BUREAU OF RECLAMATION

Long-Term Operation – Biological Assessment

Appendix H – Conservation Measure Deconstruction

October 2024

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Appendix H Conservation Measure Deconstruction

H.1 Introduction

Conservation measures as defined in in the Endangered Species Consultation Handbook (1998) as *"actions to benefit or promote the recovery of listed species that are included by the Federal agency as an integral part of the proposed action."* This conservation measure deconstruction appendix analyzes actions to minimize or compensate for effects from the seasonal operations of the Central Valley Project (CVP) and State Water Project (SWP) in a water year (October–September) or to benefit or promote the recovery of listed species. Appendix D describes the linkages between conceptual models, seasonal operations, and resulting stressors on federally listed fish species to identify the potential adverse effects from the operation of the CVP and SWP.

While conservation measures intend to benefit at least one species, they may have additional effects to other life stages or to other species. Effects associated with conservation measures that are part of the Proposed Action are described below.

H.2 Sacramento River

H.2.1 Ramping Rates

The Sacramento River *Ramping Rates* conservation measure addresses the stranding risk stressor on juvenile salmonids by minimizing the rate and timing of flow decreases. Rapid changes in river elevation from ramping reservoir releases up or down can impact aquatic biota. Sudden flow decreases can strand fishes and macroinvertebrates (Dauwalter 2013) depending on factors such as the distance downstream of the dam, season, time of day, substrate type, channel slope, channel morphology, and wetted history (how long the habitat was wetted prior to the event) (Young et al. 2011). While the United States Department of the Interior, Bureau of Reclamation (Reclamation) factors in ramping rates year-round, this conservation measure identified in the Proposed Action is applicable from July 1 to March 31. Changes in flows attenuate further downstream from diffusion and accretions.

Research on the Columbia River indicates that the highest probability of stranding is initiated by large magnitude flow reductions in the afternoon during mid-summer, at low water levels near the shore that has been inundated for a long period (Irvin et al. 2015). These conditions are related to power operations and differ substantially from the operation of CVP. Ramping rates can be expressed in terms of absolute or percent of river flow or as rates of changes in river stage. They can be derived via experimental approaches in mesocosms, flumes, or net pens, or via in-river monitoring of fish response to flows. Although some locales have developing standard ramping rates (see Fisheries and Oceans Canada [DFO] Generic Standard Ramping Rate Table 6.1 in Cathcart 2005 as cited in Table 1 of Lewis and Healey), appropriate ramping

rates may be idiosyncratic to a given location, depending on its physical and biological characteristics, and may have to consider other factors such as the benefits of natural flow variability and various operational constraints.

Listed species potentially affected by the Sacramento River *Ramping Rates* conservation measure include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, and green sturgeon.

H.2.1.1 Winter-run Chinook Salmon

Adults are migrating, holding, and spawning in the Sacramento River.

- The Sacramento River *Ramping Rates* conservation measure may increase the water temperature stressor by decreasing the storage of water in Shasta Reservoir.

Eggs may be present in the Sacramento River.

- The Sacramento River *Ramping Rates* conservation measure may increase the water temperature stressor by decreasing the storage of water in Shasta Reservoir.

Juveniles are present.

- The Sacramento River *Ramping Rates* conservation measure may reduce the Stranding Risk stressor by reducing the rate of change to inundated habitat.

H.2.1.2 Spring-run Chinook Salmon

Adults are migrating, holding, and spawning in the Sacramento River.

- The Sacramento River *Ramping Rates* conservation measure may increase the water temperature stressor by decreasing the storage of water that could reduce the coldwater pool in Shasta Reservoir.

Eggs are present in the Sacramento River.

- The Sacramento River *Ramping Rates* conservation measure may increase the water temperature stressor by decreasing the storage of water that could reduce the coldwater pool in Shasta Reservoir.

Juveniles are rearing and migrating.

- The Sacramento River *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

Yearlings are rearing and migrating.

- The Sacramento River *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.
- The Sacramento River *Ramping Rates* conservation measure may increase the water temperature and dissolved oxygen stressor by decreasing the storage of water that could deplete the coldwater pool in Shasta Reservoir.

H.2.1.3 Steelhead

Adults are migrating, holding, and spawning in the Sacramento River.

- The Sacramento River *Ramping Rates* conservation measure may increase the water temperature stressor by decreasing the storage of water in Shasta Reservoir.
- The Sacramento River *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

Kelts are present in the Sacramento River.

- The Sacramento River *Ramping Rates* conservation measure may increase the water temperature stressor by decreasing the storage of water in Shasta Reservoir. The Sacramento River *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

Eggs may be present in the Sacramento River.

- The Sacramento River *Ramping Rates* conservation measure may increase the water temperature and dissolved oxygen stressors by decreasing the storage of water in Shasta Reservoir. The Ramping Rates conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

Juveniles are rearing in the Sacramento River.

- The Sacramento River *Ramping Rates* conservation measure may increase the water temperature and dissolved oxygen stressors by decreasing the storage of water in Shasta Reservoir. The Sacramento River *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

H.2.1.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The Sacramento River *Ramping Rates* conservation measure may increase or decrease the water temperature stressor by decreasing the storage of water in Shasta Reservoir. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The Sacramento River *Ramping Rates* conservation measure may increase or decrease the water temperature stressor by decreasing the storage of water in Shasta Reservoir. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.2 Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance

The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure seeks to build and conserve storage in a manner that minimizes winter-run and fall-run Chinook salmon redd dewatering. During the fall, Sacramento River flows will decrease from the high releases in the summer; during the winter (December–February) Reclamation will release baseflows. Each year, the baseflow will be set to balance between the risk of required storage management or flood control releases in the coming fall and winter with supporting refill capabilities for Shasta Reservoir to build coldwater pool for the following year. The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may reduce Reclamation's action to store water in Shasta Reservoir, which may increase water temperatures in the upcoming year. Listed species potentially affected by fall and winter baseflows include winter-run Chinook salmon, spring-run Chinook salmon, and steelhead.

H.2.2.1 Winter-run Chinook Salmon

Adults are not present in the Sacramento River.

Eggs are present in the Sacramento River in the fall.

- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the redd dewatering stressor. Reclamation, after coordination through the Sacramento River Group (SRG) and Shasta Operations Team (SHOT), will determine the schedule for fall release reductions by developing a risk analysis that relies on real-time fish monitoring data, winter-run Chinook salmon redds remaining in the river, fall-run Chinook salmon returns, expected fall water deliveries and transfers. Based on this analysis and the coordination through SRG and SHOT, Reclamation may delay or extend the ramp down to minimum fall and winter flows for the benefit of the fish populations.
- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may decrease the water temperature stressor by building storage in Shasta Reservoir, which may be used for the following year's water temperature management season.

Juveniles are present in the Sacramento River.

- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase the outmigration cue stressor and the refuge habitat stressor by reducing flows.

H.2.2.2 Spring-run Chinook Salmon

Adults are migrating, holding, and spawning in the Sacramento River.

- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may decrease the spawning habitat stressor when flows are maintained to keep spring-run Chinook salmon redds from dewatering.

Eggs are present in the Sacramento River.

- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the redd stranding and dewatering stressor by either reducing flows and dewatering redds or maintaining flows and keeping redds inundated.
- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the water temperature stressor by either reducing flows and building storage in Shasta Reservoir, which may be used for the following year's water temperature management season or maintaining flows and depleting the coldwater pool.

Juveniles are present in the Sacramento River.

- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the outmigration cue stressor may increase or decrease by either reducing flows and masking cues to migrate and reducing outmigration travel rates or maintaining flows and sustaining cues to migrate and outmigration travel rates.
- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the refuge habitat stressor by either reducing flows; thereby, reducing suitable margin and off-channel habitats or by maintaining flows which could increase access to off-channel habitat.
- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the food availability stressor by either reducing flows which could decrease food production and access to side channels and inundated floodplain habitat or maintaining flows which could sustain food production and could increase access to side channels and inundated flood plain habitat.

Yearlings are present in the Sacramento River.

- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the outmigration cue stressor may increase or decrease by either reducing flows and masking cues to migrate and affecting outmigration travel rates or maintaining flows and sustaining cues to migrate and outmigration travel rates.
- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the refuge habitat stressor by either reducing flows; thereby, reducing suitable margin and off-channel habitats or by maintaining flows which could increase access to off-channel habitat.
- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the food availability stressor by either reducing flows which could decrease food production and access to side channels and inundated floodplain habitat or maintaining flows which could sustain food production and could increase access to side channels and inundated flood plain habitat.

H.2.2.3 Steelhead

Adults are migrating, holding, and spawning in the Sacramento River.

- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may decrease the water temperature stressor by building storage in Shasta Reservoir, which may be used for the following year's water temperature management season.
- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may decrease the spawning habitat stressor when flows are maintained to keep steelhead redds from dewatering.

Kelts are present in the Sacramento River.

- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may decrease the water temperature stressor by building storage in Shasta Reservoir, which may be used for the following year's water temperature management season.

Eggs are present in the Sacramento River.

- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the redd dewatering stressor by either reducing flows and dewatering redds or maintaining flows and keeping redds inundated.
- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the water temperature stressor by either reducing flows and building storage in Shasta Reservoir which may be used for the following year's water temperature management season or maintaining flows and depleting the coldwater pool.

Juveniles are rearing.

- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the outmigration cue stressor by either reducing flows and masking cues to migrate and reducing outmigration travel rates or maintaining flows and sustaining cues to migrate and outmigration travel rates.
- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the Refuge Habitat stressor by either reducing flows thereby reducing suitable margin and off-channel habitats or by maintaining flows which could increase access to off-channel habitat.
- The *Fall and Winter Baseflows for Shasta Reservoir Refill and Redd Maintenance* conservation measure may increase or decrease the food availability stressor by either reducing flows which could decrease food production and access to side channels and inundated floodplain habitat or maintaining flows which could sustain food production and could increase access to side channels and inundated flood plain habitat.

H.2.3 Minimum Instream Flows

Condition 2 of Order 90-5 requires Keswick Dam releases of 3,250 cubic feet per second (cfs) from September through February, except during critical dry years or emergencies. Under certain hydrologic circumstances during fall and winter months and with side flows from creeks within and around the City of Redding may experience short term periods of high flows in response to major storm events.

Under the Sacramento River *Minimum Instream Flows* conservation measure, Reclamation, after coordination through the SRG and SHOT, and also through adaptive management, may temporarily reduce Keswick Dam releases below 3,250 cfs to preserve storage, as long as flows at the Sacramento River California Data Exchange Center gage maintain a minimum 3,250 cfs throughout that Keswick Dam flow reduction. Listed species potentially affected by minimum instream flows include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, Delta smelt, and longfin smelt.

H.2.3.1 Winter-run Chinook Salmon

Adults are present.

- The Sacramento River *Minimum Instream Flows* conservation measure will increase Reclamation's ability to store water in Shasta Reservoir which may decrease water temperatures in the upcoming year for adults.

Eggs are not present in the Sacramento River.

- The Sacramento River *Minimum Instream Flows* conservation measure will increase Reclamation's ability to store water in Shasta Reservoir which may decrease water temperatures in the upcoming year for eggs.

Juveniles are present.

- The Sacramento River *Minimum Instream Flows* conservation measure may increase the refuge habitat stressor by decreasing flows.
- The Sacramento River *Minimum Instream Flows* conservation measure may increase the outmigration cue stressor by flattening the hydrograph during the fall and winter.

H.2.3.2 Spring-run Chinook Salmon

Adults are migrating, holding, and spawning in the Sacramento River.

- The Sacramento River *Minimum Instream Flows* conservation measure may decrease the water temperature stressor by increasing the storage of water in Shasta Reservoir by providing temporary relief in meeting instream flow requirements in the Sacramento River.

Eggs are present in the Sacramento River.

- The Sacramento River *Minimum Instream Flows* conservation measure may decrease the water temperature stressor by increasing the storage of water in Shasta Reservoir by providing temporary relief in meeting instream flow requirements in the Sacramento River.

Juveniles are rearing and migrating.

- The Sacramento River *Minimum Instream Flows* conservation measure may increase the refuge habitat stressor due to decrease access to additional refuge habitat connectivity resulting from temporary reductions in releases from Shasta Reservoir to conserve storage.
- The Sacramento River *Minimum Instream Flows* conservation measure may increase the outmigration cue stressor by temporarily reducing releases that may attenuate cues to migrate and outmigration travel rates.

Yearlings are rearing and migrating.

- The Sacramento River *Minimum Instream Flows* conservation measure may increase the refuge habitat stressor due to decrease access to additional refuge habitat connectivity resulting from temporary reductions in releases from Shasta Reservoir to conserve storage.
- The Sacramento River *Minimum Instream Flows* conservation measure may increase the outmigration cue stressor by temporarily reducing releases that may attenuate cues to migrate and outmigration travel rates.

H.2.3.3 Steelhead

Adults are migrating, holding and spawning in the Sacramento River.

- The Sacramento River *Minimum Instream Flows* conservation measure may decrease the water temperature stressor by increasing the storage of water in Shasta Reservoir by providing temporary relief in meeting instream flow requirements in the Sacramento River.
- The Sacramento River *Minimum Instream Flows* conservation measure may increase the Spawning Habitat stressor by decreasing spawning success due to less available spawning habitat through reduction in flows.

Kelts are present in the Sacramento River.

- The Sacramento River *Minimum Instream Flows* conservation measure may decrease the water temperature stressor by increasing the storage of water in Shasta Reservoir by providing temporary relief in meeting instream flow requirements in the Sacramento River.

Eggs may be present in the Sacramento River.

- The Sacramento River *Minimum Instream Flows* conservation measure may decrease the water temperature stressor by increasing the storage of water in Shasta Reservoir by providing temporary relief in meeting instream flow requirements in the Sacramento River.
- The Sacramento River *Minimum Instream Flows* conservation measure may increase the stranding and dewatering stressor by temporarily reducing releases that may strand and dewater redds.

Juveniles are rearing and migrating in the Sacramento River.

- The Sacramento River *Minimum Instream Flows* conservation measure may increase the water temperature and dissolved oxygen stressor by increasing the storage of water in Shasta Reservoir by providing temporary relief in meeting instream flow requirements in the Sacramento River.
- The Sacramento River *Minimum Instream Flows* conservation measure may increase the Stranding and Dewatering stressor by temporarily reducing releases that may disconnect habitat and strand juveniles.
- The Sacramento River *Minimum Instream Flows* conservation measure may decrease the refuge habitat stressor due to reduced access to additional refuge habitat connectivity resulting from a temporary reductions of instream flows provided through releases from Shasta Reservoir storage.
- The Sacramento River *Minimum Instream Flows* conservation measure may increase the outmigration cue and food availability stressor by temporarily reducing flows reducing food availability and cues to migrate and outmigration travel rates.

H.2.3.4 Delta Smelt

Adults are present in the Delta.

- The Sacramento River *Minimum Instream Flows* conservation measure may increase the food availability stressor by decreasing increasing Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

L**arvae** are present in the Delta.

- The Sacramento River *Minimum Instream Flows* conservation measure may increase the food availability stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The Sacramento River *Minimum Instream Flows* conservation measure may increase the food availability and size of low-salinity zone risk stressor by decreasing Delta inflow.

H.2.3.5 Longfin Smelt

Adults are present in the Delta.

- The Sacramento River *Minimum Instream Flows* conservation measure may increase the food availability stressor by decreasing Delta inflow.

Eggs are present, and **larvae** are present in the Delta.

- The Sacramento River *Minimum Instream Flows* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The Sacramento River *Minimum Instream Flows* conservation measure may increase the Food Availability and freshwater flow risk stressor by decreasing the Delta inflow.

H.2.4 Pulse Flows

The Sacramento River *Pulse Flows* conservation measures aim to increase outmigration survival of Chinook salmon. Reclamation would release up to 150 thousand acre-feet in pulse flow(s) each water year, typically in the spring, to benefit Chinook salmon in the Sacramento River watershed when the pulse does not interfere with the ability to meet water temperature objectives or other anticipated operations of the reservoir. Listed species potentially affected by pulse flows include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.2.4.1 Winter-run Chinook Salmon

Adults are holding in the Sacramento River.

- The Sacramento River *Pulse Flows* conservation measure may decrease the water temperature stressor for holding adults as releases may increase in the spring.

Eggs are not present in the Sacramento River but may be affected.

- The Sacramento River *Pulse Flows* conservation measure is anticipated to reduce Reclamation's storage of water, and may increase water temperatures in the upcoming year.

Juveniles are not present in the Sacramento River.

H.2.4.2 Spring-run Chinook Salmon

Adults are migrating and holding in the Sacramento River.

- The Sacramento River *Pulse Flows* conservation measure may decrease the water temperature stressor for holding adults as releases may increase in the spring.

Eggs are not present in the Sacramento River but may be affected.

- The Sacramento River *Pulse Flows* conservation measure is anticipated to reduce Reclamation's storage of water, and may increase water temperatures in the upcoming year.

Juveniles are rearing and migrating.

- The Sacramento River *Pulse Flows* conservation measure may decrease the outmigration cue stressor by increasing pulse flows cueing outmigration and increasing outmigration travel rate.
- The Sacramento River *Pulse Flows* conservation measure may decrease the entrainment risk stressor by increasing pulse flows providing for a higher rate of transport flow past diversions.

Yearlings are rearing.

- The Sacramento River *Pulse Flows* conservation measure may decrease the outmigration cue stressor by increasing pulse flows cueing outmigration and increasing outmigration travel rate.
- The Sacramento River *Pulse Flows* conservation measure may decrease the entrainment risk stressor by increasing pulse flows providing for a higher rate of transport flow past diversions.

H.2.4.3 Steelhead

Adults are migrating, holding, and spawning in the Sacramento River.

- The Sacramento River *Pulse Flows* conservation measure may decrease the water temperature stressor in the spring for migrating, holding, and spawning adults as releases may increase in the spring.

Kelts are present in the Sacramento River.

- The Sacramento River *Pulse Flows* conservation measure may decrease the water temperature stressor in the spring for migrating Kelts as releases may increase in the spring.

Eggs are present in the Sacramento River.

- The Sacramento River *Pulse Flows* conservation measure is anticipated to reduce Reclamation's storage of water and may increase water temperatures in the upcoming year.

Juveniles are rearing and migrating in the Sacramento River.

- The Sacramento River *Pulse Flows* conservation measure may decrease the outmigration cue stressor by increasing pulse flows cueing outmigration and increasing outmigration travel rate.

The Sacramento River *Pulse Flows* conservation measure may decrease the entrainment risk stressor by increasing pulse flows providing for a higher rate of transport flow past diversions.

H.2.4.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The Sacramento River *Pulse Flows* conservation measure may increase or decrease the water temperature stressor by decreasing the available coldwater pool in the summer. Dependent upon the available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The Sacramento River *Pulse Flows* conservation measure may increase or decrease the water temperature stressor by decreasing the available coldwater pool in the summer. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.4.5 Delta Smelt

Adults are present in the Delta.

- The Sacramento River *Pulse Flows* conservation measure may decrease the food availability stressor by increasing Delta inflow.

Eggs are present, but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The Sacramento River *Pulse Flows* conservation measure may decrease the food availability stressor for larvae by increasing Delta inflow.

Juveniles are present in the Delta.

- The Sacramento River *Pulse Flows* conservation measure may decrease the food availability and size of low-salinity zone risk stressor by increasing Delta inflow.

H.2.4.6 Longfin Smelt

Adults are present in the Delta.

- The Sacramento River *Pulse Flows* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

Eggs are present, and **larvae** are present in the Delta.

- The Sacramento River *Pulse Flows* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

Juveniles are present in the Delta.

- The Sacramento River *Pulse Flows* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

H.2.5 Adult Migration and Holding Water Temperature Objectives

Low flows combined with warm air temperatures and/or an intentional warmwater power bypass could cause warmer water temperatures than normal and may require the *Adult Migration and Holding Water Temperature Objectives* conservation measure. Under a circumstance where these conditions may cause water temperatures to rise to concerning levels prior to the final Temperature Management Plan, Reclamation will begin temperature management as early as March 1st through May to target water temperatures of 58 degrees Fahrenheit (°F) daily average at the Sacramento River at Clear Creek (CCR). Listed species potentially affected by these water temperature objectives include winter-run Chinook salmon, spring-run Chinook salmon, steelhead and green sturgeon.

H.2.5.1 Winter-run Chinook Salmon

Adults are holding in the Sacramento River.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may decrease the water temperature stressor on adults holding and spawning in the Upper Sacramento River.

Eggs are not present in the Sacramento River but may be affected.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may require the early operation of the Temperature Control Device (TCD) to draw cold water, which would increase the water temperature stressor for eggs in the summer and fall.

Juveniles are not present in the Sacramento River.

H.2.5.2 Spring-run Chinook Salmon

Adults are migrating in the Sacramento River.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may decrease the water temperature stressor on adults holding and spawning in the Upper Sacramento River due to implementation of early water temperature management.

Eggs are not present in the Sacramento River but may be affected. The early operation of the

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure is likely to increase the water temperature stressor in the summer and fall.

Juveniles are rearing and migrating in the Sacramento River.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may reduce the water temperature stressor on juveniles in the upper Sacramento River due to implementation of early water temperature management.

Yearlings are rearing in the Sacramento River.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may reduce the water temperature stressor on juveniles in the upper Sacramento River due to implementation of early water temperature management.

H.2.5.3 Steelhead

Adults are migrating, holding, and spawning in the Sacramento River.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may decrease the water temperature stressor on adults migrating, holding, and spawning in the upper Sacramento River due to implementation of early water temperature management.

Kelts are present in the Sacramento River.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may decrease the water temperature stressor on kelts in the Upper Sacramento River due to implementation of early temperature management.

Eggs are present in the Sacramento River.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may reduce the water temperature stressor on eggs in the upper Sacramento River due to implementation of early water temperature management.

Juveniles are present in the Sacramento River.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may reduce the water temperature stressor on juveniles in the upper Sacramento River due to implementation of early water temperature management.

H.2.5.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River during the summer.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may increase or decrease the water temperature stressor by decreasing the available coldwater pool in the summer. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for egg incubation.

Larvae may be present in the Sacramento River during the summer.

- The *Adult Migration and Holding Water Temperature Objectives* conservation measure may increase or decrease the water temperature stressor by decreasing the available coldwater pool in the summer. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.6 U.S. Fish and Wildlife Service Actions at Livingston Stone National Fish Hatchery

A broodyear assessment and other actions by the U.S. Fish and Wildlife Service (USFWS) are identified in the Proposed Action; however, the Proposed Action also states that Reclamation is only consulting on the water operations of CVP facilities. Therefore, this action is not analyzed.

H.2.7 Sacramento River Settlement Contractors Delaying or Shifting Spring Diversions to Maximize Storage

Reclamation may request that the Sacramento River Settlement (SRS) Contractors delay diversions in the spring to increase the likelihood that Shasta Reservoir elevations reach the upper gates on the Temperature Control Device. Final decision making is done by the SRS Contractors; therefore, this action is not analyzed.

H.2.8 Sacramento River Settlement Contractors Shifting Timing of Delivery of Transfer Water

Reclamation may request that the SRS Contractors shift timing of delivery of transfer water to increase the amount of water in Shasta Reservoir through the water temperature management season. Final decision making is done by the SRS Contractors. Thus, this action is not analyzed.

H.2.9 Sacramento River Settlement Contractors Rice Decomposition Smoothing

The *SRS Contractors Rice Decomposition Smoothing* conservation measure supports fall-run Chinook salmon while balancing winter-run Chinook salmon redd dewatering stressors. With lower October and November flows, fall-run Chinook salmon are less likely to spawn in shallow areas that would be subject to dewatering during winter base flows. Reclamation will release flows based on Sacramento Valley Water Service Contractors demand and SRS Contractors coordinated rice decomposition smoothing diversion schedule. SRS Contractors and CVP Water Service Contractors will synchronize their diversions to lower peak rice decomposition demand. Starting in August, Reclamation and the SRS Contractors, through the SRG, will develop a delivery schedule based on dewatering risk for winter-run Chinook salmon redd locations. These early reductions balance the potential for dewatering late-spawning winter-run Chinook salmon. Listed species potentially impacted by rice decomposition smoothing include winter-run Chinook salmon and spring-run Chinook salmon.

H.2.9.1 Winter-run Chinook Salmon

Adults are not present in the Sacramento River.

Eggs are present in the Sacramento River.

- The *SRS Contractors Rice Decomposition Smoothing* conservation measure may increase the redd dewatering stressor. However, Reclamation and the SRS Contractors, through the SRG, will develop a delivery schedule based on dewatering risk for winter-run Chinook salmon redd locations.

Juveniles are present in the Sacramento River.

- The *SRS Contractors Rice Decomposition Smoothing* conservation measure may increase the outmigration cue stressor by reducing fall flows.

H.2.9.2 Spring-run Chinook Salmon

Adults are spawning in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs are present in the Sacramento River.

- The *SRS Contractors Rice Decomposition Smoothing* conservation measure may increase the stranding and redd dewatering stressor by reducing flows in the fall which could result in redd dewatering.

Juveniles are present in the Sacramento River.

- The *SRS Contractors Rice Decomposition Smoothing* conservation measure may increase the outmigration cue stressor by reducing flows in the fall, thereby masking cues to migrate and reducing outmigration travel rates.
- The *SRS Contractors Rice Decomposition Smoothing* conservation measure may increase the refuge habitat stressor by reducing flows in the fall, which could reduce the suitable margin and off-channel habitats.

Yearlings are present in the Sacramento River.

- The *SRS Contractors Rice Decomposition Smoothing* conservation measure may increase the outmigration cue stressor by reducing flows in the fall, thereby masking cues to migrate and reducing outmigration travel rates.
- The *SRS Contractors Rice Decomposition Smoothing* conservation measure may increase the refuge habitat stressor by reducing flows in the fall, which could reduce the suitable margin and off-channel habitats.

H.2.10 Flow and Non-Flow Measures from the Voluntary Agreements

Under the Sacramento River *Flow and Non-Flow Measures from the Voluntary Agreements (VAs)* conservation measure the SRS Contractors will make water available under VAs, and Reclamation may operate Shasta Reservoir to advance inflows to the Delta, subject to determination by SHOT. Under this conservation measure, flows would likely be higher in the spring and lower in the summer. Listed species potentially impacted by VAs include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.2.10.1 Winter-run Chinook Salmon

Adults are holding and spawning in the Sacramento River.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the water temperature stressor for holding adults in the spring due to increased releases. VAs may increase the water temperature stressor spawning adults as lower summer releases may warm in-river temperatures.

Eggs are present in the Sacramento River.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may increase the water temperature stressor. The increase in spring releases from Shasta Reservoir would lower storage prior to the beginning of the water temperature management season in the spring which may lower the available coldwater pool. Decreased flows in the summer may warm in-river temperatures.

Juveniles are not present in the Sacramento River.

H.2.10.2 Spring-run Chinook Salmon

Adults are migrating, holding, and spawning in the Sacramento River.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may increase the water temperature stressor for holding adults by increasing flows in the spring prior to the water temperature management season which could deplete the coldwater pool. Decreased flows in the summer may also warm in-river temperatures.

Eggs are present in the Sacramento River.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may increase the water temperature stressor for holding adults by increasing flows in the spring prior to the water temperature management season which could reduce the coldwater pool. Decreased flows in the summer may also warm in-river temperatures.

Juveniles are rearing and migrating.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the outmigration cue stressor by increasing flows in the spring, which could increase cues for migration and travel time.
- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the refuge habitat stressor by increasing flows in the spring which could increase the margin and off-channel habitats available.
- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the food availability stressor by increasing flows in the spring, which could sustain food production and could increase access to side channels and inundated flood plain habitat.
- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the entrainment risk stressor by increasing flows in the spring providing for a higher rate of transport flow past diversions.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the Stranding Risk stressor by increasing flows in the spring which could reduce disconnected habitat from the main channel.

Yearlings are rearing.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may increase or decrease the refuge habitat stressor by either increasing flows in the spring which could increase the margin and off-channel habitats available or by decreasing flows in the summer which could reduce the margin and off-channel habitats.
- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may increase or decrease the food availability stressor by increasing flows in the spring which could sustain food production and could increase access to side channels and inundated flood plain habitat or by decreasing flows in the summer which could reduce food production and reducing access to side channels and inundated flood plain habitat.
- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may increase or decrease the stranding risk stressor by increasing flows in the spring which could reduce disconnected habitat from the main channel or by reducing flows in the summer which could increase disconnected habitat from the main channel.
- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may increase the water temperature and dissolved oxygen stressor by increasing flows in the spring prior to the water temperature management season which could reduce the coldwater pool. Decreased flows in the summer may also warm in-river temperatures.

H.2.10.3 Steelhead

Adults are migrating and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Kelts are migrating in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs are present in the Sacramento River during the spring but are not expected to be affected by this conservation measure.

Juveniles are rearing and outmigrating in the Sacramento River.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the outmigration cue stressor by increasing flows in the spring which could increase cues for migration and travel time.
- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the refuge habitat stressor by increasing flows in the spring which could increase the margin and off-channel habitats available.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the food availability stressor by increasing flows in the spring which could sustain food production and could increase access to side channels and inundated flood plain habitat.
- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the entrainment risk stressor by increasing flows in the spring providing for a higher rate of transport flow past diversions.
- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the stranding risk stressor by increasing flows in the spring which could reduce disconnected habitat from the main channel.

H.2.10.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may increase or decrease the water temperature stressor by increasing releases in the spring, which may cool in-river temperatures, and decreasing releases in the summer which may warm in-river temperatures. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may increase or decrease the water temperature stressor. This conservation measure may increase releases in the spring, cooling in-river temperatures. By contrast, this conservation measure may decrease releases in the summer, warming in-river temperatures. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.10.5 Delta Smelt

Adults are potentially present in the Delta.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the by increasing Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the food Availability stressor by increasing Delta inflow during the Spring when Delta smelt are present.

Juveniles are present in the Delta.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the Food Availability and size and location of low-salinity zone risk stressor by increasing Delta inflow during the Spring when Delta smelt are present.

H.2.10.6 Longfin Smelt

Adults are present in the Delta.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

Eggs are present, and **larvae** are present in the Delta.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

Juveniles are present in the Delta.

- The Sacramento River *Flow and Non-Flow Measures from the VAs* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

H.2.11 Wilkins Slough Minimum Flow Criteria Relief

Under the *Wilkins Slough Minimum Flow Criteria Relief* conservation measure, summer flows would be lower than 5,000 cfs in the driest of years. As a default, Reclamation will target a minimum flow of 3,400 cfs under these conditions. October flows may vary due to demands, water transfer operations and protection of winter-run Chinook salmon redds and are likely to be in the 3,250–5,000 cfs range although higher flows may be necessary at times. After the irrigation season, Reclamation expects to begin ramping down to the minimum flow of 3,250 cfs as soon as possible given deliveries, Delta conditions and winter-run Chinook salmon redd dewatering concerns. Reclamation, through coordination with the SHOT, will determine the appropriate ramp down date after evaluating tradeoffs between Shasta Reservoir storage, next year's water temperature management, winter-run Chinook salmon redd dewatering and fall-run Chinook salmon stranding and redd dewatering. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.2.11.1 Winter-run Chinook Salmon

Adults are spawning in the Sacramento River.

- The *Wilkins Slough Minimum Flow Criteria Relief* conservation measure may increase the water temperature stressor for adults by decreasing summer releases; thus, increasing water temperatures. This conservation measure may also decrease the Water Temperature stressor for the following year if Shasta Reservoir storage is conserved.

Eggs are present in the Sacramento River.

- The *Wilkins Slough Minimum Flow Criteria Relief* conservation measure may increase the water temperature stressor for eggs by decreasing summer releases; thus, increasing water temperatures. This conservation measure may also decrease the water temperature stressor for the following year if Shasta Reservoir storage is conserved.

Juveniles are present in the Sacramento River.

- The *Wilkins Slough Minimum Flow Criteria Relief* conservation measure may increase the outmigration cue stressor by decreasing summer releases, which may reduce fry to smolt survival.

H.2.11.2 Spring-run Chinook Salmon

Adults are spawning in the Sacramento River.

- The *Wilkins Slough Relief Criteria* conservation measure may increase the water temperature stressor for adults by decreasing summer releases; thus, increasing water temperatures. This conservation measure may also decrease the water temperature stressor for the following year if Shasta Reservoir storage is conserved.

Eggs are present in the Sacramento River.

- The *Wilkins Slough Relief Criteria* conservation measure may increase the water temperature stressor by decreasing spring and summer releases; thus, increasing water temperatures. This conservation may also decrease the water temperature stressor for the following year if Shasta Reservoir storage is conserved.

Juveniles are present in the Sacramento River.

- The *Wilkins Slough Relief Criteria* conservation measure may increase the outmigration cue stressor by decreasing spring and summer releases, which may reduce fry to smolt survival.

Yearlings are present in the Sacramento River.

- The *Wilkins Slough Relief Criteria* conservation measure may increase the outmigration cue stressor by decreasing spring and summer releases.

H.2.11.3 Steelhead

Adults are present in the Sacramento River.

- The *Wilkins Slough Relief Criteria* conservation measure may increase the water temperature stressor for adults by decreasing summer releases thus increasing water temperatures. This conservation measure may also decrease the water temperature stressor for the following year if Shasta Reservoir storage is conserved.

Kelts are present in the Sacramento River.

- The *Wilkins Slough Relief Criteria* conservation measure may increase the water temperature stressor for adults by decreasing summer releases; thus, increasing water temperatures. This conservation measure may also decrease the water temperature stressor for the following year if Shasta Reservoir storage is conserved.

Eggs are not present.

Juveniles are rearing and outmigrating in the Sacramento River.

- The *Wilkins Slough Relief Criteria* conservation measure may increase the water temperature stressor for juveniles by decreasing summer releases; thus, increasing water temperatures. This conservation measure may also decrease the water temperature stressor for the following year if Shasta Reservoir storage is conserved.

H.2.11.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The *Wilkins Slough Relief Criteria* conservation measure may increase or decrease the water temperature stressor by decreasing summer releases; thus, increasing water temperatures. This conservation may also increase or decrease the water temperature stressor for the following year if Shasta Reservoir storage is conserved. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The *Wilkins Slough Relief Criteria* conservation measure may increase or decrease the water temperature stressor by decreasing summer releases; thus, increasing water temperatures. This conservation may also increase or decrease the water temperature stressor for the following year if Shasta Reservoir storage is conserved. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.11.5 Delta Smelt

Adults are present in the Delta.

- The *Wilkins Slough Minimum Flow Criteria Relief* conservation measure may increase the food stressor by decreasing Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *Wilkins Slough Minimum Flow Criteria Relief* conservation measure may increase the food availability stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The *Wilkins Slough Minimum Flow Criteria Relief* conservation measure may increase the food availability and size and location of low-salinity zone risk stressor by decreasing the Delta inflow.

H.2.11.6 Longfin Smelt

Adults are present in the Delta.

- The *Wilkins Slough Minimum Flow Criteria Relief* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Eggs are present, and **larvae** are present in the Delta.

- The *Wilkins Slough Minimum Flow Criteria Relief* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The *Wilkins Slough Minimum Flow Criteria Relief* conservation measure may increase the Food Availability and freshwater flow risk stressor by decreasing the Delta inflow.

H.2.12 Rebalancing Between Other Central Valley Project Reservoirs

Under the *Rebalancing between other CVP Reservoirs* conservation measure, Sacramento River flows may decrease in dry years as one approach to conserving storage in Shasta Reservoir and operate the TCD to target 53.5° F upstream of CCR for the most critical period during the winter-run Chinook salmon spawning and egg incubation period to avoid critical loss of winter-run Chinook salmon population. Reclamation will reduce Shasta Reservoir releases for water supply (CVP allocations) to only that needed for meeting public health and safety demands, including minimum salinity levels in the Delta. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.2.12.1 Winter-run Chinook Salmon

Adults may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for adults. When spring flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Eggs may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Juveniles may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the outmigration cue stressor for juveniles. When summer and fall flows are reduced, outmigration cues may be muted; however, increasing Shasta Reservoir storage may provide for increased storage and releases in the following year.

H.2.12.2 Spring-run Chinook Salmon

Adults may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for holding adults. When spring flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Eggs may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Yearlings may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

H.2.12.3 Steelhead

Adults may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for adults. When spring flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Kelts may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for kelts. When spring flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Eggs may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Juveniles may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for juveniles. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

H.2.12.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for eggs. When spring and summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase or decrease the water temperature stressor for larvae. When spring and summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.12.5 Delta Smelt

Adults are present in the Delta.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase the food stressor by decreasing Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase the food availability stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase the food availability and size and location of low-salinity zone risk stressor by decreasing Delta inflow.

H.2.12.6 Longfin Smelt

Adults are present in the Delta.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Eggs are present, and **larvae** are present in Delta.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The *Rebalancing between other CVP Reservoirs* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

H.2.13 Limitation on Central Valley Project Allocations for End-of-September Storage

Under the *Limitation on CVP allocations for End-of-September Storage* conservation measure, Reclamation may consider water supply reductions in dry water years. Reclamation will reduce Shasta Reservoir releases for water supply (CVP allocations) to only that needed for meeting public health and safety demands, including minimum salinity levels in the Delta. Reclamation, through coordination with the SHOT, will identify moderate and heavy system-wide tradeoffs with the goal of conserving storage and meeting minimal water temperature objectives. This action attempts to increase end of water year storage for Shasta Reservoir by reducing spring and summer flows. In extremely dry years or in multi-year droughts, it is possible that these actions will not achieve an end-of-September storage above 2.0 million acre-feet. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.2.13.1 Winter-run Chinook Salmon

Adults are present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase Water Temperature stressor for adults. When summer flows are reduced, water temperatures may increase.

Eggs are present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Juveniles are present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase outmigration cue stressor for juveniles. When flows are reduced, outmigration cues may be muted.

H.2.13.2 Spring-run Chinook Salmon

Adults are present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase water temperature stressor for adults. When summer flows are reduced, water temperatures may increase.

Eggs are present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Juveniles are present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase outmigration cue stressor. When flows are reduced, outmigration cues may be muted.

Yearlings are present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase the outmigration cue stressor. When flows are reduced, outmigration cues may be muted.

H.2.13.3 Steelhead

Adults may be present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase or decrease the water temperature stressor for adults. When spring flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Kelts may be present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase or decrease the water temperature stressor for adults. When spring flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Eggs may be present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Juveniles may be present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase or decrease the water temperature stressor for juveniles. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

H.2.13.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.13.5 Delta Smelt

Adults are present in the Delta.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

H.2.13.6 Longfin Smelt

Adults are present in the Delta.

- The *Limitation on CVP Allocations for End-of-September Storage* conservation measure may increase the food availability stressor by decreasing the Delta inflow.

Eggs are present, and **larvae** are present in the Delta.

- The *Limitation on CVP Allocations for End-of-September* Storage conservation measure may increase the food availability stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The *Limitation on CVP Allocations for End-of-September* Storage conservation measure may increase the food availability and size and location of low-salinity zone risk stressor by decreasing the Delta inflow.

H.2.14 Modifications to Water Transfers

Under the *Modifications to Water Transfers* conservation measure, Reclamation may request that the SRS Contractors shift timing of delivery of transfer water during the typical irrigation season (April through September) to help improve water temperature management and/or protect against winter-run Chinook salmon redd dewatering and fall-run Chinook salmon stranding. Sacramento River flows would increase, and storage in Shasta Reservoir would be reduced. If the SHOT denies water transfers, the water would be delivered, and Shasta Reservoir would have less coldwater pool. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.2.14.1 Winter-run Chinook Salmon

Adults are present.

- The *Modifications to Water Transfers* conservation measure may decrease the water temperature stressor by increasing Sacramento River flows.

Eggs are present.

- The *Modifications to Water Transfers* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are increased, water temperatures may decrease; however, decreasing Shasta Reservoir storage would decrease the coldwater pool volume in the following year.

Juveniles are present.

- The *Modifications to Water Transfers* conservation measure may decrease the outmigration cue stressor by increasing Sacramento River flows into the Delta.

H.2.14.2 Spring-run Chinook Salmon

Adults are migrating, holding, and spawning in the Sacramento River.

- The *Modifications to Water Transfers* conservation measure may decrease the water temperature stressor by increasing Sacramento River flows.

Eggs are present.

- The *Modifications to Water Transfers* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are increased, water temperatures may decrease; however, decreasing Shasta Reservoir storage would decrease the coldwater pool volume in the following year.

Juveniles are present.

- The *Modifications to Water Transfers* conservation measure may decrease the outmigration cue stressor by increasing Sacramento River flows.

Yearlings are present.

- The *Modifications to Water Transfers* conservation measure may decrease the outmigration cue stressor by increasing Sacramento River flows.

H.2.14.3 Steelhead

Adults are present.

- The *Modifications to Water Transfers* conservation measure may decrease the water temperature stressor for adults by increasing Sacramento River flows.

Kelts are present.

- The *Modifications to Water Transfers* conservation measure may decrease the water temperature stressor for adults by increasing Sacramento River flows.

Eggs are present.

- The *Modifications to Water Transfers* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are increased, water temperatures may decrease; however, decreasing Shasta Reservoir storage would decrease the coldwater pool volume in the following year.

Juveniles are present.

- The *Modifications to Water Transfers* conservation measure may decrease the outmigration cue stressor for juveniles by increasing Sacramento River flows into the Delta.

H.2.14.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River during the summer.

- The *Modifications to Water Transfers* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for egg incubation.

Larvae may be present in the Sacramento River during the summer.

- The *Modifications to Water Transfers* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.14.5 Delta Smelt

Adults are present in the Delta.

- The *Modifications to Water Transfers* conservation measure may decrease the food availability stressor by increasing Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *Modifications to Water Transfers* conservation measure may decrease the food availability stressor by increasing Delta inflow.

Juveniles are present in the Delta.

- The *Modifications to Water Transfers* conservation measure may decrease the food availability and size and location of low-salinity zone risk stressor by increasing Delta inflow.

H.2.14.6 Longfin Smelt

Adults are present in the Delta.

- The *Modifications to Water Transfers* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

Eggs are present, and **larvae** are present in the Delta.

- The *Modifications to Water Transfers* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

Juveniles are present in the Delta.

- The *Modifications to Water Transfers* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

H.2.15 Situation-Specific Adjustments to Delta Water Quality Standards

Under the *Situation-specific Adjustments to Delta Water Quality Standards* conservation measure, Sacramento River flows may decrease in dry years as one approach to conserving storage in Shasta Reservoir. Relaxation of Delta outflow and salinity requirements historically occur in the winter, spring, and summer. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.2.15.1 Winter-run Chinook Salmon

Adults are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase or decrease the Water Temperature stressor on adults. The water temperature stressor may increase with lower flows in the Sacramento River during the winter, spring and summer; however, the water temperature stressor may decrease the following water year by increasing the volume of water in storage.

Eggs are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase or decrease the water temperature stressor on eggs. The water temperature stressor may increase with lower flows in the Sacramento River during the summer; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Juveniles are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the outmigration cue and refuge habitat stressor with lower flows in the Sacramento River during the winter.

H.2.15.2 Spring-run Chinook Salmon

Adults are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase or decrease the water temperature stressor. The water temperature stressor may increase with lower flows in the Sacramento River during the winter, spring, and summer; however, the water temperature stressor may decrease the following water year by increasing the volume of water in storage.

Eggs are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase or decrease the water temperature stressor. The water temperature stressor may increase with lower flows in the Sacramento River during the summer; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Juveniles are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the Outmigration Cue stressor by reducing in-river flows and masking outmigration cues and reducing travel time.
- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the refuge habitat stressor by reducing in-river flows, which could reduce the margin and off-channel habitats available.
- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the food availability stressor by reducing flows, which could reduce food production and decrease access to side channels and inundated flood plain habitat.
- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the entrainment risk stressor by decreasing flows, which may influence fish travel time and migration routing.
- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the stranding risk stressor by decreasing flows which could increase disconnected habitat from the main channel.

Yearlings are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase or decrease the water temperature stressor. The water temperature stressor may increase with lower flows in the Sacramento River during the summer; however, the water temperature stressor may decrease the following year by increasing the volume of water in Shasta Reservoir storage.
- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the outmigration cue stressor by reducing in-river flows and masking outmigration cues and reducing travel time.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the refuge habitat stressor by reducing in-river flows which could reduce the margin and off-channel habitats available.

H.2.15.3 Steelhead

Adults are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase or decrease the water temperature stressor on adults. The water temperature stressor may increase with lower flows in the Sacramento River during the winter, spring and summer; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Kelts are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase or decrease the water temperature stressor on adults. The water temperature stressor may increase with lower flows in the Sacramento River during the winter, spring and summer; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Eggs are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may decrease the water temperature stressor on eggs the following year by increasing the volume of water in storage.

Juveniles are present.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the outmigration cue and refuge habitat stressor by reducing in-river flows.

H.2.15.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.15.5 Delta Smelt

Adults are present in the Delta.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the food Availability stressor by decreasing Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the food availability stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the food availability and size and location of low-salinity zone risk stressor by decreasing the Delta inflow.

H.2.15.6 Longfin Smelt

Adults are present in the Delta.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Eggs are present, and **larvae** are present in the Delta.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The *Situation-Specific Adjustments to Delta Water Quality Standards* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

H.2.16 Limitations in Sacramento River Settlement Contractors Water Available Under Contract

Under the *Limitations in SRS Contractors Water Available Under Contract* conservation measure, Sacramento River flows may decrease in the spring, summer, and fall of dry years as one approach to conserving storage in Shasta Reservoir. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, and green sturgeon.

H.2.16.1 Winter-run Chinook Salmon

Adults are present.

- The *Limitations in SRS Contractors Water Available Under Contract* conservation measure may increase or decrease the water temperature stressor on adults. The water temperature stressor may increase with lower flows in the Sacramento River during the spring, summer and fall; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Eggs are present.

- The *Limitations in SRS Contractors Water Available Under Contract* conservation measure may increase or decrease the water temperature stressor on eggs. The water temperature stressor may increase with lower flows in the Sacramento River during the spring, summer and fall; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Juveniles are present.

- The *Limitations in SRS Contractors Water Available Under Contract* conservation measure may increase the outmigration cue and refuge habitat stressor on juveniles by decreasing fall flows in the Sacramento River.

H.2.16.2 Spring-run Chinook Salmon

Adults are present.

- The *Limitations in SRS Contractors Water Available Under Contract* conservation measure may increase or decrease the water temperature stressor on adults. The water temperature stressor may increase with lower flows in the Sacramento River during the spring, summer and fall; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Eggs are present.

- The *Limitations in SRS Contractors Water Available Under Contract* conservation measure may increase or decrease the water temperature stressor on eggs. The water temperature stressor may increase with lower flows in the Sacramento River during the spring, summer and fall; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Juveniles are present.

- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase the outmigration cue stressor by reducing in-river flows and masking outmigration cues and reducing travel time.
- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase the refuge habitat stressor by reducing in-river flows which could reduce the margin and off-channel habitats available.
- The *Limitations of SRS Contractors Water Available under Contract* may increase the food availability stressor by reducing flows, which could reduce food production and decrease access to side channels and inundated flood plain habitat.
- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase the entrainment risk stressor by decreasing flows, which may influence fish travel time and migration routing.
- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase the stranding risk stressor by decreasing flows, which could increase disconnected habitat from the main channel.

Yearlings are present.

- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase or decrease the water temperature stressor. The water temperature stressor may increase with lower flows in the Sacramento River during the summer; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.
- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase the outmigration cue stressor by reducing in-river flows and masking outmigration cues and reducing travel time.
- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase the refuge habitat stressor by reducing in-river flows, which could reduce the margin and off-channel habitats available.
- The *Limitations of SRS Contractors Water Available under Contract* conservation measure increase the food availability stressor by reducing flows, which could reduce food production and decrease access to side channels and inundated flood plain habitat.
- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase the entrainment risk stressor by decreasing flows, which may influence fish travel time and migration routing.
- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase the stranding risk stressor by decreasing flows, which could increase disconnected habitat from the main channel.

H.2.16.3 Steelhead

Adults are migrating, holding, and spawning in the Sacramento River.

- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase or decrease the water temperature stressor. The water temperature stressor may increase with lower flows in the Sacramento River during the spring, summer and fall; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Kelts are emigrating in the Sacramento River.

- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase or decrease the water temperature stressor. The water temperature stressor may increase with lower flows in the Sacramento River during the spring, summer and fall; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Eggs may be present in the Sacramento River.

- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase or decrease the w Water temperature stressor. The water temperature stressor may increase with lower flows in the Sacramento River during the spring, summer and fall; however, the water temperature stressor may decrease the following year by increasing the volume of water in storage.

Juveniles are rearing in the Sacramento River.

- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase the outmigration cue and refuge habitat stressor on juveniles by decreasing fall flows in the Sacramento River.

H.2.16.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The *Limitations of SRS Contractors Water Available under Contract* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.17 Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs

Under *Refuge Coordination for Instream Flow, Lake Levels and Refuge Needs* conservation measure, Shasta Reservoir releases to refuges in the summer and fall may decrease during the driest of years as a way to increase Shasta Reservoir storage. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, and green sturgeon.

H.2.17.1 Winter-run Chinook Salmon

Adults are present.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase or decrease the water temperature stressor on adults. Decreasing Sacramento River flows may warm in-river temperatures; however, conserving Shasta Reservoir storage may reduce water temperatures in the following year.

Eggs are present.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase or decrease the water temperature stressor on eggs. Decreasing Sacramento River flows may warm in-river temperatures; however, conserving Shasta Reservoir storage may reduce water temperatures in the following year.

Juveniles are present.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase the outmigration cue stressor on juveniles by decreasing Sacramento River flows.

H.2.17.2 Spring-run Chinook Salmon

Adults are present.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase or decrease the water temperature stressor. Decreasing Sacramento River flows may warm in-river temperatures; however, conserving Shasta Reservoir storage may reduce water temperatures in the following year.

Eggs are present.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase or decrease the water temperature stressor. Decreasing Sacramento River flows may warm in-river temperatures; however, conserving Shasta Reservoir storage may reduce water temperatures in the following year.

Juveniles are present.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase the outmigration cue stressor on juveniles by decreasing Sacramento River flows.

Yearlings are present.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase the outmigration cue stressor on yearlings by decreasing Sacramento River flows.

H.2.17.3 Steelhead

Adults are present.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase or decrease the water temperature stressor on adults. Decreasing Sacramento River flows may warm in-river temperatures; however, conserving storage may reduce water temperatures in the following year.

Kelts are present.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase or decrease the water temperature stressor on adults. Decreasing Sacramento River flows may warm in-river temperatures; however, conserving Reservoir storage may reduce water temperatures in the following year.

Eggs are not present.

Juveniles are present.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase the outmigration cue stressor on juveniles by decreasing Sacramento River flows.

H.2.17.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The *Refuge Coordination for Instream Flow, Lake Levels, and Refuge Needs* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.18 Egg Incubation and Emergence Water Temperature Objectives

Under the *Egg Incubation and Emergence Temperature Objectives* conservation measure, water temperature management would target 53.5°F through operation of the TCD on Shasta Dam, selectively withdrawing and blending water from different elevations within Shasta Reservoir. Water temperatures are typically targeted from May 15 – October 30; however, start and end dates may be adjusted through coordination with the SRG and SHOT based on the winter-run Chinook salmon spawning and emergence. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.2.18.1 Winter-run Chinook Salmon

Adults are present.

- The *Egg Incubation and Emergence Temperature Objectives* conservation measure may increase the water temperature stressor on adults by decreasing the volume of water in Shasta Reservoir storage during the following migrating and holding season.

Eggs are present.

- The *Egg Incubation and Emergence Temperature Objectives* conservation measure may decrease the water temperature stressor on eggs through water temperature management using the TCD to target specific temperatures for egg incubation and emergence.

Juveniles are present.

- The *Egg Incubation and Emergence Temperature Objectives* conservation measure may increase the outmigration cue stressor and refuge habitat stressor by reducing in-river flows available in the fall and winter.

H.2.18.2 Spring-run Chinook Salmon

Adults are present.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may increase the water temperature stressor on adults by decreasing the volume of water in Shasta Reservoir storage during the following migrating and holding season.

Eggs are present.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation may decrease the water temperature stressor on eggs through water temperature management using the TCD to target specific temperatures for egg incubation and emergence.

Juveniles are present.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may increase the outmigration cue stressor and Refuge Habitat stressor by reducing in-river flows available in the fall/winter.

Yearlings are present.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may increase the outmigration cue stressor and refuge habitat stressor by reducing in-river flows available in the fall/winter.

H.2.18.3 Steelhead

Adults may be present in the Sacramento River but are not expected to be affected by this conservation measure.

Kelts may be present in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs are not present in the Sacramento River.

Juveniles are rearing in the Sacramento River.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may increase the outmigration cue and refuge habitat stressor by reducing in-river flows available in the fall and winter.

H.2.18.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may decrease the water temperature stressor for green sturgeon eggs as water temperatures will be within the suitable water temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may increase the water temperature stressor for green sturgeon larvae as water temperatures would be below the suitable water temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.18.5 Delta Smelt

Adults are present in the Delta.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may decrease the food availability stressor by increasing Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may decrease the food availability stressor by increasing Delta inflow.

Juveniles are present in the Delta.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may decrease the food availability and size and location of low-salinity zone risk stressor by increasing Delta inflow.

H.2.18.6 Longfin Smelt

Adults are present in the Delta.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

Eggs are present, and **larvae** are present in the Delta.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

Juveniles are present in the Delta.

- The *Egg Incubation and Emergence Water Temperature Objectives* conservation measure may decrease the food availability and freshwater flow risk stressor by increasing Delta inflow.

H.2.19 Annual Winter-run Chinook Salmon Broodyear Assessment

Based on the outcome of the broodyear assessment prepared by the Winter-run Juvenile Production Estimate sub-team, Reclamation, the National Marine Fisheries Service (NMFS), USFWS and California Department of Fish and Wildlife (CDFW) will convene appropriate technical staff to make recommendations if it is necessary to increase the production of winter-run Chinook salmon associated with the Integrated-Recovery Supplementation Program or take other actions to protect production of winter-run Chinook salmon at the Livingston Stone National Fish Hatchery. USFWS, through coordination with the SHOT, will implement measures as appropriate. The outcome of the broodyear assessment may also be considered in implementing actions within the drought toolkit as described in Section 3.12 Drought of the Proposed Action.

Reclamation believes this is a USFWS action.

H.2.20 Drought Operations Priority Framework

Under the *Drought Operations Priority Framework* conservation measure, Reclamation will develop a Drought Emergency Plan that establishes system priorities and a water temperature management plan that seeks to provide winter-run Chinook salmon spawning water temperatures to avoid catastrophic losses related to summer water temperature management with the goal of achieving a projected end-of-September storage as close to 2.0 million acre-feet as possible. Some of the actions that will be included in the Drought Emergency Plan could occur in any month of the year. Sacramento River flows into the Delta would be reduced to conserve storage in Shasta Reservoir. Listed species potentially impacted by this action include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.2.20.1 Winter-run Chinook Salmon

Adults are present.

- The *Drought Operations Priority Framework* conservation measure may increase or decrease the water temperature stressor by decreasing Sacramento River flows into the Delta; however, increasing Shasta Reservoir storage may provide for more suitable water temperatures during the migrating, holding, and spawning season in the following year.

Eggs are present.

- The *Drought Operations Priority Framework* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Juveniles are present.

- The *Drought Operations Priority Framework* conservation measure may increase the outmigration cue stressor by decreasing Sacramento River flows into the Delta.

H.2.20.2 Spring-run Chinook Salmon

Adults are present.

- The *Drought Operations Priority Framework* conservation measure may increase or decrease the water temperature stressor by decreasing Sacramento River flows into the Delta; however, increasing Shasta Reservoir storage may provide for more suitable water temperatures during the migrating, holding, and spawning season in the following year.

Eggs are present.

- The *Drought Operations Priority Framework* conservation measure may increase or decrease the water temperature stressor for eggs. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year.

Juveniles are present.

- The *Drought Operations Priority Framework* conservation measure may increase the outmigration cue stressor by decreasing Sacramento River flows into the Delta.

Yearlings are present.

- The *Drought Operations Priority Framework* conservation measure may increase the outmigration cue stressor by decreasing Sacramento River flows into the Delta.

H.2.20.3 Steelhead

Adults are present.

- The *Drought Operations Priority Framework* conservation measure may increase or decrease the water temperature stressor by decreasing Sacramento River flows into the Delta; however, increasing Shasta Reservoir storage may provide for more suitable water temperatures the following year.

Kelts are present.

- The *Drought Operations Priority Framework* conservation measure may increase or decrease the water temperature stressor by decreasing Sacramento River flows into the Delta; however, increasing Shasta Reservoir storage may provide for more suitable water temperatures the following year.

Eggs are not present.

Juveniles are present.

- The *Drought Operations Priority Framework* conservation measure may increase the outmigration cue stressor by decreasing Sacramento River flows into the Delta.

H.2.20.4 Green Sturgeon

Adults are migrating, spawning, and holding in the Sacramento River but are not expected to be affected by this conservation measure.

Eggs may be present in the Sacramento River.

- The *Drought Operations Priority Framework* conservation measure may increase or decrease the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for egg incubation.

Larvae may be present in the Sacramento River.

- The *Drought Operations Priority Framework* conservation measure may change the water temperature stressor. When summer flows are reduced, water temperatures may increase; however, increasing Shasta Reservoir storage may provide for increased coldwater pool in the following year. Dependent upon available coldwater pool, water temperatures may be within or beyond the suitable water temperature range for the larval life stage.

Juveniles may be present in the Sacramento River but are not expected to be affected by this conservation measure.

H.2.20.5 Delta Smelt

Adults are present in the Delta.

- The *Drought Operations Priority Framework* conservation measure may increase the food availability stressor by decreasing Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *Drought Operations Priority Framework* conservation measure may increase the food availability stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The *Drought Operations Priority Framework* conservation measure may increase the Food Availability and size and location of low-salinity zone risk stressor by decreasing the Delta inflow.

H.2.20.6 Longfin Smelt

Adults are present in the Delta.

- The *Drought Operations Priority Framework* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Eggs and **larvae** are present in the Delta.

- The *Drought Operations Priority Framework* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

Juveniles are present in the Delta.

- The *Drought Operations Priority Framework* conservation measure may increase the food availability and freshwater flow risk stressor by decreasing Delta inflow.

H.3 Clear Creek

H.3.1 Ramping Rates

The Clear Creek *Ramping Rates* conservation measure addresses the stranding risk stressor by minimizing the rate of flow decreases during controlled flow reduction. In Clear Creek, the *Ramping Rates* conservation measure addresses the stranding risk stressor on juveniles and yearling salmonids. Reclamation will limit down-ramping rates to 25 cfs per hour and schedule these reductions in consideration of listed species behavior (e.g., diel movement patterns) throughout the water year.

Reclamation may vary from these ramping requirements during flood control. Reclamation, through the Clear Creek Technical Team, may develop a faster or slower down ramping rate on a case-by-case basis. Down-ramping rates are limited by Whiskeytown Dam infrastructure. Flow reductions (down ramping) can potentially induce stranding of juvenile salmonids on Clear Creek. Listed species potentially affected by the *Ramping Rates* conservation measure include spring-run Chinook salmon and steelhead.

H.3.1.1 Winter-run Chinook Salmon

Adults are not present in Clear Creek; however, the Clear Creek *Ramping Rates* conservation measure may increase the water temperature stressor in the Sacramento River below the Clear Creek confluence by decreasing the storage of water in Whiskeytown Reservoir.

Eggs are not present in Clear Creek; however, the Clear Creek *Ramping Rates* conservation measure may increase the water temperature stressor in the Sacramento River below the Clear Creek confluence by decreasing the storage of water in Whiskeytown Reservoir.

Juveniles are not present and are not likely to be affected by the Clear Creek *Ramping Rates* conservation measure.

H.3.1.2 Spring-run Chinook Salmon

Adults are migrating, holding, and spawning in Clear Creek but are not likely to be affected by the Clear Creek *Ramping Rates* conservation measure.

Eggs are present but are not likely to be affected by the Clear Creek *Ramping Rates* conservation measure.

Juveniles are rearing and migrating.

- The Clear Creek *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

Yearlings are rearing and migrating.

- The Clear Creek *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

H.3.1.3 Steelhead

Adults are migrating, holding, and spawning in the Clear Creek but are not likely to be affected by the Clear Creek *Ramping Rates* conservation measure.

Kelts are present in the Clear Creek.

- The Clear Creek *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

Eggs are present in Clear Creek but are not likely to be affected by the Clear Creek *Ramping Rates* conservation measure.

Juveniles are rearing and migrating in Clear Creek.

- The Clear Creek *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

H.3.2 Clear Creek Minimum Instream Flows

The Clear Creek *Minimum Instream Flows* conservation measure addresses habitat stressors. Reclamation will release water through Whiskeytown Dam to provide intra-annual variation to emulate natural processes. Flows will oscillate over a one-year period, with releases transitioning from 300 cfs in the winter, down to 100 cfs in the summer, and back to 300 cfs by the following winter. In critical years, Reclamation will target an average 150 cfs based on available water from Trinity Reservoir and attempt to maintain above 100 cfs.

Listed species potentially affected by the Clear Creek *Minimum Instream Flows* conservation measures include spring-run Chinook salmon and steelhead.

H.3.2.1 Winter-run Chinook Salmon

Adults are not present in Clear Creek; however. the Clear Creek *Minimum Instream Flows* conservation measure may reduce Reclamation's ability to store water in Whiskeytown Reservoir which may increase the water temperature stressor in the Sacramento River below the Clear Creek confluence in the upcoming year.

Eggs are not present in Clear Creek; however, the Clear Creek *Minimum Instream Flows* conservation measure may reduce Reclamation's ability to store water in Whiskeytown Reservoir which may increase the water temperature stressor in the Sacramento River below the Clear Creek confluence in the upcoming year.

Juveniles are not present and are not likely to be affected by the Clear Creek *Minimum Instream Flows* conservation measure.

H.3.2.2 Spring-run Chinook Salmon

Adults are migrating, holding and spawning in Clear Creek.

- The Clear Creek *Minimum Instream Flows* conservation measure may reduce Reclamation's ability to store water in reservoir which may increase the water temperature stressor in the upcoming year.

Eggs are present in Clear Creek.

- The Clear Creek *Minimum Instream Flows* conservation measure may reduce Reclamation's ability to store water in Shasta Reservoir which may increase the water temperature stressor in the upcoming year.

Juveniles are rearing and migrating.

- The Clear Creek *Minimum Instream Flows* conservation measure will reduce Reclamation's ability to store water in Whiskeytown Reservoir, which may increase the water temperature stressor in the upcoming year. The Clear Creek *Minimum Instream Flows* conservation measure may also decrease the water temperature stressor when releases are increased from the reservoir to maintain minimum instream flows.
- The Clear Creek *Minimum Instream Flows* conservation measure may decrease refuge habitat and food availability stressors for juveniles by maintaining minimum instream flows.

Yearlings are rearing.

- The Clear Creek *Minimum Instream Flows* conservation measure will reduce Reclamation's ability to store water in Whiskeytown Reservoir, which may increase the water temperature stressor by decreasing the storage from the reservoir in the upcoming year. The Clear Creek *Minimum Instream Flows* conservation measure may also decrease the water temperature stressor when releases are increased from the reservoir to maintain minimum instream flows in Clear Creek.
- The Clear Creek *Minimum Instream Flows* conservation measure may decrease refuge habitat and food availability stressors for juveniles by increasing releases from the reservoir, thereby increasing flows in Clear Creek.

H.3.2.3 Steelhead

Adults are migrating, holding, and spawning in Clear Creek.

- The Clear Creek *Minimum Instream Flows* conservation measure may reduce Reclamation's ability to store water in the reservoir which may increase the water temperature stressor by decreasing the storage from the reservoir in the upcoming year.

Kelts are present in the Clear Creek.

- The Clear Creek *Minimum Instream Flows* conservation measure may reduce Reclamation's ability to store water in the reservoir which may increase the water temperature stressor by decreasing the storage from the reservoir in the upcoming year.

Eggs are present in Clear Creek.

- The Clear Creek *Minimum Instream Flows* conservation measure may reduce Reclamation's ability to store water in the reservoir which may increase the water temperature stressor by decreasing the storage from the reservoir in the upcoming year.

Juveniles are rearing and migrating.

- The Clear Creek *Minimum Instream Flows* conservation measure may reduce Reclamation's ability to store water in Whiskeytown reservoir which may increase the water temperature stressor by decreasing the storage from the reservoir in the upcoming year. The Clear Creek *Minimum Instream Flows* conservation measure may decrease the water temperature stressor when increasing releases from the reservoir increasing flows in Clear Creek.
- The Clear Creek *Minimum Instream Flows* conservation measure may decrease the refuge habitat and food availability stressors for juveniles by increasing releases from the reservoir resulting in higher flows in Clear Creek.

H.3.3 Pulse Flows

Under the Clear Creek *Pulse Flows* conservation measure, Reclamation will release up to 10,000 acre-feet from Whiskeytown Dam for channel maintenance, spring attraction flows, and to meet other physical and biological objectives. In critical years, Reclamation will release up to 5,000 acre-feet. This conservation measure will not be implemented in years with significant uncontrolled spill. Availability of water for pulse flows is tied to water year type. The determination of water year type will be based on the Sacramento Valley Index, at 90% exceedance level.

Reclamation, through Governance, will develop pulse flows schedules, which include measures (e.g., nighttime down ramping, slow down-ramping rates) to mitigate potential risks (e.g., potential juvenile fish stranding). The pulse flows are not to exceed safe outlet works capacity of Whiskeytown Dam, currently 840 cfs, and will be scheduled on or after February 1. Listed species potentially affected by the Clear Creek *Pulse Flows* conservation measure include spring-run Chinook salmon and steelhead.

H.3.3.1 Winter-run Chinook Salmon

Adults are not present in Clear Creek; however, the Clear Creek *Pulse Flows* conservation measure may increase the water temperature stressor in the Sacramento River below the Clear Creek confluence by decreasing the storage of water in Whiskeytown Reservoir.

Eggs are not present in Clear Creek; however, the Clear Creek *Pulse Flows* conservation measure may increase the water temperature stressor in the Sacramento River below the Clear Creek confluence by decreasing the storage of water in Whiskeytown Reservoir.

Juveniles are not present in Clear Creek; however, the Clear Creek *Pulse Flows* conservation measure may increase the outmigration stressor in the Sacramento River below the Clear Creek confluence by decreasing the storage of water in Whiskeytown Reservoir.

H.3.3.2 Spring-run Chinook Salmon

Adults are migrating, holding, and spawning in Clear Creek.

- The Clear Creek *Pulse Flows* conservation measure may decrease the water temperature stressor in the spring for holding adults.
- The Clear Creek *Pulse Flows* conservation measure may decrease the stranding risk stressor for adults due to increased flows.

Eggs are not present.

Juveniles are rearing and migrating.

- The Clear Creek *Pulse Flows* conservation measure may decrease the water temperature and dissolved oxygen stressors in the spring.
- The Clear Creek *Pulse Flows* conservation measure may decrease the Outmigration Cue, Refuge Habitat, and Food Availability stressor due to increased flows.

Yearlings are not present.

H.3.3.3 Steelhead

Adults are migrating, holding, and spawning in Clear Creek.

- The Clear Creek *Pulse Flows* conservation measure may decrease the Water Temperature stressor in the spring for holding adults.
- The Clear Creek *Pulse Flows* conservation may decrease the Stranding Risk stressor for adults due to increased flows.

Kelts are present in Clear Creek but are not expected to be affected by this conservation measure.

Eggs are present in the Clear Creek.

- The Clear Creek *Pulse Flows* conservation measure may decrease the water temperature stressor by increasing releases from the reservoir resulting in higher flows and lower water temperatures in Clear Creek.

Juveniles are rearing and migrating in Clear Creek.

- The Clear Creek *Pulse Flows* conservation measure may decrease the water temperature and dissolved oxygen stressors by increasing releases from the reservoir resulting in higher flows in Clear Creek.

H.3.4 Water Temperature Management

Under the Clear Creek *Water Temperature Management* conservation measure, Reclamation will target Whiskeytown Dam releases to not exceed the mean daily temperatures at Igo gage:

- 61°F from June 1 through August 15.
- 60°F from August 16 through September 15.
- 56°F from September 16 through November 15.

Water temperature management on Clear Creek is implemented through changes in guard gate configurations and flow manipulations. In dry, critical, or transfer curtailment years, Reclamation may not be able to meet these water temperatures, and will operate Whiskeytown Dam as close to these water temperatures as practical.

Additional flows may be required to meet water temperature objectives. Reclamation will determine if additional water is available for water temperature management and inform the agency representatives through the Clear Creek Technical Team. If two consecutive days of mean daily water temperature are exceeded, and Reclamation determines additional water is available, then 25 cfs per day will be added to the base flow to address water temperatures. Flow changes completed for water temperature management in the late-summer or fall, implemented at 25-cfs increments, would be maintained until the base flow of the seasonal hydrograph rises to meet the elevated water temperature release. For example, if flows were increased to 150 cfs on September 10 to decrease water temperatures, they would remain there until October 23 when the hydrograph would normally increase to 175 cfs. This operation pattern relieves the need to down ramp during spawning and potentially dewater redds. If additional flows are needed to meet water temperature in late spring or summer during a hot spell for instance, ramp-down to base flow would occur when meteorological conditions allow.

Listed species potentially affected by the Clear Creek *Water Temperature Management* conservation measure include spring-run Chinook salmon and steelhead.

H.3.4.1 Winter-run Chinook Salmon

Adults are not present in Clear Creek; however, the *Clear Creek Water Temperature Management* conservation measure may increase the water temperature stressor in the Sacramento River below the Clear Creek confluence by decreasing the storage of water in Whiskeytown Reservoir.

Eggs are not present in Clear Creek; however, the Clear Creek *Water Temperature Management* conservation measure may decrease the water temperature stressor in the Sacramento River below the Clear Creek confluence by mixing cooler waters during the summer.

Juveniles are not present in Clear Creek; however, the Clear Creek *Water Temperature Management* conservation measure may increase the outmigration stressor in the Sacramento River below the Clear Creek confluence by decreasing the storage of water in Whiskeytown Reservoir.

H.3.4.2 Spring-run Chinook Salmon

Adults are migrating, holding, and spawning in Clear Creek.

- The Clear Creek *Water Temperature Management* conservation measure may decrease the water temperature stressor for adults holding and spawning in Clear Creek by increasing releases from the reservoir.

Eggs are present in Clear Creek.

- The Clear Creek *Water Temperature Management* conservation measure may decrease the water temperature stressor for eggs by increasing the flow release from the reservoir.

Juveniles are rearing and migrating.

- The Clear Creek *Water Temperature Management* conservation measure may decrease the water temperature stressor for juveniles by increasing releases from the reservoir.

Yearlings are rearing.

- The Clear Creek *Water Temperature Management* conservation measure may decrease the water temperature stressor for yearlings by increasing releases from the reservoir.

H.3.4.3 Steelhead

Adults are migrating, holding, and spawning in Clear Creek.

- The Clear Creek *Water Temperature Management* conservation measure may decrease the water temperature stressor for adults migrating, holding, and spawning by increasing the flow release from the reservoir.

Eggs are present in Clear Creek.

- The Clear Creek *Water Temperature Management* conservation measure may decrease the water temperature stressor for eggs by increasing the flow release from the reservoir.

Juveniles are rearing and migrating in Clear Creek.

- The Clear Creek *Water Temperature Management* conservation measure may decrease the water temperature stressor for juveniles by increasing the flow release from the reservoir.

H.4 American River

H.4.1 Ramping Rates

The American River *Ramping Rates* conservation measure addresses the stranding risk stressor by minimizing the rate of flow decreases during controlled flow reduction.

Reclamation will ramp down releases in the American River below Nimbus Dam as follows in Table H-1 and at night, if possible.

Table H-1. American River Ramping Rates

Lower American River Daily Rate of Change (cfs)	Amount of Decrease in 24 Hours (cfs)	Maximum Change per Step (cfs)
20,000 to 16,000	4,000	1,350
16,000 to 13,000	3,000	1,000
13,000 to 11,000	2,000	700
11,000 to 9,500	1,500	500
9,500 to 8,300	1,200	400
8,300 to 7,300	1,000	350
7,300 to 6,400	900	300
6,400 to 5,650	750	250
5,650 to 5,000	650	250
<5,000	500	100

cfs = cubic feet per second.

Reclamation may vary from these ramping requirements during flood control. Reclamation, through the American River Group (ARG), may develop a faster down ramping rate on a case-by-case basis to implement temporary flow reductions for critical monitoring or maintenance needs.

Listed species potentially affected by the American River *Ramping Rates* conservation measure include steelhead.

H.4.1.1 Steelhead

Adults are present.

- The American River *Ramping Rates* conservation measure may increase the water temperature stressor by decreasing the storage of water due to increasing release rates that could reduce the coldwater pool. The American River *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

Kelts are present.

- The American River *Ramping Rates* conservation measure may increase the water temperature stressor by decreasing the storage of water due to increasing release rates that could reduce the coldwater pool. The American River *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

Eggs are present.

- The American River *Ramping Rates* conservation measure may increase the water temperature and dissolved oxygen stressors by decreasing the storage of water due to increasing release rates that could deplete the coldwater pool. The American River *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

Juveniles are present.

- The American River *Ramping Rates* conservation measure may increase the water temperature and dissolved oxygen stressors by decreasing the storage of water due to increasing release rates that could deplete the coldwater pool.
- The American River *Ramping Rates* conservation measure may reduce the stranding risk stressor by reducing the rate of change to inundated habitat.

H.4.2 Minimum Instream Flow

Under the American River *Minimum Instream Flows* conservation measure, Reclamation proposes to adopt the American River Minimum Flow Schedule (ARMFS). The ARMFS is based on the Modified Flow Management Standard developed by the Water Forum in 2017, with additional modifications as described below. The ARMFS includes Minimum Release Requirements (MRRs) ranging from 500 to 2,000 cfs based on time of year and annual hydrology. The flow schedule is intended to provide suitable habitat conditions for steelhead and fall-run Chinook salmon. The Sacramento River Index (90% exceedance forecast) will be used to develop the MRR in January. The American River Index (90% exceedance forecast, with certain spills subtracted) will be used to calculate the MRR in February through December. All MRR calculations will be based on the hydrologic indices reported in the first Bulletin 120 of each month. Reclamation will continue to work with the ARG to coordinate the shaping of upcoming releases within operational constraints.

Listed species potentially affected by the American River *Minimum Instream Flows* conservation measure include steelhead.

H.4.2.1 Steelhead

Adults are present in the lower American River.

- The American River *Minimum Instream Flows* conservation measure will reduce Reclamation's ability to store water which may increase the Water Temperature stressor by decreasing the storage from the Folsom Reservoir in the upcoming year. The American River *Minimum Instream Flows* conservation measure may also decrease the Water Temperature stressor when flows are increased from the Folsom Reservoir to maintain minimum instream flows thereby increasing flows in the American River.
- The American River *Minimum Instream Flows* conservation measure may decrease the spawning habitat stressor by increasing spawning success due to available spawning habitat through suitable flows.

Kelts are present in the lower American River.

- The American River *Minimum Instream Flows* conservation measure will reduce Reclamation's ability to store water which may increase the Water Temperature stressor by decreasing the storage from the Folsom Reservoir in the upcoming year. The American River *Minimum Instream Flows* conservation measure may also decrease the Water Temperature stressor when flows are increased from the Folsom Reservoir to maintain minimum instream flows thereby increasing flows in the American River.

Eggs are present in the lower American River.

- The American River *Minimum Instream Flows* conservation measure may increase water temperature stressor by decreasing the storage of water due to minimum instream flows that could reduce the coldwater pool.

Juveniles are present in the lower American River.

- The American River *Minimum Instream Flows* conservation measure will reduce Reclamation's ability to store water which may increase the water temperature and dissolved oxygen stressors by decreasing the storage from the in the upcoming year. The American River *Minimum Instream Flows* conservation measure may also decrease the water temperature and dissolved oxygen stressors when flows are increased from the Folsom Reservoir to maintain minimum instream flows thereby increasing flows in the American River.
- The American River *Minimum Instream Flows* conservation measure may decrease the refuge habitat stressor due to an increased access to additional refuge habitat connectivity resulting from instream flows provided through releases from Folsom Reservoir storage.
- The American River *Minimum Instream Flows* conservation measure may decrease the stranding and dewatering stressor by maintaining the MRR flows.
- The American River *Minimum Instream Flows* conservation measure may decrease the outmigration cue and food availability stressor by maintaining flows and sustaining cues to migrate and outmigration travel rates.

H.4.3 Spring Pulse Flow

Under the American River *Spring Pulse Flow* conservation measure, Reclamation will implement a spring pulse in years that the MRR for March (based on the March forecast) is between 1,000 cfs and 1,500 cfs, as described in the ARMFS. The peak flow of the pulse flow would be three times the March MRR, even if implemented in April or May, but no higher than 4,000 cfs and lasting two days. Following two days at the peak flow, Nimbus Reservoir releases would be decreased at no more than 500 cfs per day and no more than 100 cfs per hour. Changes in Nimbus Reservoir releases would occur at night, if possible. The ARG will provide technical input on shaping Spring Pulse Flow volumes, with the final timing determined by CDFW, USFWS, and NMFS.

Reclamation, through the ARG, will develop a pulse flow schedule. In addition, Reclamation, through the ARG, may facilitate an additional spring pulse flow event if water is made available from non-CVP sources, or if there is flexibility to shape planned releases in a more variable schedule.

Listed species potentially affected by the American River *Spring Pulse Flow* conservation measure include steelhead.

H.4.3.1 Steelhead

Adults are present in the American River.

- The American River *Spring Pulse Flow* conservation measure is anticipated to reduce Reclamation's storage of water in Folsom Reservoir and may increase the water temperature stressor later in the water year due to releasing additional water that would otherwise be available.

Kelts are present in the American River.

- The American River *Spring Pulse Flow* conservation measure is anticipated to reduce Reclamation's storage of water in Folsom Reservoir and may increase the water temperature stressor later in the water year due to releasing additional water that would otherwise be available.

Eggs are present in the American River but are not expected to be affected by this conservation measure due to sufficient cold water during the spring.

- The American River *Spring Pulse Flow* conservation measure is anticipated to reduce Reclamation's storage of water in Folsom Reservoir and may increase water temperatures in the upcoming year.
- Flow reductions post pulse flow may increase the redd dewatering stressor if steelhead spawn during the pulse flow in late winter and early spring. Eggs are generally incubating between late December and May.

Juveniles are rearing to outmigration in the American River.

- The American River *Spring Pulse Flow* conservation measure may decrease the outmigration cue stressors by increasing the volume of flow release from the Folsom Reservoir.

H.4.4 Redd Dewatering Protective Adjustment

Under the *Redd Dewatering Protective Adjustment (RDPA)* conservation measure, as described in ARMFS, adjusts the MRR to account for hydrology and potential dewatering impacts to fall-run Chinook salmon redds in January and February and steelhead redds in February through May based on the MRR. RDPAs based on the MRR are not protective when actual flows in-river are above the MRR. Releases can be above the MRR in the winter due to contractual obligations, Delta water quality requirements, and precipitation events. The RDPAs are not based or applied to actual flows in the lower American River. The ARG will provide technical input on shaping the RDPAs.

In January, the MRR can only decrease and cannot be less than 70% of the December MRR. In February, the MRR cannot be less than 70% of the December MRR. Based on the January MRR, Table H-2 shows the minimum flow for steelhead redds through May. If the February MRR is higher than January, the February MRR is used through May.

Table H-2. Steelhead Redd Dewatering Protective Adjustment-based Minimum Release Requirement for February through May

January or February MRR (cfs)	Steelhead Redd MRR through May (cfs)
≤700	500
800	520
900	580
1,000	640
1,100	710
1,200	780
1,300	840
1,400	950
1,500	1,030
1,600	1,100
1,700	1,180
1,800 [a]	1,250

cfs= cubic feet per second; MMR = Minimum Release Requirement.
[a] The maximum MRR in January through May is 1,750 cfs, but 1,800 cfs is included in the table as a maximum value.

In February, the American River Index-based and fall-run Chinook salmon RDPA-based MRRs for February are compared to the steelhead RDPA-based MRR in Table H-2, using the controlling MRR in January as a basis. The highest of the three MRRs controls operations.

For March through May, the American River Index-based MRR for the month is compared to the steelhead RDPA-based MRR in Table H-2, using the highest of the controlling MRRs in January or February as a basis. The highest of the two MRRs controls operations.

Listed species potentially affected by the American River *RDPA* conservation measure include steelhead.

H.4.4.1 Steelhead

Adults are present in the American River but are not expected to be affected by this conservation measure.

Kelts are present in the American River but are not expected to be affected by this conservation measure.

Eggs are present in the American River.

- The *RDPA* conservation measure may decrease the stranding and dewatering stressor resulting from the MRR by softening changes in the MRR that may result in dewatering of steelhead redds.

Juveniles are present in the American River but are not expected to be affected by this conservation measure.

H.4.5 Folsom Reservoir Flow and Temperature Management

Under the *Folsom Reservoir Flow and Temperature Management* conservation measure Reclamation will implement the Automated Temperature Selection Procedure, which was developed in consultation with representatives of state and federal agencies and prioritizes water temperatures during the summer to support steelhead rearing over water temperatures in the fall to support fall-run Chinook salmon spawning. Folsom Reservoir flow and water temperature management address the tradeoffs for minimum releases and the use of the available coldwater pool for water supply and steelhead and fall-run Chinook salmon in the American River.

Reclamation would manage the Folsom/Nimbus Dam complex and the water temperature control shutters at Folsom Dam to maintain a daily average water temperature of 65°F (or other water temperature as determined by the temperature modeling) or lower at Watt Avenue Bridge from May 15 through October 31, to provide suitable conditions for juvenile steelhead rearing in the lower American River, if cold water is available.

Listed species potentially affected by the Folsom Reservoir Flow and Temperature Management include steelhead.

H.4.5.1 Steelhead

Adults are not present in the American River.

Kelts are not present in the American River.

Eggs are present in the American River.

- The *Folsom Reservoir Flow and Temperature Management* conservation measure may decrease the water temperature stressor by targeting lower water temperatures.

Juveniles are present in the American River.

- The *Folsom Reservoir Flow and Temperature Management* conservation measure may decrease the water temperature stressor by targeting lower water temperatures, though it may increase water temperatures in the upcoming months due to release of cold water.

H.5 Delta

H.5.1 Delta Cross Channel Gates Closures

The *Delta Cross Channel (DCC) Gates Closures* conservation measure addresses the outmigration cues and entrainment risk stressor for Chinook salmon and steelhead by protecting out-migrating salmonids from entering the interior Delta. Reclamation closes the DCC during the late fall, winter, and spring to reduce straying of Mokelumne River fall-run Chinook salmon, protect out-migrating salmonids from entering the interior Delta, facilitate the State Water Resources Control Board (Water Board) D-1641 Rio Vista flow objectives for fish passage, and reduce potential scouring and flooding that might occur in the channels on the downstream side of the gates when Sacramento River flows exceed 20,000 cfs on a sustained basis. DCC closure will continue to occur as follows:

- From October 1 through November 30, Reclamation proposes to close the DCC gates in addition to the requirements in D-1641 to further reduce juvenile salmonid entrainment risk based on the Knights Landing Catch Index and Sacramento Catch Index.
- From October 1 through November 30, Reclamation proposes to close the DCC gates, in addition to the requirements in D-1641, to enhance adult fall-run Chinook salmon passage into the Mokelumne River. If the East Bay Municipal Utility District releases Lower Mokelumne River attraction flows, water quality modeling shows concern level criteria are not likely to be exceeded for at least 14 days following the action, and there is no observed deterioration of interior Delta water quality, then Reclamation would close the DCC gates as soon as practicable (generally within 48 hours) for up to five days.
- From December 1 to January 31, Reclamation proposes to close the DCC gates, except to avoid exceeding a D-1641 water quality criterion within the next 14 days based on water quality modeling (rather than increase releases and reduce reservoir storage further). Reclamation and the California Department of Water Resources (DWR) will prepare an assessment to evaluate opening the DCC gates for up to five days for up to two events within this period to avoid D-1641 water quality criteria exceedance.
- From February 1 to May 20, Reclamation will keep the DCC Gates closed. Water Board D-1641 requires the DCC Gates be closed.
- From May 21 to June 15, Reclamation will close the DCC Gates for a total of 14 days.
- From June 16 to September 30, Reclamation proposes to open the DCC gate.

Listed species potentially impacted by the *DCC Gates Closures* conservation measure include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.5.1.1 Winter-run Chinook Salmon

Adults are migrating in the Delta.

- The *DCC Gates Closures* conservation measure may decrease the entrainment risk stressor by potentially preventing adults from being diverted into the interior Delta.

Eggs are not present in the Delta.

Juveniles are rearing and migrating.

- The *DCC Gates Closures* conservation measure may decrease the entrainment risk stressor by potentially preventing juveniles from being diverted into the interior Delta.

H.5.1.2 Spring-run Chinook Salmon

Adults are migrating in the Delta.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing adults from being diverted into the interior Delta.

Eggs are not present in the Delta.

Juveniles are rearing and migrating.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing juveniles from being diverted into the interior Delta.

Yearlings are migrating.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing yearlings from being diverted into the interior Delta.

H.5.1.3 Steelhead

Adults are migrating in the Delta.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing adults from being diverted into the interior Delta.

Eggs are not present in the Delta.

Juveniles are rearing and migrating.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing juveniles from being diverted into the interior Delta.

H.5.1.4 Green Sturgeon

Adults are present in the Delta but are not expected to be affected by this conservation measure.

Larvae are not present in the Delta.

Eggs are not present in the Delta.

Juveniles are rearing in the Delta.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing juvenile green sturgeon from being diverted into the interior Delta.

H.5.1.5 Delta Smelt

Adults are present.

- The *DCC Gates Closure* conservation measure may decrease the Entrainment Risk stressor by potentially preventing Delta smelt adults from being diverted into the interior Delta.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt larvae from being diverted into the interior Delta.

Juveniles are present.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt juveniles from being diverted into the interior Delta.

H.5.1.6 Longfin Smelt

Adults are present.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt adults from being diverted into the interior Delta.

Eggs are present, and **larvae** are present.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt larvae from being diverted into the interior Delta. Eggs are not susceptible to entrainment.

Juveniles are present.

- The *DCC Gates Closure* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt juveniles from being diverted into the interior of the Delta.

H.5.2 Barker Slough Pumping Plant Export Restriction

Listed species potentially impacted by the *Barker Slough Pumping Plant (BSPP) Export Restriction* conservation measure include Delta smelt and longfin smelt.

H.5.2.1 Delta Smelt

Under the *BSPP Export Restriction* conservation measure. DWR proposes to operate the BSPP to protect larval Delta smelt from March 1 to June 30 of dry and critical water years. If the water year type changes after March 1 to below normal, above normal, or wet, this action will be no

longer in effect. If the water year type changes after March 1 to dry or critical, DWR proposes to operate according to this measure.

DWR, at its sole expense, from March 1 to April 30 of dry and critical water years, if catch of larval Delta smelt (length less than 25 mm) in 20-mm Survey at station 718 exceeds 14% of the total catch of larval Delta smelt across the North Delta (20-mm Survey stations 716, 718, 719, 720, 723, 724, and 726), then DWR proposes to operate to a maximum seven-day average diversion rate at BSPP less than 60 cfs.

DWR, at its sole expense, from May 1 to June 30 of dry and critical water years, if catch of larval Delta smelt (length less than 25 mm) in 20-mm Survey at station 716 exceeds 5% of the total catch of larval Delta smelt across the North Delta (20-mm Survey stations 716, 718, 719, 720, 723, 724, and 726), then DWR proposes to operate to a maximum seven-day average diversion rate at BSPP less than 100 cfs.

Adults are present.

- The *BSPP Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt adults from being entrained at the export facility.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *BSPP Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt larvae from being diverted at the export facility.

Juveniles are present.

- The *BSPP Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt juveniles from being diverted at the export facility.

H.5.2.2 Longfin Smelt

DWR proposes to operate the BSPP to protect larval longfin smelt from January 1 to March 31 of dry and critical water years. If the water year type changes after January 1 to below normal, above normal, or wet, this action will be no longer in effect. If the water year type changes after January 1 to dry or critical, DWR proposes to operate according to this measure.

From January 1 to March 31 of dry and critical water years, DWR proposes to operate to a maximum seven-day average diversion rate at BSPP less than 100 cfs.

Adults are present.

- The *BSPP Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt adults from being entrained at the export facility.

Eggs are present, but not expected to be affected by this conservation measure.

Larvae are present.

- The *BSPP Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt larvae from being diverted at the export facility.

Juveniles are present.

- The *BSPP Export Restriction* conservation measure may decrease the Entrainment Risk stressor by potentially preventing longfin smelt juveniles from being diverted at the export facility.

H.5.3 Tracy Fish Collection Facility and John E. Skinner Delta Fish Protective Facility Export Restriction

Reclamation operates the Tracy Fish Collection Facility (TFCF) and DWR operates the John E. Skinner Delta Fish Protective Facility (Skinner Fish Facility) 24 hours per day, 365 days per year to address entrainment of species before export facilities. Salvage of fish at the TFCF occurs 24 hours per day, 365 days per year. Fish are salvaged in flow-through holding tanks, monitored by a 30-minute fish count every 120 minutes, and transported by truck to release sites near the confluence of the Sacramento and San Joaquin rivers. Larval smelt sampling commences upon detection of a spent female at TFCF or Skinner Fish Facility or when a temperature trigger of 53.6°F (12 degrees Celsius [°C]) at nearby California Data Exchange Center stations is met. Salvage and operations data necessary to calculate loss are made available daily by 10 a.m.

Under the *TFCF and Skinner Fish Facility Export Restriction* conservation measure, Reclamation will operate the TFCF to screen fish from Jones Pumping Plant. The primary channel is a behavioral barrier with effectiveness that depends on the pumping Jones Pumping Plant. The secondary channel is a positive fish barrier. When south Delta hydraulic conditions allow and conditions are within the original design criteria for the TFCF, the secondary channel is operated to achieve water approach velocities for striped bass of approximately 1 to 2.5 feet per second from June 1 through October 31 and for salmon of approximately 3 feet per second from November 1 through May 31.

Under the *TFCF and Skinner Fish Facility Export Restriction* conservation measure, DWR will operate the Skinner Fish Facility to screen fish from the Harvey O. Banks Pumping Plant. To seek additional improvements to the Skinner Fish Facility; DWR proposes to develop the Alternative Loss Pilot Study Implementation Plan (ALPS-IP) and implement the resulting pilot study, which would include consideration of additional salvage facility loss parameterization and study or further procedural modifications if identified and prioritized through the ALPS-IP Structured Decision Making results and would result in demonstrated improvements to the accuracy and reliability of data and fish survival.

Listed species potentially impacted by the *TFCF and Skinner Fish Facility Export Restriction* conservation measure include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.5.3.1 Winter-run Chinook Salmon

Adults are present from the winter through the summer in the Delta.

- The *TFCF and Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing adult winter-run Chinook salmon from being entrained at the export facility.

Eggs are not present in the Delta.

Juveniles are present from the fall to the spring in the Delta.

- The *TFCF and Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing juvenile winter-run Chinook salmon from being entrained at the export facility.

H.5.3.2 Spring-run Chinook Salmon

Adults are migrating in the Delta.

- The *TFCF and Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing adult winter-run Chinook salmon from being entrained at the export facility.

Eggs are not present in the Delta.

Juveniles are rearing and migrating.

- The *TFCF and Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing juveniles from being entrained at the export facility.

Yearlings are migrating.

- The *TFCF and Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing yearlings from being entrained at the export facility.

H.5.3.3 Steelhead

Adults are migrating in the Delta.

- The *TFCF and Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing migrating adults from being entrained at the export facility.

Eggs are not present in the Delta.

Juveniles are rearing and migrating in the Delta.

- The *TFCF and Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing juvenile steelhead from being entrained at the export facility.

H.5.3.4 Green Sturgeon

Adults are present in the Delta but are not expected to be affected by this conservation measure.

Larvae are not present in the Delta.

Eggs are not present in the Delta.

Juveniles are rearing in the Delta.

- The *TFCF and Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing juvenile green sturgeon from being entrained at the export facility.

H.5.3.5 Delta Smelt

Adults are present.

- The *TFCF and the Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt adults from being entrained at the export facility.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *TFCF and Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt larvae from being entrained at the export facility.

Juveniles are present.

- The *TFCF and Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt juveniles from being entrained at the export facility.

H.5.3.6 Longfin Smelt

Adults are present.

- The *TFCF and the Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt adults from being entrained at the export facility.

Eggs are present, and **larvae** are present.

- The *TFCF and the Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt adults from being entrained at the export facility. Longfin smelt eggs are not susceptible to entrainment.

Juveniles are present.

- The *TFCF and the Skinner Fish Facility Export Restriction* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt juveniles from being entrained at the export facility.

H.5.4 Old and Middle River Flow Management Start

Under the *Old and Middle River (OMR) Flow Management* conservation measure, Reclamation will reduce exports to achieve a 7-day average OMR value no more negative than -5,000 cfs for seven consecutive days when the genetically verified 7-day rolling sum of winter-run early season migration and spring-run Chinook salmon loss, calculated daily, exceeds the following annually calculated thresholds:

- From November 1–November 30: 0.0044% (e.g., water year 2023) of the Red Bluff juvenile winter-run Chinook salmon Brood Year Total at the end of the second biweekly period in October
- From December 1–December 31: 0.0084% (e.g., water year 2023) of the Red Bluff juvenile winter-run Chinook salmon Brood Year Total at the end of the second biweekly period in November

If the 7-day rolling sum of winter-run and spring-run Chinook salmon loss, calculated daily, is exceeded during a period of reduced exports, DWR and Reclamation will continue to reduce exports to achieve a 7-day average OMR value no more negative than -5,000 cfs until 7 days after the most recent exceedance.

Reclamation and DWR will restrict exports in response of meeting the threshold above based on initial length-at-date identification of natural older juvenile Chinook salmon.

The OMR management season starts any time after December 1 if an Adult Longfin Smelt Entrainment Protection Action, if appropriate, or First Flush Action occurs (i.e., immediately following completion of the First Flush Action) or any time after December 20 if the turbidity threshold in the Adult Delta Smelt Entrainment Protection Action is reached. If neither the Adult Longfin Smelt Entrainment Protection Action or First Flush Action occurs or the Adult Delta Smelt Entrainment Protection Action is reached, the OMR management season starts automatically on January 1. Once initiated, the OMR index on a 14-day running average will be no more negative than -5,000 cfs until the end of the OMR management season. A reduction in exports to achieve a new OMR index will occur within three days of an action that requires a change in OMR.

Listed species potentially impacted by the *OMR Flow Management Start* conservation measure include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.5.4.1 Winter-run Chinook Salmon

Adults are present from the winter through the summer in the Delta.

- The *OMR Flow Management Start* conservation measure may decrease the entrainment risk stressor by potentially preventing adults from being entrained at the export facility.

Eggs are not present in the Delta.

Juveniles are present from the fall to the spring in the Delta.

- The *OMR Flow Management Start* conservation measure may decrease the entrainment risk stressor by potentially preventing juveniles from being entrained at the export facility.

H.5.4.2 Spring-run Chinook Salmon

Adults are migrating in the Delta.

- The *OMR Flow Management Start* conservation measure may decrease the entrainment risk stressor by potentially preventing adults from being entrained at the export facility.

Eggs are not present in the Delta.

Juveniles are rearing and migrating.

- The *OMR Flow Management Start* conservation measure may decrease the Entrainment Risk stressor by potentially preventing juveniles from being entrained at the export facility.

Yearlings are migrating.

- The *OMR Flow Management Start* conservation may decrease the entrainment risk stressor by potentially preventing yearlings from being entrained at the export facility.

H.5.4.3 Steelhead

Adults are migrating in the Delta.

- The *OMR Flow Management Start* conservation measure may decrease the entrainment risk stressor by potentially preventing migrating adults from being entrained at the export facility.

Eggs are not present in the Delta.

Juveniles are rearing and migrating in the Delta.

- The *OMR Flow Management Start* conservation measure may decrease the entrainment risk stressor by potentially preventing juveniles from being entrained at the export facility.

H.5.4.4 Green Sturgeon

Adults are present in the Delta but are not expected to be affected by this conservation measure.

Larvae are not present in the Delta.

Eggs are not present in the Delta.

Juveniles are rearing in the Delta.

- The *OMR Flow Management Start* conservation measure may decrease the entrainment risk stressor by potentially preventing juvenile green sturgeon from being entrained at the export facility.

H.5.4.5 Delta Smelt

Adults are present.

- The *OMR Flow Management Start* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt adults from being entrained at the export facility.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *OMR Flow Management Start* conservation measure may decrease the Entrainment Risk stressor by potentially preventing Delta smelt larvae from being entrained at the export facility. Eggs are not at risk of being entrained.

Juveniles are present.

- The *OMR Flow Management Start* conservation measure may decrease the Entrainment Risk stressor by potentially preventing Delta smelt juveniles from being entrained at the export facility.

H.5.4.6 Longfin Smelt

Adults are present.

- The *OMR Flow Management Start* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt adults from being entrained at the export facility.

Eggs are present but not expected to be affected by this action.

Larvae are present.

- The *OMR Flow Management Start* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt larvae from being entrained at the export facility.

Juveniles are present.

- The *OMR Flow Management Start* conservation measure may decrease the Entrainment Risk stressor by potentially preventing longfin smelt juveniles from being entrained at the export facility.

H.5.5 Old and Middle River Management Real-Time Operation

Under the *OMR Management Real-Time Operation* conservation measure, Reclamation and DWR will manage diversion rates from the South of Delta modified based on abiotic and biotic factors for several listed species. To see the full list of real time operations of OMR management look at the OMR section in the Proposed Action.

Listed species potentially impacted by the *OMR Management Real-Time Operation* conservation measure include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.5.5.1 Winter-run Chinook salmon

Adults are present from the winter through the summer in the Delta.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing adults from being entrained at the export facility.

Eggs are not present in the Delta.

Juveniles are present from fall to spring in the Delta.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing juveniles from being entrained at the export facility.

H.5.5.2 Spring-run Chinook salmon

Adults are present in the winter and summer in the Delta.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing steelhead adults from being entrained at the export facility.

Eggs are not present in the Delta.

Juveniles are present in spring and fall in the Delta.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing juveniles from being entrained at the export facility.

Yearlings are present in spring and fall in the Delta.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing yearlings from being entrained at the export facility.

H.5.5.3 Steelhead

Adults are migrating in the Delta.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing migrating adults from being entrained at the export facility.

Eggs are not present in the Delta.

Juveniles are present in spring and fall in the Delta.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing steelhead juveniles from being entrained at the export facility.

H.5.5.4 Green Sturgeon

Adults are present in the Delta but are not expected to be affected by this conservation measure.

Larvae are not present in the Delta.

Eggs are not present in the Delta.

Juveniles are rearing in the Delta.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing juvenile green sturgeon from being entrained at the export facility.

H.5.5.5 Delta Smelt

Adults are present.

- The *OMR Management Real-Time Operation* conservation measure may decrease the Entrainment Risk stressor by potentially preventing Delta smelt adults from being entrained at the export facility.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt larvae from being entrained at the export facility.

Juveniles are present.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing Delta smelt juveniles from being entrained at the export facility.

H.5.5.6 Longfin Smelt

Adults are present.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt adults from being entrained at the export facility.

Eggs are present, but not expected to be affected by this conservation measure.

L**arvae** are present.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt larvae from being entrained at the export facility.

Juveniles are present.

- The *OMR Management Real-Time Operation* conservation measure may decrease the entrainment risk stressor by potentially preventing longfin smelt juveniles from being entrained at the export facility.

H.5.6 Summer and Fall Delta Outflow and Habitat

The *Summer and Fall Delta Outflow and Habitat* conservation measure is comprised of two components the Fall X2 action and the operation of the Suisun Marsh Salinity Control Gates (SMSCG). Under the *Summer and Fall Delta Outflow and Habitat* conservation measure, Reclamation and DWR will maintain a 30-day average X2 ≤ 80 km for September through November in wet and above normal years. In addition, DWR will operate the SMSCG for 60 days using a 7 day tidal 7 day open operation (7-7) schedule to maximize the number of days that Belden's Landing three-day average salinity is equal to, or less than, 4 psu in Suisun Marsh and Grizzly Bay from June through October during above normal, below normal years, and dry years following wet or above normal years, Operation of the SMSCG will end by December 1. In dry years following below normal years, DWR will operate SMSCG for 30 days using 7-7 operation to maximize the number of days Belden's Landing three-day salinity is equal to, or less than 6 psu. DWR and Reclamation, through the Delta Coordination Group, may prepare an assessment to propose an alternative gate operation if modeling of hydrological and/or existing D-1641 conditions indicate the action can achieve the same habitat benefits in an equal or better manner within the range of effects analyzed. Reclamation and DWR, through the Delta Coordination Group, will develop an annual monitoring plan that responds to uncertainties in the performance metrics to evaluate action performance. DWR and Reclamation will also produce an annual report that summarizes monitoring findings and assesses action performance.

Listed species potentially impacted by the *Summer and Fall Delta Outflow and Habitat* conservation measure include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.5.6.1 Winter-run Chinook Salmon

Adults are not present.

Eggs are not present in the Delta.

Juveniles are present from the fall to the spring in the Delta.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the entrainment risk stressor by increasing flows in the Delta and, thus, benefitting the migratory transport of juveniles to the estuary and potentially preventing entrainment at the export facility.

H.5.6.2 Spring-run Chinook Salmon

Adults are present in the Delta but are not expected to be affected by this conservation measure.

Eggs are not present in the Delta.

Juveniles are present in the Delta.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the entrainment risk stressor by increasing flows in the Delta and thus benefitting the migratory transport of juveniles to the estuary and potentially preventing entrainment at the export facility. The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the outmigration cue and food availability stressors by increasing flow through the Delta.

Yearlings are present in the Delta.

H.5.6.3 Steelhead

Adults are present in the Delta but are not expected to be affected by this conservation measure.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the entrainment risk stressor by increasing flows in the Delta and thus benefitting the migratory transport of adults to the estuary and potentially preventing entrainment at the export facility.

Eggs are not present in the Delta.

Juveniles are rearing and migrating in the Delta.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the entrainment risk stressor by increasing flows in the Delta and thus benefitting the migratory transport of juveniles to the estuary and potentially preventing entrainment at the export facility.

H.5.6.4 Green Sturgeon

Adults are present in the Delta but are not expected to be affected by this conservation measure.

Larvae are not present in the Delta.

Eggs are not present in the Delta.

Juveniles are rearing in the Delta.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the entrainment risk stressor by increasing flows in the Delta and thus benefitting the migratory transport of juveniles to the estuary and potentially preventing entrainment at the export facility.

H.5.6.5 Delta Smelt

Adults are present.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the Food Availability stressor by increasing the Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the food availability stressor by increasing the Delta inflow.

Juveniles are present.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the food availability stressor by increasing the Delta inflow, and may decrease the size and location of the low-salinity zone stressor by decreasing the salinity in the Suisun Bay and the Suisun Marsh.

H.5.6.6 Longfin Smelt

Adults are present.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the food availability stressor by increasing the Delta inflow, and may decrease the freshwater flow stressor by decreasing the salinity in the Suisun Bay and the Suisun Marsh.

Eggs are present, but are not expected to be affected by this conservation measure.

Larvae are present.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the food availability stressor by increasing the Delta inflow, and may decrease the freshwater flow stressor by decreasing the salinity in the Suisun Bay and the Suisun Marsh.

Juveniles are present.

- The *Summer and Fall Delta Outflow and Habitat* conservation measure may decrease the food availability stressor by increasing the Delta inflow, and may decrease the freshwater flow stressor by decreasing the salinity in the Suisun Bay and the Suisun Marsh.

H.5.7 Spring Delta Outflow

Under the *Spring Delta Outflow* conservation measure, Reclamation and DWR will take actions intended to supplement Delta outflow per the terms of the VAs approved by the Water Board and executed agreements by VA Parties. Actions that will support the additional Delta outflow include the following: (1) Reclamation and DWR south of Delta export modifications; (2) Reclamation reoperating upstream reservoirs to advance and allow for scheduling of water made available by contractors in CVP watersheds; and (3) passing Delta inflow from water made available by VA Parties.

- **Early Implementation of VAs:** Reclamation and DWR, after coordination through the Water Operations Management Team, will provide the SWP and CVP Foregone Exports, along with other VA Parties taking actions similar to those contemplated by the VAs only if (i) Reclamation issues a Record of Decision for the coordinated operation of the CVP and SWP that are the subject of the consultation, and (ii) the Water Board has not updated the Water Quality Control Plan (WQCP). These early implementation actions are intended to develop data that could assist decisions whether to implement the VAs or decisions how to implement the VAs. Delta outflow from DWR and Reclamation actions described above would be in March through May and prioritized during the period of April 1 through May 31 [*]. These early implementation actions will continue until the Water Board updates the WQCP or for two years, whichever occurs first.
- **After the early implementation period:**
    - Reclamation and DWR will operate consistent with the VAs only if: (1) the Water Board incorporates the VAs, as proposed by the VA parties, into the WQCP; and (2) the VA parties execute the agreements contemplated by the VAs, or
    - Reclamation and DWR will operate as described by the Proposed Action but without any of the actions contemplated for "early implementation" or the VAs if: (1) the Water Board does not incorporate the VAs, as proposed by the VA parties, into the WQCP; or (i2) the VA parties do not execute the agreements contemplated by the VAs.

Listed species potentially impacted by the *Spring Delta Outflow* conservation measure include winter-run Chinook salmon, spring-run Chinook salmon, steelhead, green sturgeon, Delta smelt and longfin smelt.

H.5.7.1 Winter-run Chinook Salmon

Adults are present.

- The *Spring Delta Outflow* conservation measure may decrease the water temperature stressor by increasing flow in the migratory corridor from the Delta to the Sacramento River.

Eggs are not present in the Delta.

Juveniles are present from the fall to the spring in the Delta.

- The *Spring Delta Outflow* conservation measure may decrease the entrainment risk stressor by increasing migratory transport of juveniles to the estuary, potentially preventing entrainment at the export facility.

H.5.7.2 Spring-run Chinook Salmon

Adults are migrating in the Delta.

- The *Spring Delta Outflow* conservation measure may decrease the water temperature stressor by increasing flow in the migratory corridor from the Delta to the Sacramento River. The water temperature stressor may also increase the following year due to higher release requirements that could deplete the coldwater pool.

Eggs are not present in the Delta.

Juveniles are rearing and migrating.

- The *Spring Delta Outflow* conservation measure may decrease the entrainment risk stressor by increasing migratory transport of juveniles to the estuary, potentially preventing entrainment at the export facility.
- The *Summer Delta Outflow* conservation measure may decrease the outmigration cue and food availability stressors by increased flow through the Delta.

Yearlings are migrating.

- The *Spring Delta Outflow* conservation measure may decrease the entrainment risk stressor by increasing migratory transport of yearlings to the estuary, potentially preventing entrainment at the export facility.
- The *Summer and Fall Delta Outflow* conservation measure may decrease the outmigration cue and food availability stressors by increased flow through the Delta.

H.5.7.3 Steelhead

Adults are present in the Delta but are not expected to be affected by this conservation measure.

Eggs are not present in the Delta.

Juveniles are rearing and migrating in the Delta.

- The *Spring Delta Outflow* conservation measure may decrease the entrainment risk stressor by increasing migratory transport of juvenile steelhead to the estuary, potentially preventing entrainment at the export facility.

H.5.7.4 Green Sturgeon

Adults are present in the Delta, but are not expected to be affected by this conservation measure.

Larvae are not present in the Delta.

Eggs are not present in the Delta.

Juveniles are rearing in the Delta.

- The *Spring Delta Outflow* conservation measure may decrease the entrainment risk stressor by increasing migratory transport of juvenile green sturgeon to the estuary, potentially preventing entrainment at the export facility.

H.5.7.5 Delta Smelt

Adults are present.

- The *Spring Delta Outflow* conservation measure may decrease the food Availability stressor by increasing Delta inflow.

Eggs are present but are not expected to be affected by this conservation measure.

Larvae are present in the Delta.

- The *Spring Delta Outflow* conservation measure may decrease the Food Availability stressor by increasing Delta inflow.

Juveniles are present.

- The *Spring Delta Outflow* conservation measure may decrease the Food Availability and the size and location of the low-salinity zone stressor by increasing Delta inflow.

H.5.7.6 Longfin Smelt

Adults are present.

- The *Spring Delta Outflow* conservation measure may decrease the food availability and the freshwater flow stressor by increasing Delta inflow.

Eggs and **larvae** are present.

- The *Spring Delta Outflow* conservation measure may decrease the food availability and the freshwater flow stressor by increasing the Delta inflow.

Juveniles are present.

- The S*pring Delta Outflow* conservation measure may decrease the food availability and the freshwater flow stressor by increasing the Delta inflow.

H.5.8 Delta Smelt Supplementation

Under the *Delta Smelt Supplementation* conservation measure, Reclamation and DWR, through the Culture and Supplementation of Smelt Steering Committee, will continue to collaborate with USFWS and CDFW on the development of a program to conduct supplementation of the wild Delta smelt population with propagated fish consistent with USFWS' Supplementation Strategy (U.S. Fish and Wildlife Service 2020).

This conservation measure does not directly address any of the relevant stressors for Delta smelt as identified in the MAST report and stressor. However, this conservation measure is included as it is thought to be generally beneficial to the species due to the increased releases of Delta smelt into the Delta.

H.6 Stanislaus River

H.6.1 Ramping Rates

The Stanislaus River *Ramping Rates* conservation measure addresses the stranding risk stressor by minimizing the rate of flow decreases during controlled flow reduction. Reclamation will coordinate releases on the Stanislaus River as shown in Table H-3.

Table H-3. Goodwin Dam Ramping Rates

Goodwin Release Range (cfs)	Standard Rate of Increase (cfs per 2 hours)	Standard Rate of Decrease (cfs per 2 hours)	C and D WYT Rate of Increase (cfs per 2 hours)	C and D WYT Rate of Decrease (cfs per 2 hours)
At or above 4,500	250	250	250	250
2,000 to 4,499	500	250	500	250
500 to 1,999	250	100	500	200
300 to 499	100	50	200	100

cfs = cubic feet per second; C = critical; D = dry; WYT = water year type.

Reclamation, through the Stanislaus Watershed Team (SWT), may develop a faster down-ramping rate on a case-by-case basis to implement temporary flow reductions for critical monitoring or maintenance needs.

Consideration for ramping rates that promote recruitment of native riparian vegetation on floodplain surfaces should be implemented when instream flow budgets are sufficient.

Listed species potentially impacted by the Stanislaus River *Ramping Rates* conservation measure include steelhead.

H.6.1.1 Steelhead

Adults are migrating, spawning, and holding in the Stanislaus River.

- The Stanislaus River *Ramping Rates* conservation measure may increase the water temperature stressor by decreasing storage in New Melones Reservoir.
- The Stanislaus River *Ramping Rates* conservation measure may decrease the stranding risk stressor by minimizing the rate of flow decreases during controlled flow reduction periods.

Kelts are emigrating in the late winter through early spring (February through June) in the Stanislaus River.

- The Stanislaus River *Ramping Rates* conservation measure may increase the water temperature and dissolved oxygen stressors by decreasing storage in New Melones Reservoir.

Eggs are present in the Stanislaus River.

- The Stanislaus River *Ramping Rates* conservation measure may increase the water temperature stressor by decreasing the storage in New Melones Reservoir.

Juveniles are present in the Stanislaus River.

- The Stanislaus River *Ramping Rates* conservation measure may increase the water temperature and dissolved oxygen stressor by decreasing storage in New Melones Reservoir.
- The Stanislaus River *Ramping Rates* conservation measure may decrease the stranding risk stressor by minimizing the rate of flow decreases during controlled flow reduction periods.

H.6.2 Spring Pulse Flows

Reclamation will operate the New Melones Reservoir in accordance with the 2023 New Melones Stepped Release Plan (SRP). The 2023 SRP increases the potential outmigration response of juvenile steelhead and increases the annual total volume of water for all year types. Modifications would use a single pulse and increase peak releases from 400 cfs to 1,500 cfs.

Under the Stanislaus River *Spring Pulse Flows* conservation measure, Reclamation will release additional flows starting as early as March through as late as June. Reclamation, through the SWT, will schedule spring pulse flow volumes consistent with volumes in the 2023 SRP.

Listed species potentially impacted by the Stanislaus River *Spring Pulse Flows* conservation measure include steelhead.

H.6.2.1 Steelhead

Adults are present in the winter through summer in the Stanislaus River.

- The Stanislaus River *Spring Pulse Flows* conservation measure may increase the migratory and shallow-water habitat stressors and increase temperature buffering for steelhead adults.

Kelts are emigrating in the late winter through early spring (February through June) in the Stanislaus River

- The Stanislaus River *Spring Pulse Flows* conservation measure may increase the water temperature and dissolved oxygen stressors by decreasing storage of water in the reservoir.

Eggs are present in the winter through spring in the Stanislaus River but are not expected to be affected by this conservation measure.

Juveniles are present in Stanislaus River.

- The Stanislaus River *Spring Pulse Flows* conservation measure may increase the migratory and shallow-water habitat stressors and decrease the water temperature stressor for steelhead juveniles.

H.6.3 Fall Pulse Flows

Under the Stanislaus River *Fall Pulse Flows* conservation measures, Reclamation will release additional flows in October and/or November. Reclamation, through the SWT, will schedule fall pulse flow volumes consistent with the volumes in the 2023 SRP, and considering other system objectives. Fall pulse flows improve instream conditions and provide an attraction cue for adult salmonids returning to spawn.

Listed species potentially impacted by the Stanislaus River *Fall Pulse Flows* conservation measure include steelhead.

H.6.3.1 Steelhead

Adults are migrating, spawning, and holding in the Stanislaus River.

- The Stanislaus River *Fall Pulse Flows* conservation measure may increase the water temperature stressor by decreasing the New Melones Reservoir storage.

Kelts are not present in the Stanislaus River during this period.

Eggs are present in the Stanislaus River.

- The Stanislaus River *Fall Pulse Flows* conservation measure may increase the water temperature stressor by decreasing the storage in New Melones Reservoir.

Juveniles are present in the Stanislas River.

- The Stanislaus River *Fall Pulse Flows* conservation measure may increase the water temperature stressor by decreasing the storage in New Melones Reservoir.

H.6.4 Winter Instability Flows

Under the Stanislaus River *Winter Instability Flows* conservation measure, Reclamation releases additional flow in February, as provided in the 2023 SRP, to simulate natural variability in the winter hydrograph and to enhance access to varied rearing habitats. Reclamation, through the SWT, schedules the winter instability flow volume. Whenever possible, the pulse is scheduled to coincide with a natural storm event, which may naturally cue outmigration. In some years, natural rain events may provide sufficient natural variability in the hydrograph and an additional pulse may be determined to be necessary. Reclamation, through the SWT, will prepare an assessment when rain events meet the need for winter instability flows and not require additional releases.

Listed species potentially impacted by the Stanislaus River *Winter Instability Flows* conservation measure include steelhead.

H.6.4.1 Steelhead

Adults are present in the winter through summer in the Stanislaus River.

- The Stanislaus River *Winter Instability Flows* conservation measure may decrease the water temperature stressor for adults by increasing the flow release from the reservoir if consecutive dry years occur.

- The Stanislaus River *Winter Instability Flows* conservation measure may increase the rearing habitat conditions stressor by increasing releases from New Melones Reservoir in the winter.

Kelts are present in the Stanislaus River.

- The Stanislaus River *Winter Instability Flows* conservation measure may increase the water temperature stressor by decreasing storage of water in New Melones Reservoir.

Eggs are present in the winter through spring in the Stanislaus River.

- The Stanislaus River *Winter Instability Flows* conservation measure may increase the rearing habitat conditions stressor by increasing release flow from the reservoir in the winter.

Juveniles are present in the Stanislas River.

- The Stanislaus River *Winter Instability Flows* conservation measure may decrease the Water Temperature stressor for juveniles by increasing the flow release from New Melones Reservoir if consecutive dry years occur.
- The Stanislaus River *Winter Instability Flows* conservation measure may increase access to rearing habitat conditions stressor by increasing release flow New Melones Reservoir in the winter.

H.7 San Joaquin River

Reclamation would operate the Friant Division consistent with the San Joaquin River Restoration Program Record of Decision, which is a related action not included in this consultation.

H.8 References

Cathcart, J. 2005. Fisheries and Oceans Canada flow ramping study: study of flow ramping rates for hydropower developments. Consultants report prepared by Knight Piesold Ltd. for Fisheries and Oceans Canada. Ref. No. Va103-79/2-1. 50 pp.

Dauwalter, D. 2013. A pilot study of fish stranding on the South Fork Boise River, 2012.

Irvine, R. L., J. L. Thorley, R. Westcott, D. Schmidt, and D. DeRosa. 2015. Why do fish strand? An analysis of ten years of flow reduction monitoring data from the Columbia and Kootenay rivers, Canada. *River Research and Applications* 31(10):1242–1250.

U.S. Fish and Wildlife Service. 2019. *Biological Opinion for the Reinitiation of Consultation on the Coordinated Operations of the CVP and SWP.* Service File No. 08FBTD00-2019-F-0164. October.

Young, P. S., J. J. Cech, and L. C. Thompson. 2011. Hydropower-related pulsed-flow impacts on stream fishes: a brief review, conceptual model, knowledge gaps, and research needs. *Reviews in Fish Biology and Fisheries* 21(4):713–731.