Chapter 3 Environmental Baseline

This section analyzes the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat) and the ecosystem, within the action area. The environmental baseline includes the impacts of all federal, state, and private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR § 402.02). It does not include the effects of the action under review in the consultation; that is, the Long Term Coordinated Operations of the Central Valley Project and State Water Project.

As described below, the environmental baseline includes the effects of multiple physical, hydrological, and biological alterations that have negatively affected the species and habitat considered in this consultation. These baseline conditions include the past, present, and ongoing effects of the existence of the CVP structures. It is well established that the existence of dams and other structures, which may already be endangering species survival and recovery, is an existing human activity that is included in the environmental baseline and is not an effect of the action. The decisions of Congress and the state legislature to authorize the construction of those structures fundamentally altered the habitat and survival prospects of the species considered in this document. While those negative effects may continue to occur, they are not effects of the ongoing operation of the CVP and SWP.

Reclamation has discretion in aspects of its operations, such as the exercise of discretion in operational decision making, including deciding how to comply with the existing terms of respective existing water supply and settlement contracts, and legal obligations. However, Reclamation does not have discretion to remove any of the CVP or SWP structures. In contrast to other obligations, Reclamation has a fundamental, nondiscretionary obligation to ensure that its facilities do not present an unreasonable risk to people, property, and the environment. Reclamation Safety of Dams Act, P.L. 95-589, directs Reclamation to “preserve the structural safety of Bureau of Reclamation dams and related facilities...” (P.L. 95-578, as amended).

The environmental baseline projects the future “without-action” condition and the past, present, and ongoing impacts of human and natural factors, including the present and ongoing effects of current operations that were considered in prior consultations. These are included in the “Past and Present Impacts” section below.

By projecting the prospects for species survival and recovery without the action, the environmental baseline plays a necessary role in defining the effects of the action. That, in turn, allows for a determination of whether the action jeopardizes the continued existence of listed species or adversely modifies their critical habitat.

3.1 Past and Present Impacts

The baseline includes the past and present impacts of all federal, state, and private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process, including the past and present impacts of CVP and SWP operations under 2008 and 2009 biological opinions.

The CVP and SWP operate in an environment vastly different from the conditions under which native aquatic species evolved. Physical, hydrological, and biological alterations present novel conditions that result in stressors on California species and that pre-date the CVP. During the last 200 years, human activities have dramatically altered and reshaped the habitat upon which the species addressed in this consultation depend for survival. Those activities, as well as others, have reduced and continue to reduce significantly the species' likelihood of survival and recovery.

3.1.1 Physical Alteration

Since 1900, approximately 95 percent of historical freshwater wetland habitat in the Central Valley floodplain has been lost, typically through the construction of levees and draining for agriculture or residential uses (Hanak et al. 2011). Human expansion has occurred over vast areas in the Delta and Sacramento and San Joaquin Valleys between the 1850s and the early 1930s, completely transforming their physical structure (Thompson 1957, 1965; Suisun Ecological Workgroup 2001; Whipple et al. 2012; Whipple 2010). Levee ditches were built to drain land for agriculture, human habitation, mosquito control, and other human uses, while channels were straightened, widened, and dredged to improve shipping access to the Central Valley and to improve downstream water conveyance for flood management.

3.1.1.1 *Dams*

Water storage and diversion in California began in 1772, with a 12-foot high dam on the San Diego River. The water needs of mining, agriculture, communities, and electricity generation resulted in dams throughout the Sierra Nevada. In 1890, the California Fish and Game Commission first documented concerns with upstream passage and seasonal barriers for Chinook Salmon. Around the same time, the Folsom Powerhouse created a stone dam across the American River in 1893 (California Parks and Recreation 2018b). On the Sacramento River, the Anderson-Cottonwood Irrigation District constructed a dam near Redding in 1916. PG&E developed the Pit River in the 1920s for hydroelectricity (FERC 2011). On the Stanislaus River, the Oakdale and South San Joaquin Irrigation Districts constructed the original Melones Dam in 1926 to provide water for agriculture. On the San Joaquin River, Mendota Dam diverted irrigation water beginning in 1919 (CCID 2011). These early, non-CVP dams and diversions blocked fish passage and reduced downstream flows during the irrigation season. Since the 1850s, declining numbers of California's anadromous salmonids have been attributed, in large part, to dams (Yoshiyama et al. 1998).

On non-CVP and non-SWP streams, local districts have constructed dams and diversion facilities. Examples include Ward Dam on Mill Creek; Deer Creek Irrigation Diversion Dam on Deer Creek; Comanche Dam on the Mokelumne River; Durham Mutual Diversion on Butte Creek; La Grange Diversion Dam on the Tuolumne River; Crocker-Huffman Dam on the Merced River; and New Hogan Dam on the Calaveras River.

The primary negative effect of dams on salmonids is the elimination of access to a portion of spawning habitat, and for some species, the majority of spawning habitat. This effect started before the CVP, as early as 1918. Starting in the 1930s, the "rim dams" were constructed, which blocked higher elevation spawning habitat for salmonids. Construction of major CVP facilities began in 1938 with breaking of ground for Shasta Dam on the Sacramento River near Redding in Northern California. Over the next five decades, the CVP was expanded into a system of 20 dams and reservoirs that together can hold nearly 12

MAF of water. Currently, in California's Central Valley, dams block access to more than 80 percent of historical salmonid spawning areas (Yoshiyama et al. 1998; Lindley et al. 2006).

These CVP, SWP, and other dams prevent fish passage into cold upstream areas with more spawning habitat. Historical Winter-Run Chinook Salmon and Green Sturgeon spawning habitat may have extended up into the three major branches of the Upper Sacramento River above the current location of Shasta Dam; the Upper Sacramento River, the Pit River, and the McCloud River. In a 2014 habitat assessment, Reclamation found suitable and stable temperatures for Chinook Salmon during the warmest weeks of summer in portions of the McCloud and Upper Sacramento Rivers. For Central Valley Steelhead, it has been estimated that access to as much as 95 percent of all spawning habitat in the Central Valley has been lost (California Advisory Committee on Salmon and Steelhead Trout 1988). For several species, dams have resulted in a consolidation of spawning areas into one reach of one river. This increases the vulnerability of the species because a single catastrophic event could eliminate the population. Multiple reaches of spawning habitat in multiple rivers allows for greater resiliency of the population. Preventing access to the coldest water spawning habitat has greatly reduced the resiliency of Chinook Salmon to respond to stressors such as higher temperatures and extended drought.

Dams also trap sediment from upstream, which can lead to downstream streambeds becoming coarser or armored, hindering excavation of redds by spawning salmonids. Also, fine sediment from side channels that is normally flushed out by more frequent and larger flows can accumulate in gravel, reducing spawning success of salmonids.

3.1.1.2 *Disconnected Floodplains and Drained Tidal Wetlands*

Flooding has always been a regular occurrence along the Sacramento River (Thompson 1957) and the San Joaquin River. Floodplains are areas inundated by overbank flow, typically during the winter and spring peak flows. Inundation can last for up to several months. Floodplains can provide conditions that support higher biodiversity and productivity relative to conditions in river channels (Tockner and Stanford 2002; Jeffres et al. 2008). Floodplains also create important habitat for rearing and migrating fish; migratory waterfowl; and amphibians, reptiles, and mammals native to the Central Valley. Historically, Central Valley Chinook Salmon juveniles reared for up to three months on inundated floodplains, growing rapidly prior to ocean entry (Sommer et al. 2001).

Between the 1850s and 1930s over 300,000 acres of tidal marshes in the Delta were diked, drained, and converted to agriculture (Atwater et al. 1979). In addition, fill associated with past development has resulted in the loss of approximately 79 percent of tidal marsh habitat and approximately 90 percent of all tidal wetlands in the San Francisco Bay (California State Coastal Conservancy et al. 2010). Thus, the complex, shallow, and dendritic marshlands were replaced by simplified, deep, and less vegetated channels. This hydrogeomorphic modification fragmented aquatic and terrestrial habitats and decreased the value and quantity of available estuarine habitat (Herbold and Vendlinski 2012; Whipple et al. 2012). In the Central Valley, 95 percent of historical floodplain wetland has disappeared (Katz et al. 2017). The decline in, and disconnection from, floodplain habitat and the food it produces has been linked to native fish population declines (Jassby et al. 2003). The degradation and simplification of aquatic habitat in the Central Valley has also greatly reduced the resiliency of Chinook Salmon to respond to additional stressors (NMFS 2016b). Further, important ongoing development stressors (e.g., urban and agricultural development) continue to affect wetlands in California, and stream-associated salt marsh and wetland habitat have shown declining health and function due to urbanization effects (California Natural Resources Agency 2010).

3.1.1.3 *Levees*

The development of California's agricultural industry and water conveyance system has resulted in the construction of armored, riprap levees on more than 1,100 miles of channels and diversions to increase channel elevations and flow capacity of the channels (Mount 1995). As part of the Sacramento River Flood Control Project, the U.S. Army Corps of Engineers (USACE) constructed levees in the lower Sacramento River Basin. Revetments and bank armoring caused channel narrowing and incision and prevented natural channel migration. Levees have also isolated former floodplains from the river channel, preventing access for rearing for juvenile salmonids.

Many of these levees use riprap to armor the bank. Constructing and armoring levees changes bank configuration and reduces cover (Stillwater Sciences 2006). Constructed levees protected with rock revetment generally create nearshore hydraulic conditions characterized by greater depths and faster, more homogeneous water velocities than occur along natural banks. Higher water velocities typically reduce deposition and retention of sediment and woody debris. This reduces the shoreline variability, especially by eliminating the shallow, slow-velocity river margins used by juvenile fish as refuge and to escape from fast currents, deep water, and predators (Stillwater Sciences 2006).

In addition, the armoring and revetment of stream banks may narrow rivers, reducing the amount of habitat per unit channel length (Sweeney et al. 2004). As a result of river narrowing and deepening, benthic habitat decreases and the number of macroinvertebrates per unit channel length decreases, affecting salmonid food supply.

3.1.1.4 *Gold and Gravel Mining*

Significant gold and gravel mining in the Sacramento River watershed has further degraded aquatic habitats by decreasing the availability and recruitment of suitable spawning gravels. Hydraulic gold mining began in mid-1800, with an estimated 5,000 miles of mining canals and flumes established by 1859 (Lufkin 1996). Around 1.5 billion cubic yards of debris were sluiced into streams. For over 100 years, around 1.5 billion cubic yards of hydraulic mining debris moved through California's rivers and the Sacramento–San Joaquin Delta (Lufkin 1996). Fine sediments settle in between spawning gravels, reducing hyporheic flow and the movement of required dissolved oxygen to developing salmonid eggs. This contributed to decreased salmonid populations in the 1800s and early 1900s; however, the direct effect no longer occurs, as fine sediments from hydraulic mining are moving past the Golden Gate Bridge (James 2004). Persistent effects from the genetic bottlenecks and physical alterations remain.

3.1.1.5 *Gravel*

Coarse sediment from the upper watershed is prevented from being transported downstream by dams, resulting in an alluvial sediment deficit and reduction in fish habitat quality within the Sacramento River (Wright and Schoellhamer 2004). In addition to the reduction of sediment supply, recruitment of large woody material to the river channel and floodplain has also declined due to a reduction in bank erosion and blockage of wood transport by dams.

3.1.1.6 *Timber Production*

Timber production is a dominant land use within private timber holdings that operate in the mountains of Humboldt, Trinity, and Mendocino Counties. The effects of road building associated with timber harvest, and rural road construction in general, can destabilize hillsides and increase erosional processes that deliver fine sediment to streams and rivers. Poorly designed or constructed stream crossings can often preclude adult and juvenile fish from migrating upstream past the crossing, and can alter stream channel morphology and hydraulic characteristics within, and upstream and downstream, of the road crossing. High instream sediment loads and poor large woody debris recruitment associated with timber production can affect salmonid habitat for decades after logging has stopped (NMFS 2016).

3.1.1.7 *Marijuana Cultivation*

Changes in land use associated with growing marijuana can result in habitat fragmentation, agricultural water diversions from rivers and streams, and non-point pollutant discharge (i.e., sediment, pesticides, etc.). Illegal marijuana cultivation has grown into a leading threat to Salmon and Steelhead recovery on smaller creeks throughout California, including those that form part of the watersheds of the Trinity and Sacramento Rivers. Illegal growers often dam and dewater creek channels to irrigate their marijuana gardens, and commonly use pesticides, fertilizers and poisons without regard for their impacts on the environment. On January 16, 2019, the the Office of Administrative Law approved California Department of Food and Agriculture's final cannabis cultivation regulations, which include requirements for diversions, fertilizers, and pesticides, and should reduce this effect.

3.1.1.8 *Large Woody Debris*

Prior to the 1970s, some streams were so clogged with logs that biologists believed they were total barriers to fish migration. As a result, in the early 1970s it was common practice for fisheries agencies to remove woody debris (Bisson et al. 1987). It is now recognized, however, that too much large woody debris was removed from the streams. Large quantities of downed trees are an important component of many streams in order to increase channel complexity, shade the channel, and provide nutrient inputs (Bisson et al. 1987).

3.1.1.9 *Alterations to Address Effects*

Reclamation, DWR, USFWS, NMFS, and CDFW as well as other agencies have worked to address the effects of these factors on listed species over the past decades as directed by Congress and state legislatures. The following sections describe beneficial physical alterations.

3.1.1.10 *Fish Passage*

Although agencies have reduced fish passage by damming rivers, they have also worked to provide fish passage over their dams. In the late 20th century, agencies including Reclamation and DWR have increasingly worked to increase fish passage above water infrastructure and reduce fish entrainment into diversions. Providing fish passage increases access to spawning habitats, decreasing density-dependent effects and allowing more variability in the population, thereby increasing resiliency.

For example, in August 2012, Reclamation completed the Red Bluff Pumping Plant and Fish Screen to improve fish passage conditions on the Sacramento River. The facility includes a 1,118-foot flat-plate fish screen, intake channel, 2,500-cfs capacity pumping plant, and discharge conduit to divert water from the Sacramento River into the Tehama-Colusa and Corning Canals. In 2011, the dam gates were permanently placed in the open position for free migration of fish while ensuring continued water deliveries by way of the Red Bluff Pumping Plant. Other examples of passage improvements include removal of the McCormack-Seltzer Dam on Clear Creek, passage at the ACID diversion dam, and tributary efforts under the CVPIA on Battle, Butte, Calaveras, Mill, Deer, and Antelope Creeks.

3.1.1.11 *Spawning and Rearing Habitat Augmentation*

Through CVPIA(b)(12), Reclamation has augmented spawning and rearing habitat for listed species in CVP tributaries. Between 1997 and 2008, over 195,000 tons of gravel have been placed in the Sacramento, Stanislaus, and American River tributaries. Since 2016, a number of spawning and rearing side channel restoration sites on the American and Sacramento Rivers have been implemented. In the Lower American River, roughly 24 acres have been devoted to gravel augmentation, while approximately 50 acres have focused on side channel creation. In the Sacramento River, roughly 4 acres have been devoted to ongoing gravel augmentation launching sites, while approximately 20 acres have been devoted to side channel creation. As a result of these actions, Reclamation has improved spawning and rearing habitat for ESA-listed salmonids in these tributaries.

3.1.1.12 *Tidal Marsh Restoration*

To repair some of the 300,000 acres of tidal wetlands that were drained starting in the 1800s, DWR is in the process of implementing 8,000 acres of tidal wetland habitat restoration in the Sacramento–-San Joaquin Delta and Suisun Marsh. DWR has completed 159 acres of tidal and subtidal restoration with another 2,020 acres in construction. As some projects are still being planned, Reclamation is programmatically consulting on tidal wetland habitat restoration in this biological assessment.

3.1.1.13 *Suisun Marsh Preservation Agreement*

Reclamation and DWR will address salinity in the Suisun Marsh related to operations through the 2015 Suisun Marsh Preservation Agreement (SMPA) and Suisun Marsh Habitat Management, Preservation, and Restoration Plan (Suisun Marsh Plan), which has separate NEPA and ESA compliance completed in 2014. Public Law 99-546 identifies that Reclamation and DWR will share the implementation cost of the 2015 SMPA. The 2015 SMPA was signed by DWR, CDFW, Suisun Resource Conservation District, and Reclamation. The Suisun Marsh Plan addresses concerns of operations of the CVP and SWP on the ecosystem, much of which is privately owned and home to waterfowl hunting clubs. As part of the Suisun Marsh Plan, Reclamation and DWR propose to work with the SMPA principals to: (1) Restore 5,000 to 7,000 acres of tidal marsh to contribute to the recovery of threatened and endangered species; (2) Protect and enhance 40,000 to 50,000 acres of managed wetlands to benefit waterfowl and other resident and migratory wildlife species; (3) Improve ecological processes and reduce stressors, such as invasive species and contaminants; (4) Maintain waterfowl hunting heritage and expand opportunities for hunting, fishing, bird watching, and other nature-oriented recreational activities; (5) Maintain and improve Marsh levee system integrity; and (6) Protect and, where possible, improve water quality for beneficial uses in the Marsh through operating the Suisun Marsh Salinity Control Gates and Roaring River distribution system.

3.1.1.14 *Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project*

To assist in recovering some of the hundreds of thousands of acres of floodplain that were disconnected from Central Valley streams starting in the 1800s, Reclamation and DWR will modify infrastructure at Fremont Weir to increase access to floodplain habitat in the Yolo Bypass for juvenile salmonids. The project will also increase the ability of adult salmon and sturgeon to migrate from the Yolo Bypass to the Sacramento River.

3.1.2 Hydrologic Alteration

3.1.2.1 *Dams*

Construction and operation of CVP and SWP dams, as well as other large dams in the California Central Valley, have changed streamflow downstream of the dams. Dams reduce downstream peak spring flows by storing snowmelt and precipitation inflows for industrial and domestic uses and agriculture. A large percentage of the natural historical inflow to Central Valley watersheds and the Delta is now diverted for human uses. Flows are increased in the summer and fall periods due to releases from storage for downstream agricultural, municipal, and industrial water supplies. Dams disrupt natural hydrologic patterns and impair sediment transport, channel morphology, substrate composition, and water quality (including temperature and turbidity) within downstream reaches (Spence et al. 2008). Operations at reservoir-related dams often affect downstream reaches by impairing flow timing and volume. These effects impair salmonid habitat and affect salmonid migration, spawning, and rearing within the affected reaches.

Reduced streamflows have contributed to decreased recruitment of gravel, decreased recruitment of large woody debris, and reduced geomorphic work. Stable year-round flows have resulted in diminished natural channel formation, altered foodweb processes, and slowed regeneration of riparian vegetation. These stable flow patterns have reduced bedload movement (Mount 1995), caused spawning gravels to become embedded, and decreased channel widths due to channel incision, all of which has decreased the available spawning and rearing habitat below dams. Dams have also trapped fine sediment which otherwise could have entered the Delta (Wright and Schoellhamer 2004), thus contributing—along with other factors such as increases in invasive aquatic vegetation (Hestir et al. 2016) and declining wind speed (Bever et al. 2018)—to a long-term reduction in turbidity for Delta Smelt (e.g., Nobriga et al. 2008).

The reduced flow variability has also shifted water temperatures. If warm surface water from the reservoir is released, dams may increase downstream water temperatures, particularly in summer, when flows are lowest. Lower base flows and warm-water releases can reduce the amount of available habitat, increase the metabolic demands of fishes, and disrupt fish migration patterns (Olden and Naiman 2010). Warm water can also facilitate the spread of disease (Okamura et al. 2011; Kocan et al. 2009).

Most large dams, however, release cold water from the bottom of reservoirs. Cold water releases that maintain or increase downstream base flows will usually reduce water temperatures in summer and fall (Huang et al. 2011; Yates et al. 2008), effectively shifting cold-water rearing habitat for juvenile anadromous salmonids from headwaters to below reservoirs (Ward and Stanford 1983). Cold water releases are often crucial for sustaining remnant salmonid populations. For example, endangered Winter-Run Chinook Salmon in the Sacramento River are maintained entirely by cold-water flows from Shasta Dam, which prevents access to their former habitats (Moyle 2002). However, reliance on cold-water releases to protect salmon can be a problem if there is insufficient cold water in the reservoir to keep temperatures cool during late summer or during periods of drought. Cooler temperatures can also delay juvenile migration cues and slow juvenile growth (Moyle and Cech 2004).

3.1.2.2 *Diversions*

A large number of water diversions were constructed in the Central Valley in the 1900s, for riparian water rights holders, water districts, and CVP and SWP water users. These diversions reduce the flow in California rivers, reducing available spawning area, dewatering redds, and stranding juvenile salmonids.

Water withdrawals, for agricultural and municipal purposes, have reduced river flows and increased temperatures during the critical summer months, and in some cases, have been of a sufficient magnitude to result in reverse flows in the Lower San Joaquin River (Reynolds et al. 1993). Direct relationships exist between water temperature, water flow, and juvenile salmonid survival in riverine sections of the Central Valley (Brandes and McLain 2001). Elevated water temperatures in the Sacramento River have limited the survival of young salmon in those waters. Juvenile Fall-Run Chinook Salmon survival in the Sacramento River is also directly related to June streamflow and June and July Delta outflow (Dettman et al. 1987). Diversions can also affect pelagic species, e.g., by influencing the extent of abiotic rearing habitat for juvenile and subadult Delta Smelt (Feyer et al. 2011).

Reclamation delivers water to the Sacramento and San Joaquin Valleys and the San Francisco Bay Area, and DWR delivers water to these areas as well as southern California cities. Effects in both CVP and SWP water delivery service areas have already been addressed in separate, completed ESA consultations. These effects have been previously analyzed and there is no new information that would change that analysis. The results remain valid and are incorporated by reference.

In addition to surface water diversion, groundwater withdrawals also impair stream habitat by lowering groundwater resources. This impairs volume, extent, timing, and temperature of surface flows.

3.1.2.3 *Entrainment*

Entrainment of fish into irrigation canals can be a major source of mortality (Carlson and Rahel 2007). Legislation requiring fish screens in the Western United States began as early as 1893 in Montana (Clothier 1953), and anadromous fish were being entrained by the millions in Oregon in 1928 (McMillan 1928). Fish entering unscreened water diversions undergo injury and mortality (Kimmerer 2008; Baumgartner et al. 2009; Grimaldo et al. 2009), reduced fitness (Bennett 2005; Kimmerer 2008) or habitat degradation (Drinkwater and Frank 1994; Kingsford 2000). Entrainment into water diversions can harm several fish species, including ESA-listed species, such as Delta Smelt (Bennet 2005) and Green Sturgeon (Mussen et al. 2014).

Entrainment at Jones and Banks Pumping Plants, as well as the effects of changed Delta hydrodynamics, is a significant source of mortality for listed species in the Delta. To minimize these effects, Reclamation currently operates in accordance with RPA actions from the 2008 and 2009 biological opinions that minimize and reduce the effects of entrainment, including salvaging fish and operating to OMR reverse flow criteria.

The 1992 passage of CVPIA included construction of new screens, rehabilitation and replacement of existing screens, and relocation of diversions. In 1997, there were at least 3,356 diversions taking water from the Sacramento and San Joaquin Rivers, their tributaries, and the Delta (Herren and Kawasaki 2001). Over 98 percent of these diversions were unscreened or inadequately screened (Herren and Kawasaki 2001). Since the start of CVPIA's Anadromous Fish Screen Program through 2012, Reclamation and USFWS have provided funding for 35 fish screen projects, screening 5,412 cfs of diversions. Only one diversion greater than 100 cfs remains unscreened on the Sacramento River.

3.1.2.4 *Contaminants (Runoff, Waste Treatment, Etc.)*

As described above, historical activities, such as gold mining, have resulted in high concentrations of methylmercury in much of the Central Valley. Many of the more than 500 mercury mines in California have not been remediated and continue to release mercury to the environment (CDFW 2017). Methylmercury is formed from inorganic mercury by microscopic organisms that live in waterbodies and sediments. Inundation of sediments, such as on a floodplain, can increase the methylation of mercury. Methylmercury is a neurotoxin that bioaccumulates and biomagnifies in the aquatic foodweb (Davis et al. 2003). It can also impair the smoltification and subsequent outward migration behavior in juvenile salmon.

Current activities continue to contribute contaminants to Central Valley waterways. For example, from Fong et al 2016: "Monitoring entities and research studies have detected multiple contaminants occurring simultaneously in Delta water samples (Ensminger et al. 2013; Orlando et al. 2013, 2014). Multiple pesticides are continuously detected in the two primary tributaries to the Delta. For example, 27 pesticides or degradation products were detected in Sacramento River samples, and the average number of pesticides per sample was six. In San Joaquin River samples, 26 pesticides or degradation products were detected, and the average number detected per sample was 9."

High levels of toxicity to aquatic invertebrates were found to originate from urban stormwater pyrethroid pesticide loading to San Francisco Estuary tributaries (Weston et al. 2014, 2015; Brander 2013; Connon et al. 2009; Amweg et al. 2006). Weston and Lydy (2010) detected pyrethroids in all but one of 33 urban runoff samples and observed toxicity over at least a 30 km reach of the American River, and at one site in the San Joaquin River. Pyrethroid pesticides have been identified as a factor possibly contributing to pelagic organism decline because of their increased use in recent years and their high toxicity to aquatic organisms (Fong et al 2016).

The discharge of contaminants into California waters from urban and agricultural sources is likely to continue into the future. The Central Valley is becoming more urbanized, which increases the likelihood of urban discharges entering waterways. Likewise, regional agriculture will continue to discharge agricultural return flows from irrigation practices into surrounding waterways.

3.1.2.5 *Pulse Flows*

As discussed above, operation of dams has reduced flow variability across California. To address this, Reclamation and DWR have implemented pulse flows on a variety of CVP and SWP streams due to the 2000 Trinity River ROD, CVPIA (b)(2), 1960 Memorandum of Agreement (MOA) with CDFG, 1987 CDFG agreement on the Stanislaus, SWRCB water rights orders, and 2009 NMFS Biological Opinion. Spring pulse flows have beneficial effects on salmonids by increasing Chinook Salmon smolt survival (Michel 2015) and subyearling Chinook Salmon smolt survival (Zeug et al. 2014).

3.1.2.6 *Management for Temperature*

Reclamation and DWR have managed for temperature on CVP and SWP tributaries as a result of SWRCB Water Rights Order 90-5 and ESA requirements. These temperature management actions have had generally beneficial effects on species. Reclamation and DWR's temperature management has resulted in cooler flows during summer and fall periods than would occur without temperature management. Absent these temperature management actions, increased temperatures and therefore increased egg and juvenile salmonid mortality would occur.

3.1.2.7 *Temperature Control Devices*

Reclamation has constructed a TCD at Shasta Dam, a selective withdrawal device at Folsom Dam, and a selective withdrawal device on the Folsom Dam Urban Water Supply Pipeline for greater flexibility in managing the cold water reserves while enabling hydroelectric power generation to occur and to improve salmonid habitat conditions. Many reservoirs have a low-level outlet that accesses the coldest water in the reservoir. However, these outlets often are not routed through the hydroelectric powerplant at the dam. Therefore, a TCD allows several elevations of water to be withdrawn from the reservoir—warm from the surface or cold from the bottom—and routed through the powerplant. Temperature control devices allow Reclamation to release warmer water from the top of the reservoir in the springtime, when salmonid temperature requirements are warmer, without bypassing power generation. These devices also allow Reclamation to lower the reservoir elevation at which water is taken for river release, in accordance with changing fish temperature requirements throughout the year. As air temperatures and stratification result in a warming surface of the reservoir in the summer and fall, Reclamation uses the warmer surface water until fisheries requirements necessitate withdrawal of colder water from lower in the reservoir.

Without temperature control devices, Reclamation either would not be able to provide as much cold water in any given year for meeting fisheries temperature requirements, or would reduce the hydroelectricity generated from releases from its dams.

3.1.2.8 *Water Quality*

Although conditions in most streams, rivers, and estuaries throughout the State are much improved from 40 years ago, the rate of improvements have slowed over time (San Francisco Estuary Partnership 2015). Contaminants such as polybrominated diphenyl ethers (PBDEs), and copper have declined over time, however many potentially harmful chemicals and contaminants of emerging concern (pharmaceuticals) have yet to be addressed. Legacy pollutants such as mercury and PCBs limit consumption of most fish, and directly and indirectly affect endangered fish populations, as well as their designated critical habitat.

In particular, urban stormwater runoff is consistently toxic to fish and stream invertebrates (McIntyre et al. 2014, 2015). The array of toxicity is variously attributed to metals from motor vehicle brake pads; petroleum hydrocarbons from vehicle emissions of oil, grease, and exhaust; and residential pesticide use. Urban stormwater toxicity has been linked to pre-spawn mortality of Coho Salmon (*Oncorhynchus kisutch*) (Scholz et al. 2011). The degree of impervious surface (Feist et al. 2011) has also been linked to pre-spawn mortality of Coho Salmon, and both have been directly linked to effects at the population level (Sprомber and Scholz 2011). Emphasis on wastewater treatment plant upgrades and new legislative requirements (SWRCB and EPA), development and implementation of total maximum daily load (TMDL) (i.e., pathogens, selenium, pesticides, pyrethroids, methylmercury, heavy metals, salts, nutrients) programs, and adoption of new water quality standards (i.e., Basin Plans), all aid in protecting beneficial uses for aquatic wildlife.

In recent years, NOAA scientists have investigated the direct and indirect effects of pesticides on individual ESA-listed species, the foodwebs on which they depend, and at the population level (Baldwin et al. 2009; Laetz et al. 2009; Macneale et al. 2010; Scholz et al. 2012). NMFS has consulted on seven batched pesticide ESA Section 7 consultations, and concluded that chlorpyrifos, diazinon, malathion, carbaryl, carbofuran, methomyl, bensulide, dimethoate, ethroprop, methidathion, naled, phorate, phosmet, 2,4-D, chlorothalonil, diuron, oryzalin, pendimethalin, and trifluralin jeopardize the continued existence of ESA-listed species and/or adversely modified critical habitat for salmonids across the West Coast Region (NMFS 2008b, 2010, 2011b, 2013).

3.1.3 Biological Alteration

3.1.3.1 *Commercial Harvest*

Commercial harvest of salmon began in the 1850s (CDFG 1929) and gill net salmon fisheries became well established in the Lower Sacramento and San Joaquin Rivers by 1860. In 1864, the first Pacific

Coast salmon cannery was constructed along the Sacramento River. By its peak in 1882, the Sacramento and San Joaquin Rivers had 20 salmon canneries and processed about 11 million pounds of catch (CDFG 1929). In 1910, there were 10 million pounds of commercial salmon catch; that declined to 4.5 million pounds by 1919 when the last inland cannery closed (CDFG 1929). An estimate of historical abundances of Chinook Salmon in the Central Valley is about 1 to 2 million annual spawners (Yoshiyama et al. 1998).

In 1916, ocean harvest at Monterey alone was over 5 million pounds (Yoshiyama et al. 1998). Between 2006 and 2017, the highest total commercial ocean harvest was 3.8 million pounds in 2013, averaging about 1.5 million pounds over that period (CDFW 2016). The ocean commercial harvest at Monterey in 2016 and 2017 was about 150,000 pounds, representing about 25 and 30 percent of the total ocean commercial harvest, respectively (CDFW 2016). NMFS recently revised harvest rules, which had the effect of increasing harvest pressures on Winter-Run Chinook Salmon at low abundances (NMFS 2018).

3.1.3.2 *Hatcheries*

Five hatcheries currently produce Chinook Salmon in the Central Valley, and four of these also produce Steelhead. Releasing large numbers of hatchery fish can have negative effects on wild populations through competition for space and food, direct predation, and loss of genetic diversity (Moyle 2002). Interbreeding between artificially propagated hatchery and wild individuals can reduce fitness of offspring (Araki et al. 2009). Barnett-Johnson et al. (2008) found that only 10 percent of Central Valley Fall-Run Chinook Salmon harvested in the ocean fishery were of natural origin. On the Mokelumne River, approximately 4 percent of returning adults in the 2004 escapement were found to be of natural origin (Johnson et al. 2012) and the work identified large-scale hatchery production as masking poor natural production and recruitment. These patterns appear throughout the Central Valley, with large proportions of returning adult salmon straying into watersheds without hatcheries (Palmer-Zwahlen and Kormos 2015).

In 1942, CNFH was established to mitigate the loss of spawning areas due to construction of the Shasta and Keswick Dams. Reclamation constructed the LSNFH, a sub-station to CNFH, in 1997 to assist in Winter-Run Chinook Salmon recovery. CDFW operates a number of hatcheries for Salmon and Steelhead, including on the Trinity, Feather, and American Rivers.

Hatchery practices as well as spatial and temporal overlaps of habitat use and spawning activity between Spring-Run and Fall-Run Chinook Salmon have led to the genetic hybridization of some subpopulations (CDFG 1998). Spring-Run from the Feather River Fish Hatchery have been straying throughout the Central Valley for many years (CDFG 1998), and in many cases have been recovered from the spawning grounds of Fall-Run, an indication that Feather River Fish Hatchery Spring-Run may have Fall-Run life history characteristics.

To start to address these interbreeding and hybridization concerns, modern hatcheries are required to develop a Hatchery Genetic Management Plan under Section 4 of ESA. A Hatchery Genetic Management Plan addresses long-range planning and management of the hatchery fish.

3.1.3.3 *Nonnative Predators*

Aquatic invasive species (both plants and animals) have been shown to have major negative effects on the receiving communities, where they often outcompete native species, reduce species diversity, change community structure, reduce productivity and disrupt foodweb function by altering energy flow among trophic levels (Cohen and Carlton 1995; Ruiz et al. 2000; Stachowicz and Byrnes 2006). Multiple mechanisms of impact affect salmonids directly, such as predation and infection (disease and parasitism), and indirectly, such as competition, hybridization, and habitat alterations (Mack et al. 2000; Simberloff et al. 2005). Based on the number of species, individuals and biomass, as well as high and accelerating rate of invasion, the Delta may be the most invaded estuary in the world (Cohen and Carlton 1998).

Striped Bass were introduced in 1880s to provide a commercial fishery. Now a recreational fishery, Striped Bass and other introduced species including Catfish prey upon listed species. A Striped Bass population of 1,000,000 could consume 9 percent of out-migrating Winter-Run Chinook Salmon based on Bayesian population dynamics modeling (Lindley and Mohr 2003). According to the Coalition for a Sustainable Delta’s website, invasive species represent 95 percent of the total biomass in the Delta. Striped Bass are identified by Bennett (2005) as a low potential threat to Delta Smelt.

High rates of predation have been known to occur at diversions and locations where rock revetment has replaced natural river bank vegetation (Grossman et al. 2013). Young salmonids are more susceptible to predation at these locations because predators congregate in areas that provide refuge (Tucker et al. 1998; Williams 2006). Nonnative centrarchids, such as Largemouth Bass and Spotted Bass, will opportunistically feed on juvenile salmonids.

3.1.3.4 *Invasive Aquatic Weeds*

The Delta has changed as a result of the proliferation of invasive aquatic vegetation in recent years (Ta et al. 2017). These aquatic plants, largely comprised of invasive species, create highly productive microhabitats (Lucas et al. 2002; Nobriga et al. 2005; Grimaldo et al. 2009), but they degrade habitat quality for native species by increasing water transparency (Nobriga et al. 2008; Hestir et al. 2016) and harboring predatory fishes (Ferrari et al. 2014; Conrad et al 2016), increasing nonnative predator populations. Aquatic weeds have resulted in increased nonnative predator populations, while on their own they would likely be helpful for salmon by providing food and shelter.

3.1.3.5 *Foodweb Dynamics and Clams*

Diatoms are the group of phytoplankton that tend to be most important to open-water foodwebs in estuaries and coastal marine systems. Diatoms need three things to grow: sunlight, nutrients, and time. The primary historical limit on sunlight was turbidity so diatoms tended to grow best in shallow water. Suisun Bay and marsh were important locations for fish in the low-salinity zone because the Delta was already so channelized and deep (Cloern et al. 1983; Cole and Cloern 1984). Historically, the estuary was considered to have excess nutrients for diatom growth, so that nutrients were not limiting the base of the foodweb (Jassby et al. 2002). The third thing diatoms need to grow is time. Historical limits on this were water residence time and clam grazing rates (Cloern et al. 1983; Lopez et al. 2006).

There are two clam species that affect phyto- and zooplankton biomass. The freshwater *Corbicula fluminea,* which has been in the Delta and its tributaries since the 1940s, and the estuarine overbite clam *Potamocorbula amurensis*, which has been in the Bay and west Delta (but not tributaries) since 1986. Freshwater *Corbicula fluminea* can have foodweb impacts in shallow freshwater habitats with long water residence times (Lucas et al. 2002; Lopez et al. 2006).

Year to year variation in Delta outflow, especially during the spring and summer, led to year to year variation in plankton productivity because in wet years, outflow brought nutrients and organic carbon into the low-salinity zone, and in dry years, the elevated salinity let a marine clam (*Mya arenaria*) colonize Suisun Bay and eat the diatoms down to low levels (Knutson and Orsi 1983; Cloern et al. 1983). This lowered the production of opossum shrimp (*Neomysis*) that was a significant food source for native fish species at the time (Feyrer et al 2003). However, wet year plankton productivity did not extend to increases in Delta Smelt abundance (Stevens and Miller; Jassby et al. 1995). It was also shown through modeling and data analysis that water exports could affect foodweb productivity in the low-salinity zone by affecting rates of organic carbon/diatom subsidy from the Delta (Jassby and Cloern 2000).

By 1987, the overbite clam (*P. amurensis*) was established and resulted in a permanent source of loss to diatoms and copepod larvae. This resulted in rapid step-declines in the abundance of the most important historical foodweb components like diatoms, *Neomysis*, and *Eurytemora affinis* (Alpine and Cloern, 1992; Kimmerer and Orsi 1996). *Eurytemora affini*s was a major prey for both *Neomysis* and Delta Smelt (Knutson and Orsi).

Another hypothesis for the decline in foodweb components in the Delta is ammonium from wastewater treatment plants. Also around 1987, ammonium levels frequently rose above 4 micro-molar, which is a critical threshold that slows diatom growth (Wilkerson et al. 2006; Gilbert et al. 2011; Rev Fish Sci; Dugdale et al. 2016; Dugdale et al. 2007). Opponents of this hypothesis argue that but for the overbite clam, diatom populations would eventually build up enough biomass each year to use up the ammonium and then rapidly accelerate their growth by feeding on nitrate. The overbite clam recruitment increases in the late spring to early summer, and the clam population eats most of the diatom biomass so that there is no opportunity for sustaining enough diatoms long enough into the summer to consume the ammonium and reach the nitrate (Dugdale et al. 2012; Dugdale et al. 2016). Uncertainty exists in the scientific literature on this point, with Dugdale et al. (2016) stating that estimates of the overbite clam’s grazing rates are too high, while Kimmerer and Thompson (2014) defend overbite clam grazing rates and further state that other microscopic organisms also contribute to the grazing rate calculation.

In addition to directly reducing fish food, the overbite clam changed the overall ecosystem of the Delta. By repressing the production of historically dominant diatoms and zooplankton, several invertebrates invaded the Delta, causing changes in plant communities (Kimmerer and Orsi 1996; Bouley and Kimmerer 2006; Winder and Jassby 2011). Drought is also thought to have contributed to the species changes (Winder and Jassby 2011). The reduction in diatoms reduced and changed the copepod community, which is the majority of the diet of younger Delta Smelt (Slater and Baxter 2014).

After the overbite clam invasion came the copepod invasions of the late 1980s and early 1990s, which actually helped stem (but not recover from) what had been a major decline in their abundance (Winder and Jassby 2011). Prior to the overbite clam, Delta Smelt mostly ate the native copepod *E. affinis* from the time the larvae started feeding into the following fall (Moyle et al. 1992). The overbite clam suppressed *E. affinis*, leading to several nonnative copepods including *Pseudodiaptomus forbesi* taking over *E. affinis*’s niche in the ecosystem. *P. forbesi* then became the new main prey of larval and juvenile Delta Smelt (Nobriga 2002; Hobbs et al. 2006; Slater and Baxter 2014; Hammock et al. 2017).

P. forbesi production originates in the freshwater parts of the Delta (Merz et al. 2016; Kayfetz et al. 2017), including the Cache Slough-Yolo Bypass complex (Kimmerer et al. 2018). *E. affinis* had peak abundance near X2 (Orsi and Mecum 1986). However, now, when either *E. affinis* or *P. forbesi* are in the low-salinity zone, they are consumed by both the overbite clam and a predatory nonnative copepod that appeared in the 1990s (Kayfetz et al. 2017). Therefore, Delta Smelt food in the low-salinity zone has to be constantly replenished or subsidized from the Delta where the overbite clam and the predatory copepod are less abundant. Delta outflow can provide this food subsidy (Kimmerer et al. 2018a and Kimmerer et al. 2018b).

3.2 Status of the Species in the Action Area

California native freshwater fishes have declined as a result of the aforementioned anthropogenic influences and climate change, and have benefited by anthropogenic improvements as also discussed above. These species will likely continue to suffer population declines in the future in the action area due to existing stressors as well as long-term meteorological variability, sea level rise, and extreme weather events. Moyle et al. (2010) found that 83 percent of California's native freshwater fishes are extinct, endangered, or in decline. Fishes requiring cold water (<22°C) are particularly likely to go extinct (Moyle et al. 2013). For this consultation, the action area encompasses most if not all of the range of the species. Therefore, please refer to Chapter 2, Aquatic and Terrestrial Status of the Species and Designated Critical Habitat, for more information on the status of the species in their entire range and the action area, as well as for the status of terrestrial species.

Winter-Run Chinook Salmon: Escapements have declined from the levels that occurred in the 1960s and 1970s, several decades after dam construction. The run size in 1969 was approximately 120,000, whereas run sizes averaged 600 fish from 1990 to 1997 (Moyle 2002). Escapement subsequently increased after Red Bluff Diversion Dam operations were modified and temperature control shutters were installed on Shasta Dam (Reclamation 2008a). Winter-Run Chinook Salmon adult escapement data for the Sacramento River Basin from 1974 to 2016 are included in Figure 2.1-2 (CDFW 2018). Preliminary data show a decline since 2012 corresponding to severe drought conditions.

Spring-Run Chinook Salmon: The Central Valley drainage as a whole is estimated to have supported annual runs of Spring-Run Chinook Salmon as large as 600,000 fish between the late 1880s and 1940s (CDFG 1998). The Central Valley Spring-Run Chinook Salmon ESU has displayed broad fluctuations in adult abundance. Estimates of Spring-Run Chinook Salmon in the Sacramento River and its tributaries (not including the lower Yuba and Feather Rivers because CDFW's GrandTab does not distinguish between Fall-Run and Spring-Run Chinook Salmon in-river spawners, and not including the FRFH) have ranged from 1,404 in 1993 to 25,890 in 1982. Adult Spring-Run Chinook Salmon are predominantly found in tributaries to the Upper Sacramento River with the bulk of adults found in Mill, Deer, and Butte Creeks. Clear and Battle Creeks also contain regular runs of Spring-Run Chinook. Butte Creek has produced an average of two-thirds of the total production over the past 10 years (DWR and Reclamation 2017; CDFW 2018b). During recent years, Spring-Run Chinook Salmon escapement estimates (excluding in-river spawners in the Yuba and Feather Rivers) have ranged from 23,696 in 2013 to 8,112 in 2016 throughout the tributaries to the Sacramento River surveyed (CDFW 2018b).

Central Valley Steelhead: In the 1950s, Central Valley Steelhead populations numbered approximately 40,000 fish, while during the mid-1960s, the Steelhead population was estimated at 27,000 (DFG 1965, as cited in McEwan and Jackson 1996). McEwan and Jackson (1996) estimated the annual run size for Central Valley Steelhead to be less than 10,000 fish by the early 1990s. Steelhead returns have been lower than average (n = 1,480) on the American River during recent years with a return of 756 adults in 2016, 1,032 in 2017, and 513 in 2018. Furthermore, Steelhead redd counts on the American River have been lower than average (n = 122) with 53 redds counted in 2015, 10 in 2017, and 63 counted in 2018. A total of 25 Steelhead have been counted migrating upstream on the Tuolumne River from 2009 to 2018, according to the counting weir operated by FishBio, with a high of 16 counted in 2011. On the Stanislaus River 82 Steelhead have been counted passing the FishBio weir from 2011 through 2017 with an annual low of 10 (2011) and a high of 82 (2017). The Mokelumne River regularly passes Steelhead through the Woodbridge fish ladder.

Central Coast Steelhead: CDFG (1965) estimated a total of 94,000 adult CCC Steelhead spawned in the rivers and streams of this DPS during the mid-1960s, including 50,000 fish in the Russian River—the largest population within the DPS. Near the end of the 20th Century, the Steelhead population in the Russian River was believed to have declined substantially and local CDFG biologists estimated the wild run population in the Russian River Watershed was between 1,700 and 7,000 fish (McEwan and Jackson 1996). Abundance estimates for smaller coastal streams indicate low but stable levels with individual run size estimates for several streams (Lagunitas, Waddell, Scott, San Vicente, Soquel, and Aptos Creeks) of approximately 500 fish or less (62 FR 43937).

Green Sturgeon: Based on surveys of sites where adult North American Green Sturgeon aggregated in the upper Sacramento River from 2010 to 2015, the total number of adults in the Southern DPS population was estimated to be 2,106 ± 860 (Mora 2016 as cited in NMFS 2018).

Killer Whale: The historical abundance of Southern Resident Killer Whales was estimated based on genetic data to have ranged from 140 to 200 individuals (Krahn et al. 2002; NMFS 2008c). As of September 13, 2018, the Southern Resident Killer Whale population comprised 74 individuals. J pod has 22 members; K pod has 18; and L pod has 34 (Orca Network 2019).

Delta Smelt: Fisheries surveys indicate that Delta Smelt abundance has declined substantially in the San Francisco Estuary since the 1970s and has been relatively low during most years since 2004 (CDFW 2018a). The 2018 Delta Smelt 20-millimeter, TNS, and Fall Midwater Trawl (FMWT) indices were all zero or unable to be calculated, the lowest in history, which began with the FMWT in 1967 (CDFW 2018a).

Coho Salmon: Wild Coho Salmon in the Trinity River today are not abundant and the majority of the fish returning to the river are of hatchery origin. Data from the monitoring program at the Willow Creek Weir indicates the Trinity River portion of the Southern Oregon/Northern California Coast Coho Salmon ESU is predominately of hatchery origin (NMFS 2014; Reclamation and CDFW 2017).

Eulachon: There are no reliable historical abundance estimates for Eulachon. Available information (based largely on commercial fishery records) indicates that, starting in 1994, the southern DPS of Eulachon experienced an abrupt decline in abundance throughout its range (Gustafson et al. 2010). Since the 2010 listing, improved monitoring of Eulachon in several rivers detected general increases in adult spawning abundance, especially in 2013 to 2015 (NMFS 2016d). However, sharp declines in Eulachon abundance occurred in 2016 and 2017, likely in response to poor conditions in the north east Pacific Ocean (NMFS 2017).

3.3 Without-Action Analysis

Environmental baseline is a concept that both courts and agencies have struggled to address for ongoing actions, but it is important in understanding the status of the species and factors affecting species environment within the action area but without the proposed action. In a consultation on a new action, where the status quo does not include the effects of the action under consultation because the action has not yet taken place, a simple projection of the status quo can often represent the without-action scenario. However, in a consultation on an ongoing action, the without-action scenario cannot be defined by simply projecting the status quo into the future, because doing so would improperly include in the baseline the continued effects of the action under consultation. Instead, in a consultation on an ongoing action, such as operation of the CVP and SWP, the baseline analysis must project a future condition without the action. This allows for isolation of the effects of the action from the without-action scenario and, in turn, a determination of whether the action is likely to jeopardize listed species and/or destroy or adversely modify critical habitat. Thus, to provide a snapshot of the species' survival and recovery prospects without the proposed action, Reclamation is analyzing a without-action scenario. The without-action scenario entails no future operations of the CVP and SWP: in other words, no discretionary regulation of flows through the system, including, for example, storing and releasing water from reservoirs and delivering water otherwise required by contract.

Reclamation reviewed consultations on other ongoing water project actions to inform this analytical approach. Recently, in the USACE (2014) consultation with NMFS on the ongoing operation of the Daguerre Point and Englebright Dams, the agencies recognized that "effects attributable to the existence of a dam over which the agency has no discretion," as well as "to non-discretionary operations and maintenance should be included in the environmental baseline rather than attributable to the proposed action" (NMFS 2014). The biological opinion utilized a predominantly qualitative analysis to represent the environmental baseline, explaining how the existence of the dams as a baseline condition had multiple effects on the action area.

With this and other examples and the foregoing principles in mind, in the without-action scenario, Reclamation and DWR would not operate to meet the CVP and SWP's water rights permit obligations, or any environmental or contractual obligations. The without-action scenario is consistent with Reclamation's mandatory obligation to preserve the integrity of the facilities (per the Reclamation Safety of Dams Act P.L. 95-589). Described in more detail below, this condition essentially entails each of the CVP facilities simply passing inflows with no pumping or flow routing operations.

Reclamation considered multiple types of structural configurations and gate positions to identify a configuration to protect the long-term integrity of the structures in a without-action scenario, regardless of hydrology. One option considered was to set conditions at continuous low flow releases. However, while setting river release valves at a low flow release condition would result in storing water and maintaining a regular high storage, it would eventually result in overtopping of the dams under high inflow conditions, thereby threatening the structural integrity of the dams.

Review of the hydrologic and operational record identified a historical example where Reclamation and the SWP operated most major facilities with gates essentially fully open to pass inflow for the purpose of preserving the integrity of structures pursuant to the National Dam Safety Program. Reclamation and DWR selected a day within the historical period of record with high inflow, February 19, 1986, that resulted in releases that were intended to preserve the integrity of the structures. February 19, 1986, was during a flood event during which Reclamation and DWR were dealing with massive inflows at all major reservoirs, and were operating most dams for the purpose of passing flows. Flows below Shasta Dam and Folsom Dam were 76,900 cfs and 134,000 cfs, respectively, and the configuration was that the projects passed through all the runoff, constrained only by the structural reservoir and gate capacities, for the purpose of protecting the structural integrity of the facilities. Gates and barriers that could be damaged under high flow events, such as the DCC, were closed on this date.

The purpose of this historical example is to provide an empirical precedent for how Reclamation and DWR would model passing flows in a situation where the infrastructure is operating "without action," for the purpose of preserving the existence of the structures. This is not a separate alternative, but a historical snapshot that provides the basis for isolating the causal effects of operations and, thus, determining whether the effects of operations would jeopardize the species. Consistent with this historical example, the existence of the dams as a component of the without-action scenario is represented by setting the outlet works on storage facilities to release inflows in a way that ensures the structural integrity of the facilities in any hydrologic condition over the period of the proposed action. Generally, the analysis assumes the gate positions as they were on February 19, 1986; however some configurations may differ from the exact conditions on that day. For example, this scenario assumes Jones and Banks Pumping Plants exist but are turned off, which preserves the integrity of the pumps.

To establish the species' conditions absent operations, Reclamation modeled the hydrograph without the agencies' discretionary reshaping of flows. This approach represents the absence of the action under consultation using both quantitative tools and the qualitative analytical method from the Daguerre Point consultation. Based on the information available, this approach provides the most reasonable representation of the without-action component of the environmental baseline in this consultation.

While all demands continue to exist, the without-action scenario assumes that the CVP and SWP will not be operated to meet demands. However, water right holders having rights that pre-date the CVP and SWP would reasonably be expected continue to divert available supplies. Sacramento River Settlement Contractor, Exchange Contractor, Feather River Settlement contractor, holding contracts, and other senior water rights holder demands are based on senior water rights claimed by the contractors, and this without-action scenario assumes they would continue to divert water off of the rivers under those rights, to the extent water is available and they use their own facilities. This is what these senior water rights holders did previously in the absence of operation of the CVP and SWP. Water district operations and diversions for non-CVP or non-SWP water rights are thus assumed to continue in the environmental baseline.

In addition to the aforementioned senior water rights holders, refuges having pre-CVP rights would be expected to continue to divert available supplies. Sutter National Wildlife Refuge, Los Banos Wildlife Area, San Luis Unit of the San Luis National Wildlife Refuge, and East Bear Creek Unit of the San Luis National Wildlife Refuge all have riparian water rights and non-CVP diversions. Several other refuges have water rights as landowners within non-CVP and non-SWP water districts.

No regulations or RPAs tied to operation of the CVP or SWP would occur. Operations of non-CVP and non-SWP facilities would still occur as they are occurring today.

The specific hydrology of the 1986 date is not relevant; the operational model (CalSim) was run using the standard hydrologic period of record (1922–2003) and projected climate, with facilities configured (i.e., spillways, valves, etc.) mostly as they were on February 19, 1986, to represent preservation of the existing structures.

The detailed assumptions regarding hydrology, demands, facilities, and other criteria in the without-action scenario are explained below.

3.3.1 Trinity

Under the without-action scenario, Trinity and Lewiston Dam gates would be open to the extent necessary to protect Trinity and Lewiston Dams without exports to the Sacramento River watershed. Trinity Reservoir storage is assumed at current capacity (2,400 TAF). No transbasin diversion would occur through the Carr Power Plant to Whiskeytown Lake or through Spring Creek Tunnel to Keswick Reservoir.

Because the CVP and SWP would not operate under the without-action scenario, the Trinity River Restoration Program would not be implemented.

Whiskeytown Dam would pass flows with the river release valves set fully open, approximately 1,200 cfs. Additional flows would pass through the Glory Hole spillway. No flows would be diverted from Whiskeytown Reservoir through Spring Creek Tunnel.

3.3.2 Sacramento

Lake Shasta is assumed at current capacity (4,552 TAF). Under this scenario, it is assumed that Shasta Dam spillway gates would be fully open and river release valves would be set at the static level to pass approximately 80,000 cfs, or the amount necessary to preserve the integrity of the dam under this baseline, consistent with Reclamation's operation on February 19, 1986. The Shasta TCD would not operate under this scenario. All gates are assumed to be open.

Keswick Dam spillway gates are assumed to be open and valves would be set to pass a flow of approximately 80,000 cfs, which is the amount necessary to preserve the integrity of the dam under this scenario.

Because the CVP would not operate to meet project demands under this scenario, there would be no diversions for CVP water service contracts off of the Sacramento River. Sacramento River Settlement Contractors would still divert water off of the Sacramento River under their water rights and using their facilities.

Flood control weirs along the Sacramento River are assumed to be left in place; however, facilities to increase the frequency of floodplain inundation in the bypasses would not be operated.

Freeport Regional Water Project (FRWP) is assumed to be in place; however, CVP diversions through FRWP for delivery would not take to place under this without-action scenario. Deliveries based on other water rights would occur under this scenario.

Water transfers that do not rely on CVP and SWP facilities (e.g., NOD) could still occur.

3.3.3 Feather River

Lake Oroville has a capacity of 3,553 TAF. Under this scenario, spillway gates are assumed to be open and valves set to pass a flow of approximately 180,000 cfs, or the amount necessary to preserve the integrity of the Oroville Dam.

Oroville has a FERC license which is non-CVP and non-SWP; however, as the SWP would not be operating in the without-action scenario, Oroville release valves would be set at fixed condition similar to the other reservoirs.

Table A allocations would not occur, nor would Article 21 deliveries. Feather River Service Area settlement contractors would be expected to divert off of the Feather River when there is water available in the Feather River because they have non-CVP and non-SWP water rights.

The CVP and SWP would not be operated for CALFED Agreements under this scenario, including the Lower Yuba River Accord transfers. Operations of non-CVP facilities (i.e., Yuba) would still occur as they are occurring today.

3.3.4 American River

Folsom Reservoir has a capacity of 977 TAF. Under this scenario spillway gates are assumed to be open and valves set to pass a flow of up to 134,000 cfs, or the amount necessary to preserve the integrity of the Folsom Dam. The temperature shutters would be set in the raised position, allowing water to be released from the lowest portions of the reservoir. Reclamation would not operate the M&I Intake. Water agencies along the American River downstream of the dam would be expected to continue to divert under their own water rights as long as adequate flow is in the river.

Because the CVP and SWP do not operate in the without-action scenario, the American River Flow Management Standard would not apply.

Folsom South Canal would not deliver CVP water, and the Folsom South Canal gate would be closed to protect the structural integrity of the canal. However, water rights holders would be able to divert water from Folsom Reservoir and the American River through their own facilities.

Nimbus Dam spillway gates are open and set to pass all incoming flow.

3.3.5 Delta

The Jones and Banks Pumping Plants are turned off under the without-action scenario. Because in this scenario Reclamation and DWR are operating for protection of the facilities, pumps would be turned off to avoid breakage and destruction of the facility due to lack of maintenance and power. Moreover, because Reclamation's hydropower facilities would not be generating hydroelectricity, Reclamation would not have the power to run Jones Pumping Plant. CCF gates are assumed to be closed. Without filling of CCF, DWR would not run Banks Pumping Plant. No south of Delta pumping would take place. Delta outflow would be the result of the hydrology minus the other non-CVP/SWP facilities throughout the Sacramento and San Joaquin Basins. No south of Delta exports would occur for CVP, SWP, or non-project use. This includes no pumping for health and safety purposes or the facilitation of transfers.

Reclamation and DWR would not pump water into San Luis Reservoir. O'Neill Forebay gates would be left open, and associated pumping plants would be off.

Similar to other non-CVP water rights holders, under this scenario, CCWD is assumed not to divert CVP water, but would divert water based on their water rights through their own facilities.

No Delta barriers would be installed or operated because they are part of SWP operations. The south Delta agricultural barriers would not be in place, nor would the Head of Old River Barrier. However, the current Delta channel configuration would remain intact. In-Delta water users would continue to divert water for use and discharge drainage water.

The DCC would be left closed to prevent scouring around the facility and thus to preserve structural integrity to represent the system without operation of the CVP.

Suisun Marsh Salinity Control Gates would be left open year-round and other Suisun Marsh facilities would not be operated.

Water right permits assigned to Reclamation and DWR would not be applicable because the CVP and SWP would not be diverting water in California. Therefore, all D-1641 requirements including X2 standards, Delta water quality standards, real-time DCC operation, and San Joaquin flow standards are assumed not to be implemented under the without-action scenario. Without project water diversions, exports, or requirements, it is likewise assumed that there would be no implementation of the Coordinated Operations Agreement under this scenario.

3.3.6 Stanislaus River

New Melones Reservoir has a capacity of 2,400 TAF. Under this scenario, the lower level river outlets would be closed to preserve the integrity of the gate structure and the Flood Control and Industrial gate would be set fully open to pass a flow of up to an assumed 8,000 cfs. Inflow exceeding this capacity would be stored in the reservoir until the releases capacity could physically evacuate the water. The spillway would prevent overtopping of the dam and accordingly protect the structural integrity of the dam and related facilities. This spillway is not gated and would naturally flow should the reservoir reach that height.

3.3.7 San Joaquin River

Millerton Lake has a capacity of 520 TAF. Under the without-action scenario, the river release valves are assumed to be set to pass a flow of up to 15,000 cfs and the spillway gates are assumed to be open to pass the amount necessary to preserve the integrity of the Friant Dam.

Friant-Kern and Madera Canal gates and valves would be closed to protect the structures. Riparian water right holders below Friant Dam would be expected to divert from the San Joaquin River when water is available in the San Joaquin River. San Joaquin River Exchange Contractors would likewise be expected to divert off of the San Joaquin River when water is available. Friant Dam releases for the SJRRP would not be implemented in the without-action scenario.

3.3.8 Non-Operational Actions

The without-action scenario assumes that Reclamation is not operating the CVP for water supply, fish and wildlife, or any other authorized purpose, including CVPIA. Activities intended to protect, restore, and mitigate the effects of CVP and SWP operations would not occur, including but not limited to:

- CVPIA. These actions are in part reimbursable by beneficiaries of project operations. Without the action, Reclamation would have no revenue from project beneficiaries to offset costs. None of CVPIA would occur, including but not limited to:
    - (b)(1) – Reasonable measures to double anadromous fish in the Central Valley and address other identified adverse environmental impacts
    - (b)(12) – Clear Creek Restoration Program
    - (b)(13) – Spawning and Rearing Habitat on CVP Streams
    - (b)(21) – Anadromous Fish Screen Program
- Conservation Hatcheries
    - Livingston Stone National Fish Hatchery
    - U.C. Davis Fish Culture Center
- Monitoring Programs under IEP and CVPIA
    - (b)(1) – Federal Science
    - (b)(16) – Comprehensive Assessment and Monitoring Program
    - Bay Studies – Reclamation would not exercise its water rights
    - Delta Juvenile Fish Monitoring Program (DJFMP)
    - Environmental Monitoring Program (EMP)

  - Delta Status and Trend Monitoring Trawls (SKT, STN, FMWT)
- Watershed-Specific Restoration Programs
  - San Joaquin River Restoration Program
  - Trinity River Restoration Program

Reclamation has ongoing activities that would continue, including fish hatchery programs at Coleman and Nimbus, because these facilities were intended as mitigation for the construction of CVP dams. Because CVP dams exist in the without-action scenario, activities tied to the existence of the dam would also occur. The Battle Creek Restoration Program is a nonreimbursable activity that Congress has directed Reclamation to perform that is not tied to operation of the CVP and SWP, which would continue under the without-action scenario.