

Chapter 15 Summary of Effects Analysis and Effects Determination

The potential effects of CVP and SWP operations were evaluated into the future by examining and comparing modeled river flows and temperatures to the environmental baseline and how the changes effect the following protected species and their critical habitat (where designated): Central Valley steelhead Distinct Population Segment (DPS), Sacramento River winter-run Chinook salmon Evolutionarily Significant Unit (ESU), Central Valley spring-run Chinook salmon ESU, Southern Oregon/Northern California Coast coho salmon ESU, Central California Coast steelhead DPS, Southern DPS of North American green sturgeon, delta smelt, and Southern Resident DPS of killer whales. Operation of diversions and facilities affecting migrations were included in the analysis.

The determination of effects for the listed species and their designated critical habitat considers direct and indirect effects of the proposed action on the listed species together with the effect of other activities that are interrelated or interdependent with the action. These effects are considered along with the environmental baseline and the predicted cumulative effects.

Central Valley Steelhead DPS

Upper Sacramento River

Keswick Reservoir releases are expected to provide suitable flows for adult steelhead passage and spawning. The minimum release of 3,250 cubic feet per second (cfs) will sustain the population through dry years. Red Bluff Diversion Dam (RBDD) operations allow most steelhead to pass unimpeded. Those arriving prior to gate opening will use one of the fish ladders or be temporarily delayed. Operations agreements already in place will help to ameliorate effects due to flood control releases should they occur. Water temperatures provided through operation of the Shasta temperature control device (TCD) in the upper Sacramento River will be appropriate for all steelhead life history stages present in the upper river year-round. We project that steelhead populations in the upper Sacramento River will be maintained through continued operation of the project. The steelhead life history includes anadromous and resident forms of the species, allowing populations to persist during periods of poor ocean conditions and periods of low freshwater in streams. The nature of straying allows steelhead to repopulate areas of local disturbance, although no such disturbances requiring straying to repopulate areas are likely to occur as a result of project operations.

Clear Creek

Whiskeytown Reservoir releases will provide adequate flows for passage and spawning in most years. During some years additional Central Valley Project Improvement Act (CVPIA) 3406 (b)(2) water may be used for better attraction and upstream migration conditions for steelhead. Water temperatures should generally be adequate for all steelhead and Chinook life stages throughout the year in the upper river where Whiskeytown releases have the most effect on water temperature. Whiskeytown project releases will not result in scour of redds. Some

minor stranding of juveniles could potentially occur, similar to that which occurs in unregulated rivers. We project that steelhead populations in Clear Creek will be maintained through continued operation of the project. CVPIA habitat improvement projects are improving conditions for steelhead. The steelhead life history includes anadromous and resident forms of the species, allowing populations to persist both during periods of poor ocean conditions and periods of low freshwater in streams. The nature of straying allows steelhead to repopulate areas of local disturbance, although no such disturbances requiring straying to repopulate areas are likely to occur as a result of project operations.

Feather River

Flow, habitat, and water temperature conditions should be generally suitable for all steelhead life history stages all year in the low flow channel. The reach below the Thermalito outlet will be less suitable. Water temperatures generally begin exceeding the spawning and emergence recommendations during March; however, this is the latter part of the spawning/emergence season in the Feather River and most spawning occurs upstream. Summer temperatures will generally exceed 65° F below the Thermalito outlet by June, and will remain too warm for steelhead rearing throughout the summer months. Most steelhead rearing occurs in the low flow channel where temperatures are projected to be generally suitable year round and to be slightly improved in the future. We project that steelhead populations in the Feather River will be maintained through continued operation of the project. The steelhead life history includes anadromous and resident forms of the species, allowing populations to persist both during periods of poor ocean conditions and periods of low freshwater in streams. The nature of straying allows steelhead to repopulate areas of local disturbance, although no such disturbances requiring straying to repopulate areas are likely to occur as a result of project operations.

American River

Nimbus Reservoir releases are expected to provide suitable flows for adult steelhead passage and spawning. Operations agreements already in place should ameliorate effects due to flood control releases should they occur. Water temperatures should be generally appropriate for steelhead spawning and emergence from December through March. However, temperatures may be marginal for spawning and emergence during March through May of some years. May through mid-October water temperatures will be marginal for steelhead rearing at times and will be higher in the future. The survival of some juveniles through summer under similar conditions during previous years indicates the conditions are tolerable for some fish. Water temperatures should be appropriate for yearling emigration between December and March. Temperatures will be higher in June through November under the future operations scenario. The steelhead run in the American River will likely continue to be supported primarily by the hatchery, with limited successful in-river smolt production in dry water years.

Stanislaus River

Conditions for steelhead in the Stanislaus River should generally be favorable for completion of the life cycle. Goodwin Dam releases will provide suitable flows for adult steelhead passage and spawning. Water temperatures are suitable for adult migration and spawning and juvenile rearing. Water temperatures between Goodwin Dam and Orange Blossom Bridge should be

suitable for all steelhead life history stages present most of the year. Temperatures at and below Oakdale may exceed the preferred range for rearing at times during the summer months, but the presence of a large resident trout population in the river indicates suitable in-river conditions. This resident population will be maintained and provides a source of the anadromous form of the species for those times when San Joaquin River migratory conditions are poor. The steelhead life history includes anadromous and resident forms of the species, allowing populations to persist both during periods of poor ocean conditions and periods of low freshwater in streams. The nature of straying allows steelhead to repopulate areas of local disturbance, although no such disturbances requiring straying to repopulate areas are likely to occur as a result of project operations.

Sacramento-San Joaquin Delta

Previous plans in place to protect spring- and winter-run Chinook salmon and Delta smelt have helped reduce steelhead salvage, and help to minimize CVP and SWP Delta effects on steelhead. The data assessment team (DAT) will continue to monitor conditions in the Delta so that actions can be taken when higher numbers of steelhead are more vulnerable to being taken at the pumps. Projected operation of other Delta facilities (for example, the North Bay Aqueduct, the Delta Cross Channel (DCC), Rock Slough Diversion, and the Suisun Marsh Salinity Control Gates (SMSCG)) are not expected to substantially impact steelhead. Steelhead take at these facilities has historically been low relative to the Central Valley Steelhead population as a whole.

Steelhead Summary

CVP and SWP operations will result in take of some steelhead. The magnitude of effects on population trends are unknown but the effects on the Central Valley steelhead population should be small relative to the population as a whole. Water operations during dry years will reduce steelhead habitat when cold water supplies are not large enough to maintain suitable rearing conditions throughout the habitat generally used by steelhead. However, wild steelhead are consistently captured in smolt outmigration monitoring programs and observed in snorkel surveys, and wild steelhead habitat enhancements have increased since they were listed in 1998, suggesting that protections and enhancements in freshwater habitats and the Delta are sufficient to maintain populations of Central Valley Steelhead at a level similar to the current population. Climate change scenarios include some scenarios where water temperatures in the rivers would be degraded. This would reduce the area of the rivers suitable for steelhead rearing during the summer, potentially decreasing carrying capacity, should these scenarios occur in the future. The steelhead life history includes anadromous and resident forms of the species (*O. mykiss*), allowing populations to persist both during periods of poor ocean conditions and periods of low freshwater in streams. The nature of straying allows steelhead to repopulate areas of local disturbance, although no such disturbances requiring straying to repopulate areas are likely to occur as a result of project operations.

Determination of Effects to Central Valley Steelhead DPS and their Designated Critical Habitat

Based on the effects analysis we have determined that CVP and SWP project operations are likely to adversely affect the Central Valley steelhead DPS.

Based on the effects analysis we have determined that CVP and SWP project operations are likely to adversely affect Central Valley steelhead designated critical habitat.

Sacramento River Winter–run Chinook ESU, Central Valley Spring–run Chinook Salmon ESU

Upper Sacramento River

Keswick Reservoir releases are expected to provide suitable flows for adult Chinook salmon passage and spawning. The minimum release of 3,250 cfs can sustain the population through dry years if suitable temperatures are maintained in the upper river. Operations agreements already in place will ameliorate effects due to flood control releases when they occur. Water temperatures will be appropriate for most Chinook salmon life history stages year-round during most years in the upper river, but during dry years temperatures during late summer and fall will be above preferred ranges for spawning and rearing so will likely result in lower production than during wet years. Winter–run spawning has shifted upstream with passage enhancements so that although water temperature will be higher, upper river temperatures will maintain incubation conditions down to Balls Ferry in most years. This covers the area where 99 percent of winter–run spawn (based on 2001 – 2005 spawning distribution). The few spring–run that spawn in the Sacramento River spawn further downstream than winter–run, so effects will be greater on them. In addition, winter–run are the primary focus of temperature management so temperatures sometimes warm in the fall during spring–run incubation. During critically dry years most spring–run eggs could suffer mortality due to high water temperature during incubation. A small proportion of the Central Valley spring–run population spawns in the Sacramento River, so overall population effects of low spring run production in the mainstem river will be minor. The entire winter–run population spawns in the upper Sacramento River.

Clear Creek

Whiskeytown Reservoir releases should provide adequate flows for passage and spawning most years. During some years additional CVPIA 3406 (b)(2) water may be needed for better attraction and upstream migration conditions for spring–run and fall–run fish. Summer water temperatures are expected to be suitable for adult holding in the upper river. Water temperatures will be suitable for most life history stages above Igo, but spawning and rearing temperatures near the mouth of the creek will be slightly above the preferred range during the summer. Spring run spawning and rearing habitat is upstream of Igo. A very small proportion of the Central Valley spring–run population enters Clear Creek, but habitat and flow improvements have increased spring run escapements in recent years. These conditions will be maintained with project operations.

Feather River

Flow and water temperature conditions should generally be suitable for all spring–run Chinook salmon life history stages all year in the low flow channel, particularly in the upper low flow channel. However, superimposition on spring–run Chinook salmon redds by fall–run Chinook

may continue to be a problem until the Segregation Weir is constructed. The reach below the Thermalito outlet will be less suitable, until a Facility Modification(s) for temperature control is constructed, as water temperatures below Thermalito will be too warm for adult holding and spawning, but will be appropriate for juvenile rearing and emigration during winter and early spring.

Sacramento-San Joaquin Delta

Actions taken in the past to protect winter-run and spring-run Chinook and Delta smelt provide protection during the winter and spring, thereby reducing the impact of CVP and SWP Delta operations. Emigrating yearling Chinook salmon will receive protection from actions triggered through the Salmon Protection Decision Process during the emigration period. The DAT team will continue to watch fish monitoring data throughout the system so that operational adjustments can be made to minimize salvage.

Winter-run and Spring-run Chinook Summary

Chinook losses due to CVP and SWP operations may be substantial. However, the cohort replacement rate methodology discussed in Chapter 4 indicates Chinook salmon populations are generally increasing through 2007. The cohort replacement rate (CRR) data from the Sacramento River, Deer, Mill, and Butte creeks suggest existing protections and enhancements in the upper watershed and the Delta are sufficient to maintain populations of Central Valley winter-run, and Central Valley spring-run Chinook salmon during the continued operations of the CVP and SWP considered in this consultation. The spring-run population uses primarily non-Project tributaries for spawning and rearing, and uses the Sacramento River and Delta as a migratory corridor. Migratory conditions will be adequate to maintain the spring-run and winter-run populations. Climate change scenarios include scenarios with warmer temperatures and decreased precipitation leading to increased water temperatures in the rivers. These scenarios would decrease carrying capacity for winter-run and spring-run Chinook in the future. Ocean conditions will likely continue to produce population fluctuations, and the effects of climate change scenarios on ocean conditions for salmon are still uncertain.

Determination of Effects to Sacramento River Winter-run Chinook Salmon ESU and their Designated Critical Habitat

Based on the effects analysis we have determined that CVP and SWP project operations are likely to adversely affect the Sacramento River winter-run Chinook salmon ESU.

Based on the effects analysis we have determined that CVP and SWP project operations are likely to adversely affect Sacramento River winter-run Chinook salmon designated critical habitat.

Determination of Effects to Central Valley Spring-run Chinook Salmon ESU and their Designated Critical Habitat

Based on the effects analysis we have determined that CVP and SWP project operations are likely to adversely affect the Central Valley spring-run Chinook salmon ESU.

Based on the effects analysis we have determined that CVP and SWP project operations are likely to adversely affect Central Valley spring-run Chinook salmon designated critical habitat.

Southern Oregon/Northern California Coast Coho Salmon ESU

The Southern Oregon/Northern California Coast coho salmon ESU occurs in the Trinity River. Reclamation is implementing higher flows and physical habitat improvements for the Trinity River Restoration Program in the Trinity River. The net effect of future CVP operations on coho salmon in the Trinity River should be a benefit to the population through the habitat values provided as outlined in the Trinity River Restoration Program.

Based on the effects analysis we have determined that CVP and SWP project operations may affect, but are not likely to adversely affect the Southern Oregon/Northern California Coast coho salmon ESU.

Based on the effects analysis we have determined that CVP and SWP project operations may affect, but are not likely to adversely affect Southern Oregon/Northern California Coast coho salmon designated critical habitat.

Central California Coast Steelhead DPS

No adverse effects of the project on Central California Coast steelhead have been identified. The portion of the project area intersecting the CCC steelhead DPS is in the north-western Delta leading to Suisun Creek. Suisun Creek was excluded from the Critical Habitat designation. Effects on this migratory corridor for CCC steelhead are expected to be minimal to water quality and of no measurable effect on VSP parameters for CCC steelhead.

Based on the effects analysis we have determined that CVP and SWP project operations are not likely to adversely affect the Central California Coast steelhead DPS.

Based on the effects analysis we have determined that CVP and SWP project operations are not likely to adversely affect Central California Coast steelhead designated critical habitat.

Delta Smelt

We have considered direct entrainment effects and indirect effects on delta smelt in terms of (1) changes in expected flows at the CVP and SWP export facilities, (2) changes in Old and Middle River flow, and (3) changes in X2 position. These exports, flow and X2 are expected to increase, increasing potential risks for delta smelt. However, the past population effects have been difficult to determine, and DSRAM and EWA-based actions are expected to curtail the exports and flows.

(1) Since exports flows increase under the future scenarios considered, entrainment of unspent adults at the SWP and CVP export facilities may increase in some months, depending on the application of the DSRAM and EWA curtailments. Substantial increases in pumping in some scenarios in one or more months during March to July are likely to increase the entrainment of juvenile delta smelt during drier years. It is important to note here that the beneficial effects of flow and operational restrictions imposed by a federal judge to protect delta smelt from entrainment are not considered in the scenarios.

(2) More negative Old and Middle River flow are predicted in studies 7.0, 7.1, and 8.0 especially for months during drier years when adult, larval and juvenile delta smelt are vulnerable to entrainment. However, other flows and tactical curtailments in exports, and application of DSRAM and EWA curtailments will reduce potential effects of increases in Old and Middle River reversed flows.

(3) Upstream movements of X2 are predicted in studies 7.0, 7.1, and 8.0 with respect to Study 6.0 for the months when delta smelt live in the low salinity zone. Upstream movements of 5 km or more, as projected for some months in late summer and fall, are expected to reduce the availability and quality of delta smelt habitat as defined by salinity, transparency and volume. Such changes may have other effects on the pelagic food web that supports delta smelt. However, the extent of population effects of X2 and entrainment changes are unknown.

Determination of Effects to Delta Smelt and their Designated Critical Habitat

Based on the effects analysis we have determined that CVP and SWP project operations will adversely affect delta smelt.

Based on the effects analysis we have determined that CVP and SWP project operations are likely to adversely affect delta smelt designated critical habitat.

Southern DPS of North American Green Sturgeon

We have considered (1) Sacramento River flows and water temperature, (2) Red Bluff Diversion Dam Operation, (3) entrainment loss at the CVP and SWP export facilities.

(1) Sacramento River flows provide conditions suitable for adult and juvenile green sturgeon migration. Water temperatures provided for Chinook salmon and steelhead are suitable for all green sturgeon lifestages in the Sacramento River.

(2) Red Bluff Diversion Dam gate operations have been modified to make downstream passage for green sturgeon safer. Gates under current and near future operations block some late migrating green sturgeon. Future operations will allow unimpeded passage for upstream migrating green sturgeon.

(3) A small number of green sturgeon become entrained in the SWP and CVP Delta export facilities.

At this time, critical habitat for the green sturgeon has not been designated.

Determination of Effects to Southern DPS of North American Green Sturgeon

Based on the effects analysis we have determined that CVP and SWP project operations are likely to adversely affect the Southern DPS of North American green sturgeon.

Southern Resident DPS of Killer Whales

Project operations have the potential to affect the prey base of Southern Resident killer whales. Project operations would only affect Southern Resident killer whales to the extent that the effects of the project operations alter salmonid populations which could indirectly lead to a reduction in prey availability to the Southern Resident killer whales. Reductions in prey availability may force the whales to spend more time foraging, and could lead to reduced reproductive rates and higher mortality.

Determination of Effects to Southern Resident DPS of Killer Whales and their Designated Critical Habitat

Based on the effects analysis we have determined that CVP and SWP project operations may effect but are not likely to adversely affect the Southern Resident DPS of killer whales.

Based on the effects analysis we have determined that the effects of the CVP and SWP project operations on salmon populations are not likely to adversely affect designated critical habitat since the effects are discountable due to the small percentage of California salmon potentially present in Washington waters identified as critical habitat.

Summary of Beneficial Effects

A summary of the CVPIA, Four Pumps Agreement, and CALFED Bay-Delta Program (CALFED) actions is in Chapter 18. CVPIA Section 3406 (b)(2) and Yuba Accord Purchase assist the projects with the VAMP actions. Adaptive Management is summarized in Chapter 2.