provide the draft February forecast, and a projection of temperature management operations for the summer months, to NMFS no later than seven business days after receipt of the official DWR runoff forecast.
b) NMFS shall be provided at 3 three business days to review the draft forecast.
c) NMFS shall review the draft February forecast to determine whether the predicted delivery schedule is likely to leave sufficient water for temperature management to meet ESA requirements.
d) NMFS shall provide a written evaluation to Reclamation prior to Reclamation making the first allocation announcements and for each subsequent month for discretionary contract deliveries.
e) Reclamation shall manage releases from Keswick consistent with the February forecast and subsequent monthly hydrology updates.

2) Reclamation shall make releases to maintain a temperature compliance point not in excess of 56 degrees between Balls Ferry and Bend Bridge from April 15 through May 15.

Action I.2.3.A Implementation Procedures if February Forecast, Based on 90 Percent Hydrology, Shows that Balls Ferry Temperature Compliance Point and 2.2 MAF EOS are Both Achievable

NMFS will review the draft February forecast to determine whether both a temperature compliance point at Balls Ferry during the temperature control season (May – October), and EOS storage of at least 2.2 MAF, is likely to be achieved. If both are likely, then Reclamation shall announce allocations and operate Keswick releases in March, April, and May consistent with its standard plan of operation. Preparation of a separate Keswick release schedule is not necessary in these circumstances.

Rationale: The 90 percent forecast is a conservative approach for assessing the potential to meet both the Balls Ferry TCP and 2.2 MAF EOS performance goals. If both of these performance goals are projected to be met at the time of the February forecast, then no restrictions on allocations due to this suite of actions are necessary.

Action I.2.3.B Implementation Procedures if February Forecast, Based on 90 Percent Hydrology, Shows that Only Balls Ferry Compliance or 2.2 MAF EOS, but Not Both, Is Achievable

1) On or before February 15, Reclamation shall reduce Keswick releases to 3,250 cfs, unless NMFS concurs on an alternative release schedule. This reduction shall be maintained until a flow schedule is developed per procedures below.

2) In coordination with NMFS, by March 1, Reclamation shall develop an initial monthly Keswick release schedule, based on varying hydrology of 50 percent, 70 percent, and 90 percent (similar in format to the fall and winter action implementation procedures – see table above). These schedules shall be used as guidance for monthly updates and consultations.

3) Based on this guidance, Reclamation shall consult with NMFS monthly on Keswick releases. Reclamation shall submit a projected forecast, including monthly average release schedules and temperature compliance point to NMFS every month, within 7 business days of receiving the DWR runoff projections for that month. Within 3 business days of receiving this information from Reclamation, NMFS will review the draft schedule for consistency with the criteria below and provide written recommendations to Reclamation.

4) The initial monthly Keswick release schedule, and subsequent monthly updates, shall be developed based on the following criteria and including the following actions:

    a) Maintain minimum monthly average flows necessary to meet nondiscretionary delivery obligations and legal requirements.
    b) Provide for flow-related biological needs of spring life stages of all species covered by this Opinion in the Sacramento River and Delta, to the greatest extent possible.
    c) If operational changes are necessary to meet Delta outflow, X2, or other legal requirements during this time, then:

        - CVP/SWP Delta combined exports shall be curtailed to 2,000 cfs if necessary to meet legal requirements while maintaining a 3,250 cfs Keswick Dam release (or other planned release based on biological needs of species); and
        - if it is necessary to curtail combined exports to values more restrictive than 2000 cfs in order to meet Delta outflow, X2, or other legal requirements, then Reclamation and DWR shall, as an overall strategy, first, increase releases from Oroville or Folsom Dam; and
        - in general, Reclamation shall increase releases from Keswick Dam as a last resort.
        - Based on improvements in updated monthly hydrology, this restriction may be relaxed, with NMFS' concurrence.

Rationale: It is necessary to manage storage for potential dry years, to reduce adverse effects on winter-run egg incubation in summer months, and on spring-run in fall months. According to information provided by Reclamation, the hydrology is too variable this time of year to provide for a meaningful 3-month release schedule. Instead, monthly consultations between NMFS and Reclamation are needed to ensure that operations are based on biological criteria.

Action I. 2.3. C. Drought Exception Procedures if February Forecast, Based on 90 Percent Hydrology, Shows that Clear Creek Temperature Compliance Point or 1.9 MAF EOS Storage is Not Achievable

Reclamation shall follow all procedures immediately above (Action I.2.3.B) and, in addition, shall:

1) By March 1, provide a contingency plan with a written justification that all actions within Reclamation's authorities and discretion are being taken to preserve cold water at Shasta Reservoir for the protection of winter-run.

2) The contingency plan shall also, at a minimum, include the following assessments and actions:

    a) Relaxation of Wilkins Slough navigation criteria to at most 4,000 cfs.
    b) An assessment of any additional technological or operational measures that may be feasible and may increase the ability to manage the cold water pool.
    c) Notification to State Water Resources Control Board that meeting the biological needs of winter-run and the needs of resident species in the Delta, delivery of water to nondiscretionary Sacramento Settlement Contractors, and Delta outflow requirements per D-1641, may be in conflict in the coming season and requesting the Board's assistance in determining appropriate contingency measures, and exercising their authorities to put these measures in place.

3) If, during the temperature control season, a Clear Creek TCP on the Sacramento River cannot be achieved, then Reclamation shall bypass power at Shasta Dam if NMFS determines a bypass is necessary for preserving the cold water pool. This power by-pass may be necessary to maintain temperature controls for winter-run, or later in the temperature season, for spring-run.

Rationale: In these circumstances, there is a one-in-ten likelihood that minimal requirements for winter-run egg survival will not be achieved due to depletion of the cold water pool, resulting in temperature-related mortality of winter-run and, in addition, most likely contributing to temperature-related mortality of spring-run spawning in the fall. This is a conservative forecast, since there is a 90 percent probability that conditions will improve. However, the effects analysis in this Opinion concludes that these poor conditions could be catastrophic to the species, potentially leading to a significant reduction in the viability of winter-run. Delta objectives (salinity, X2, E/I ratio, OMR flow restrictions for both smelt and salmon) are also controlling at this time of year. There is potential for conflict between the need to maintain storage at Shasta and other legal and ecological requirements. Consequently, it is necessary to immediately limit releases from Shasta and develop a contingency plan.

Notification to the State Water Resources Control Board (SWRCB) is essential. Sacramento Settlement Contract withdrawal volumes from the Sacramento River can be quite substantial during these months. The court has recently concluded that Reclamation does not have discretion to curtail the Sacramento Settlement contractors to meet Federal ESA requirements. Therefore, NMFS is limited in developing an RPA that minimizes take to acceptable levels in these circumstances. Consequently, other actions are necessary to avoid jeopardy to the species, including fish passage at Shasta Dam in the long term.

Separate from this consultation, NMFS will work with the SWRCB to determine whether contingency plans within the Board's authority are warranted, and to assist in developing such plans that will allow Reclamation to meet ESA requirements. The incidental take statement for this Opinion also provides limitations of ESA incidental take coverage for Settlement Contractors under the terms of this Opinion.

Action 1.2.4 May 15 Through October Keswick Release Schedule (Summer Action)

Objective: To manage the cold water storage within Shasta Reservoir and make cold water releases from Shasta Reservoir to provide suitable habitat temperatures for winter-run, spring-run, CV steelhead, and Southern DPS of green sturgeon in the Sacramento River between Keswick Dam and Bend Bridge, while retaining sufficient carryover storage to manage for next year's cohorts. To the extent feasible, manage for suitable temperatures for naturally spawning fall-run.

Action: Reclamation shall develop and implement an annual Temperature Management Plan by May 15 to manage the cold water supply within Shasta Reservoir and make cold water releases from Shasta Reservoir and Spring Creek to provide suitable temperatures for listed species, and, when feasible, fall-run.

Reclamation shall manage operations to achieve daily average water temperatures in the Sacramento River between Keswick Dam and Bend Bridge as follows:

1) Not in excess of 56°F at compliance locations between Balls Ferry and Bend Bridge from May 15 through September 30 for protection of winter-run, and not in excess of 56°F at the same compliance locations between Balls Ferry and Bend Bridge from October 1 through October 31 for protection of mainstem spring run, whenever possible.

2) Reclamation shall operate to a final Temperature Management Plan starting May 15 and ending October 31.

3) As part of the adaptive management process, and in coordination with NMFS, by March 2010, Reclamation shall fund an independent modeler to review these procedures and the recommendations of the Calfed Science Panel report on temperature management and recommend specific refinements to these procedures to achieve optimal temperature management, with due consideration of the Calfed Science panel's recommendations

(Deas *et al*., 2009) regarding temperature management. Upon written concurrence of NMFS, refinements to the implementation procedures for this action suite, based on the independent contractor's report, may be adopted and implemented.

Implementation Procedures: Reclamation shall take the following steps to develop an annual Temperature Management plan:

1) By April 15, Reclamation shall develop and submit to NMFS both 50 percent and 90 percent forecasts, consistent with its draft plan of summer operations. Reclamation shall model two complete runs for each forecast, one with an upstream TCP and one with a downstream TCP. Together, Reclamation will present four risk-management options to NMFS for review. EOS Storage will be projected for each of the four runs. If it is very wet or very dry, there will be fewer options to present to NMFS.
2) NMFS will provide comments within five business days to Reclamation, recommending that Reclamation either: (1) operate to one of the options; or (2) develop an alternative operations plan necessary to meet reasonably attainable preferred TCP and EOS storage.
3) Within five business days of receiving NMFS' recommendations, and based on NMFS' comments, Reclamation will develop an operations plan with specific monthly average Keswick releases to attain both TCP from May 15 through the EOS and EOS storage, and submit the plan to NMFS for concurrence.
4) By May 15, Reclamation and NMFS shall jointly submit a final Temperature Management Plan to meet the SWRCB 90-5 requirements using the SRTTG. From May 15 through October 31, the SRTTG shall track implementation of this plan, and shall refine it based real-time information, including run timing, location of redds, air and surface water temperature modeling, and projected versus actual extent of the cold water pool. Any disagreement at the work group level regarding how to implement or modify the plan will be elevated to NMFS and resolved through WOMT standard operating procedures.

Rationale: Depending on hydrology and air temperature, from May through October, it is necessary to use the cold water pool in Shasta Reservoir to provide cold water releases to maintain suitable water temperatures for listed anadromous fish below Shasta. Without access to the cold water pool, suitable temperatures for egg incubation are not attainable. Preparation of an annual Temperature Management Plan allows Reclamation, in consultation with NMFS, to achieve optimal cold water management in a given year. Temperature management requires tradeoffs between extending the range of suitable habitat by moving the compliance point downstream from Balls Ferry, and conserving EOS storage. The storage level at the EOS is important to manage the risk of unsuitably warm water temperatures for winter-run in the following summer. Maintaining suitable temperatures in September and October is also important to minimize adverse effects of project operations to main stem Sacramento River spring-run. Fall-run, a non-listed species that is important as a prey base for Southern Resident Killer Whale, also benefits from suitable temperatures in the Fall.

Development of 2 to 4 options for temperature management, prior to finalizing a plan allows for meaningful discussion of appropriate risk management strategies in a given year, based on timely hydrologic and biological considerations. Important factors differ from year to year, and need to be considered in operations planning. They include the projected size of the winter-run year class (and thus the extent of habitat needed); timing and location of spawning and redds based on aerial surveys; the extent of the cold water pool, given air temperatures; and operation of the Temperature Control Device to provide optimal use of the cold water pool. Preparation of a draft plan also allows for iterative planning and feedback. Operations can be tailored each year to achieve the optimal approach to temperature management to maintain viable populations of anadromous fish, based on the best available information.

The Calfed Science Program peer review report on temperature management emphasized the importance of refining temperature management practices in the long term and included recommendations for doing so. The requirement to hire an independent contractor to recommend specific refinements to the procedures in this RPA responds to these recommendations.

Action I.2.5. Winter-Run Passage and Re-Introduction Program at Shasta Dam

See Fish Passage Program, Action V

Action I.2.6. Restore Battle Creek for Winter-Run, Spring-Run, and CV Steelhead

Objective: To partially compensate for unavoidable adverse effects of project operations by restoring winter-run and spring-run to the Battle Creek watershed. A second population of winter-run would reduce the risk of extinction of the species from lost resiliency and increased vulnerability to catastrophic events.

Description of Action: Reclamation shall direct discretionary funds to implement the Battle Creek Salmon and Steelhead Restoration Project. Phase 1A funding is currently allocated through various partners and scheduled to commence in Summer 2009 (Reclamation 2008c). DWR shall direct discretionary funds for Phase 1B and Phase 2, consistent with the proposed amended Delta Fish Agreement by December 31 of each year, Reclamation and DWR will submit a written report to NMFS on the status of the project, including phases completed, funds expended, effectiveness of project actions, additional actions planned (including a schedule for further actions), and additional funds needed. The Battle Creek Salmon and Steelhead Restoration Project shall be completed no later than 2019.

Rationale: Modeling projections in the BA show that adverse effects of ongoing project operations cannot be fully minimized. Severe temperature-related effects due to project operations will occur in some years. This RPA includes an exception procedure in anticipation of these occurrences (see Action I.2.2). Establishing additional populations of winter-run is critical to stabilize the high risk of extinction resulting from the proposed action

on the only existing population of this species. $26 million has been identified for this project in the American Recovery and Reinvestment Act of 2009.

Action Suite I.3. Red Bluff Diversion Dam (RBDD) Operations

Objectives: Reduce mortality and delay of adult and juvenile migration of winter-run, spring-run, CV steelhead, and Southern DPS of green sturgeon caused by the presence of the diversion dam and the configuration of the operable gates. Reduce adverse modification of the passage element of critical habitat for these species. Provide unimpeded upstream and downstream fish passage in the long term by raising the gates year-round, and minimize adverse effects of continuing dam operations, while pumps are constructed replace the loss of the diversion structure.

Action I.3.1. Operations after May 14, 2012: Operate RBDD with Gates Out

Action: No later than May 15, 2012, Reclamation shall operate RBDD with gates out all year to allow unimpeded passage for listed anadromous fish. If the Red Bluff Alternative Intake Structure is not anticipated to be operational by May 15, 2012, Reclamation may submit a request to NMFS, no later than January 31, 2012, to close the gates from June 15 to September 1, 2012. This request must document that all milestones for construction of the alternative pumping plant have been met and that all other conservation measures (see below) have been implemented.

Rationale: RBDD impedes and delays upstream migration of adult winter-run, spring-run, CV steelhead, and Southern DPS of green sturgeon. It also impedes and delays downstream passage of juveniles of the same species. It adversely modifies critical habitat for these species by impairing important mainstem passage. Pumps can be used to deliver water currently made available by placing gates in the river, and $109 million has been identified in the recent American Recovery and Reinvestment Act of 2009 for the Red Bluff Pumping Plant.

Action I.3.2. Interim Operations

Action: Until May 14, 2012, Reclamation shall operate RBDD according to the following schedule:

- September 1 - June 14: Gates open. No emergency closures of gates are allowed.
- June 15 - August 31: Gates may be closed at Reclamation's discretion, if necessary to deliver water to TCCA.

Rationale: Having gates out until June 15 is necessary for winter-run, spring-run and green sturgeon adult passage to spawning habitat. TCCA can withdraw 465 cfs without the gates in the river. Their water demand typically reaches 800 cfs by June 15, therefore, TCCA will need supplemental pumping capacity to meet water demand until June 15. NMFS has