1 Introduction

In accordance with 40 CFR 1508.9, an environmental assessment (EA) serves to briefly provide sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement or a Finding of No Significant Impact. An EA shall include brief discussions of the need for proposal (Section 1), alternatives (Section 2), environmental impacts of the Proposed Action and alternatives (Section 3) and a listing of agencies and persons consulted (Section 4).

2 Alternatives Including the Proposed Action

This section considers two possible alternatives: the No Action Alternative and the Proposed Action. The No Action Alternative reflects future conditions without the Proposed Action and serves as a basis of comparison for determining potential impacts to the human environment that would result from implementation of the Proposed Action.

2.1 No Action Alternative

Under the No Action Alternative, Reclamation would not implement the proposed action outlined in this EA. Reclamation and the California Department of Water Resources (DWR) would not implement water supply actions and would operate to the 2008 Fish and Wildlife Service (Service) and 2009 National Marine Fisheries Service (NMFS) Biological Opinions (2008 & 2009 BOs) on the Coordinated Long-term Operation of the Central Valley Project (CVP) and State Water Project (SWP) (LTO) Reasonable and Prudent Alternative (RPA) actions. In 2015 Reclamation completed an Environmental Impact Statement (EIS) on the LTO (LTO EIS) with implementing the BOs as part of the No Action Alternative. In 2016, Reclamation signed the Record of Decision (ROD) on the LTO EIS. The LTO EIS and ROD form the basis for the No Action Alternative in this EA.

2.2 Proposed Action Alternative

Given the advancement in the scientific understanding of delta smelt (*Hypomesus transpacificus*) and salmonids (*Oncorhynchus tshawytscha, Oncorhynchus mykiss*, *Acipenser medirostris*) in the Delta since completion of the 2008 & 2009 BOs (Moyle et al 2016; Perry et al. 2016), the Proposed Action would implement near-term actions to maximize water deliveries and optimize marketable power generation consistent with applicable laws, contractual obligations, and agreements without creating additional adverse effects to listed species beyond those analyzed in the 2008 & 2009 BOs.

2.2.1 Old and Middle River Reverse Flows

Old and Middle River (OMR) reverse flow criteria are intended to protect listed fish species in the Delta from being entrained at C.W. "Bill" Jones and Harvey O. Banks Pumping Plants (export pumps). OMR flow provides a surrogate for how export pumping influences hydrodynamics in the south Delta based on two U.S. Geological Survey (USGS) flow measurement stations. Reverse OMR flow (negative) indicates a net flow from the Sacramento River towards the export pumps. Positive OMR flow indicates a net flow towards the ocean.

2.2.1.1 Existing Requirements

- 2008 Service BO (Actions 1-3): December to March by controlling OMR flows during vulnerable periods. Action 1 requires limit exports no more negative than -2,000 cfs for 14 days, with a 5-day running average no more negative than -2,500 cfs. Immediately after Action 1 begins Action 2, where flows will be no more negative than -1,250 to 5,000 cfs (depending on conditions). Based on temperature or biological triggers, Action 3 begins where flows will be no more negative than -1,250 to 5,000 cfs (depending on conditions), based on a 14-day running average and 5-day running average within 25 percent. Action 1 and 2 are designed to protect adult delta smelt migrating and residing in the Delta prior to spawning. Action 3 is to reduce direct mortality of larval and juvenile delta smelt.
- 2009 NMFS BO (Action IV.2.3): January 1 – June 15, exports must be managed to a level that produces a 14-day running average of the tidally filtered flow of -5000 cfs in Old and Middle River. More restrictive OMR beyond the -5000 cfs is also required based on First Stage and Second Stage Triggers, which depend on juvenile loss density dependence of fish per thousand acre-feet (Action IV.2.3).
- Water Infrastructure Improvements for the Nation (WIIN) Act: Section 4002 and 4003: Requires the Secretary of Interior and Secretary of Commerce to manage reverse flow in Old and Middle Rivers to maximize water supplies, subject to no additional adverse effects on listed species beyond the range of the effects anticipated to occur to the listed species for the duration of the smelt biological opinion or salmonid biological opinion, using the best scientific and commercial data available.

2.2.1.2 Current Science

Since completion of the 2008 & 2009 BOs, scientific advancements have improved the detection, identification, and monitoring of delta smelt and salmonids and led to a more reliable and accurate understanding of the distribution of fish to better inform the OMR action triggers described above. These advancements include:

- Particle Tracking Models (PTM): Two-dimensional and three-dimensional hydrodynamic modeling allows for particle tracking, used as an estimate of fish movement with flow in the Delta. Recent developments presented at the ePTM Workshop on August 18, 2017, show Particle Tracking models have improved to incorporate some swimming behaviors and make these mechanistic models more closely predictive of fish distribution (Perry 2017).
- Enhanced Delta Smelt Monitoring: The 2008 Service BO bases OMR action triggers on, in part, the Fall Mid-water Trawl (FMWT), Spring Kodiak Trawl (SKT), and delta smelt salvage at the Jones and Banks pumping plants, but available physical and biological monitoring data other than these may be used. Recent Enhanced Delta Smelt Monitoring (EDSM) also provides information to inform entrainment risk. As indicated in the 2008 Service BO, "abundances near the detection threshold of the sampling techniques makes it very difficult to draw reliable inferences about how many delta smelt there are, and where they are located".

- Enhanced Acoustic Tagging, Analysis and Real-time Salmon Monitoring: Reclamation is currently working to deploy a large acoustic network, Juvenile Salmon Acoustic Telemetry System (JSATS), tags and receivers to gather real-time data and retrospective modeling.
- Salmonid Rapid Genetics Protocol: Rapid Genetic Protocol (RGP) identifies ESA-listed fish species that fit within the older juvenile size-at-date criteria at the fish salvage facilities. Genetic analysis is an improvement on existing techniques that assume the fish species based solely on its size and the date. A pilot effort in 2015 established RGP to identify winter-run Chinook Salmon based on genetic results as opposed to their size (length-at-date). The program has been approved on an annual basis since 2015.
- DWR's Stipulation Study: found that "OMR flows tested and the conditions that occurred during the field study, there was little influence of OMR flows on steelhead tag movement during the study." (DWR 2014).
- Aqueous Environmental DNA (eDNA): Identification of eDNA allows determination of presence without direct observation of organisms (Turner 2015). Environmental DNA decomposes quickly, and degrades with UV radiation exposure – in less than a week (Matsui, 2001) or month (Dejean, 2011). Methods exist to obtain eDNA information even at low densities (Ficetola, 2008) and hard to capture fish (Nevers 2018). Scent dogs are currently being used and developed in several applications to identify rare aquatic species, including Giant Garter Snake in California (unpublished data referred to in Hansen, 2017), and quagga mussels in Lake Mead (DeShon, 2016).

2.2.1.3 Proposed Action

2.2.1.4 Addressing Uncertainty

2.2.2 San Joaquin Inflow to Export Ratio

The San Joaquin River inflow-to-combined export pumping ratio seeks to reduce the vulnerability of emigrating central-valley steelhead within the lower San Joaquin River to entrainment into the channels of the South Delta and at the export pumps. It is also possible that stimulation of transfers was another purpose of the San Joaquin Inflow to Export ratio, as in 2016 NMFS stated that they expected the survival benefits of a flow pulse would be greater than the effect of a reduced I:E.

2.2.2.1 Existing Requirements

- 2009 NMFS BO (Action IV.2.1): the San Joaquin River inflow-to-combined export pumping ratio, from April 1 through May 31 each year is restricted based on Water Year type classification for the watershed and a 14-day running average. For every 1,000 acre feet of San Joaquin River inflow, measured at Vernalis, equates to pumping 1,000 acre feet during critically dry years (1:1), 500 acre feet during dry years (2:1), 333.3 acre feet during below normal years (3:1), and finally 250 (4:1) acre feet during above normal and wet years. This was based on the historical data indicating that high San Joaquin River flows in the spring result in higher survival of outmigrating Chinook salmon smolts and greater adult returns 2.5 years later and that when the ratio between spring flows and exports increase, Chinook salmon production increases.

- Water Infrastructure Improvements for the Nation (WIIN) Act: Section 4001.(b)(7): Requires adopting a 1:1 inflow to export ratio for the increment of increased flow, as measured as a 3-day running average at Vernalis during the period from April 1 through May 31, that results from the voluntary sale, transfer, or exchange, unless the Secretary of the Interior and Secretary of Commerce determine in writing that a 1:1 inflow to export ratio for that increment of increased flow will cause additional adverse effects on listed salmonid species beyond the range of the effects anticipated to occur to the listed salmonid species for the duration of the salmonid biological opinion using the best scientific and commercial data available

2.2.2.2 Current Science

Reclamation, DWR, Collaborative Adaptive Management Team (CAMT), and others have completed several studies to better understand the relationship between San Joaquin River inflow, exports, and outmigrating survival of juvenile steelhead. Below is a brief list of studies that help inform this relationship and provide additional insights not available during the development of the 2009 NMFS BO.

- Multivariate San Joaquin River Chinook Salmon Survival Investigation, 2010 – 2013: The effect of changes in river stage were more complex, such that increases in river stage were associated with higher probability of entering Old River when river stage was high, and with lower probability of entering Old River when river stage was low. Survival was positively associated with San Joaquin River flow at Vernalis (VNS) when flows were low (2012, 2013), and negatively associated with Vernalis flow when flow was higher, up to about 11,000 cfs (2011). Lower variability in survival was accounted for by exports and I:E; survival was predicted to be higher for higher levels of CVP exports (< approximately 3,100 cfs), and lower for higher levels of I:E (< approximately 4.6). Survival was negatively associated with water temperature at Mossdale. The I:E ratio was not found to be associated with survival from the head of Old River to Chipps Island when route was accounted for (P=0.2728). Only the San Joaquin River flow at Vernalis and Old River flow just downstream of the head of Old River were associated with route optimization in these four years
- Technical Memorandum 86-68290-10-07- 2010 Effectiveness of a Non-Physical Fish Barrier at the Divergence of the Old and San Joaquin Rivers (CA): In 2010, a statistically higher percentage of Chinook salmon was deterred when the Old River Barrier was On (23.0%) than when it was Off (0.5%). Yet, 2010 deterrence with Bio-Acoustic Fish Fence On, was far lower in 2010 than it was in 2009 with Bio-Acoustic Fish Fence On (81.4%); and, this difference was significant (Kruskal-Wallis X2 = 7.5469, p = 0.0060). In 2009 there was significantly better deterrence (81.4%) than in 2010 (23.0%). However, high predation kept the Protection Efficiency down in 2009 (30.9). In 2010, there appeared to be lower predation. And, while 2010 deterrence was much lower than in 2009, the 2010 deterrence still made a highly significant contribution to survival (P) down the SJR.

- Zeug and Cavallo (2014) constructed models predicting juvenile Chinook salmon salvage and found that a ratio of flow to diversion (I:E) was less effective in predicting salvage than including flow and exports separately.
- February 2014 Stipulation Study: California Department of Water Resources: This study found that there is little evidence that altering OMR flows within the range that we examined in this study would alter fish behavior in a meaningful way. The observed limited influence of OMR flows evaluated in this study on steelhead tag behavior does not support real-time monitoring as an effective tool to protect salmonids from entrainment. (The study was limited by the amount of time for its preparation and the ranges of OMR flows tested).
- Reclamation's Six-Year Acoustic Telemetry Steelhead Study: indicated there was no apparent relationship between export rates and the probability of steelhead remaining in the San Joaquin River at the head of Old River. Preliminary results of the Six-Year Steelhead Acoustic Tag Study indicate as Vernalis flows increased, survival increased. Vernalis flows accounted for more of the variation in steelhead survival than the other variables: exports, inflow/export ratio, flow at the head of Old River, and OMR flows. "Exports did not appear to have an effect on route entrainment at the head of Old River, but flows, or rather, flow and stage did" (Reclamation 2013).
- 2014 South Delta Chinook Salmon Survival Study: Route survival in the San Joaquin River and in the Old River has been equally low. Analyses of acoustic tag study results between 2010 and 2014 suggest survival increases between Mossdale and the Old River junction (HOR) with higher San Joaquin River flow at VNS and higher standard deviation of VNS flow respectively. The probability of staying in the San Joaquin River at the Old River junction also increased with increased flows at Vernalis.

  The modeling results predicted survival to be higher between the HOR and Chipps Island in both the Old River and San Joaquin River routes with a higher 3-d RMS of Old River flow at Bacon Island. Survival was predicted to be higher in the Old River route than in the San Joaquin River route, but there was high uncertainty in the predictions. This suggests the amount of flow in Old River at Bacon Island is important to survival from the HOR to Chipps Island regardless of its flow direction and may be indicative of the influence of daily variation in tide and exports on flow in these routes. The flow in the Old River at Bacon Island is influenced by the CVP pumping rates and the operation of the gates at Clifton Court Forebay. Inflow and tides, as well as exports, affect the direction (upstream or downstream) of flows in Old River downstream of the facilities (e.g., Bacon Island and further downstream), complicating the understanding of how the RMS of flow in Old River at Bacon Island affects survival through the Delta.
- 2015 South Delta Chinook Salmon Survival Study: While there was no statistical difference in survival to Chipps Island via the two routes indicated by detection at SJD and OSJ, respectively (P=0.6239). Counter to Perry et al (2018) we found survival to be highest in the downstream reaches of the San Joaquin Delta (i.e. Jersey Point to Chipps Island) in 2015, with survival from Disappointment Slough or Old River at its mouth to Jersey Point somewhat lower. The lowest survival in 2015 was between Durham Ferry to Mossdale.
- Cavallo et al. 2015 found that increased exports only have the potential for minor changes in routing probabilities at junctions downstream from the Head of Old River. This suggests the

survival benefits from increased flows are greater than any negative effect of increased exports.

- Effects of Water Project Operations on Juvenile Salmonid Migration and Survival in the South Delta (2017): The Salmonid Scoping Team (SST) issued a two-volume report in 2017 that looked at hydrodynamics, juvenile migration behavior of salmon and steelhead, and survival of juvenile salmon and steelhead. The report, as well as DSM2 modeling, found exports do not measurably affect San Joaquin River flow at Vernalis. Neither Coded Wire Tag (CWT) nor acoustic tag (AT) data show a strong or consistent relationship between survival and exports (SST 2017).
- Multivariate San Joaquin River Chinook Salmon Survival Investigation: In 2017, Buchanan studied survival and route selection in the San Joaquin River and Delta including Old River and Chipps Island. Since implementation of the revised I:E regulations in 2012, through-Delta survival of San Joaquin River-origin Chinook has remained low, even in wet years, suggesting the current strategy is not producing the desired results (Buchanan et al. 2018).
- Perry et al. (2018) A multi-year analysis of flow-survival relationships in the North Delta revealed that flow effects were only significant in reaches that switch from bidirectional to unidirectional as flow increases, whereas flow has no detectable effect where flow is always bidirectional. The study concluded that increased total Delta survival in high flow years is a result of survival changing in these "transitional "reaches.

2.2.2.3 Proposed Action

2.2.2.4 Addressing Uncertainty

2.2.3 Low Salinity Zone Management

The low salinity zone (LSZ) in the Delta is indexed by X2, the 2 practical salinity unit (psu) isohaline, described in kilometers (km) from the Golden Gate. The 2008 Service BO uses X2 as a surrogate indicator of habitat for delta smelt. Delta Smelt fall occurrence is generally greatest in the LSZ and Delta Smelt generally moves upstream as the salinity field moves upstream (Sommer et al. 2011).

2.2.3.1 Existing Requirements

- 2008 Service BO RPA Action 4: provide sufficient Delta outflow to maintain average X2 for September and October no greater (more eastward) than 74 km in the fall following wet years and 81 km in the fall following above normal years. The monthly average X2 must be maintained at or seaward of these values for each individual month and not averaged over the two month period. In November, inflow must equal outflow in upstream reservoirs. Action 4 seeks to restore habitat quality for rearing juveniles in the estuary (Service 2008). The objective of Fall X2 is to "improve fall habitat for Delta Smelt by managing of X2 through increasing Delta outflow during fall when the preceding water year was wetter than normal. This will help return ecological conditions of the estuary to that which occurred in the late 1990's when smelt populations were much larger. Flows provided by this action are expected to provide direct and indirect benefits to Delta Smelt. Both the direct and indirect benefits to

Delta Smelt are considered equally important to minimize adverse effects" due to "significant adverse impacts of the long-term operation of the CVP and SWP on X2, which is a surrogate indicator of habitat suitability and availability for Delta Smelt in all years" (Service 2008).

2.2.3.2 Current Science

Numerous studies since the 2008 Service BO have been conducted on the Low Salinity Zone and delta smelt habitat and food. Below is a brief list of studies and models that describe food production for delta smelt and habitat needs that have improved understanding since the development of the 2008 Service BO.

- <u>Food production for Delta Smelt:</u> New science has indicated that the Delta may be food limited. In contrast to the relatively high productivity in the low salinity zone before clam invasions, the low salinity zone is now a net sink for phytoplankton, organic matter, and zooplankton (Jassby 2008; Kimmerer and Thompson 2014; Kayfetz 2014). Clam grazing, light limitation and ammonium inhibition all may contribute to limiting the accumulation of phytoplankton biomass (Brown et al, 2016). As Delta waters became clearer (Schoellhamer et al. 2016), and algae blooms became commonplace and invasive submerged aquatic vegetation became more pervasive, Nitrogen and Phosphorus may be more important for fish (Dahm et al 2016). Management of clams, nutrient ratios, and off-channel habitat subsidies may assist in food production in the Delta (Durand, 2015).
- <u>Interagency Ecological Program – Management, Analysis, and Synthesis Team's Fall Low Salinity Habitat (FLaSH) Report :</u> In 2011, the Interagency Ecological Program (IEP) Management, Analysis, and Synthesis Team (MAST) released the Fall Low Salinity Habitat (FLaSH) report to suggest studies to explore the importance of fall low-salinity habitat for delta smelt (Brown et al. 2014).
- <u>Grizzly Bay and Honker Bay are key regions:</u> As described in Bever et al (2016), Grizzly Bay and Honker Bay are key regions for delta smelt. Flow management is more effective in confined regions where existing flows are small, rather than broadly across the entire Delta (Brown et al. 2008). The current kilometer requirement for Fall X2 requires large amounts of water to achieve in the months of September and October.
- Distribution and Response: Mac Nally et al. 2010; Thomson et al. 2010; Miller et al. 2012 did not find a significant population-level response to changes in habitat associated with Fall X2. The overall distribution of delta smelt occurs over a broader range of salinity than solely the low salinity zone (Sommer and Mejia 2013; Moyle et al. 2016).
- <u>Abiotic Habitat Index:</u> Feyrer et al. 2011 and Brown et a. 2014 show effects from the location of X2 are not linear. The FlaSH report contains a lookup table between X2 and delta smelt fall abiotic habitat index (Brown et al. 2014; Feyrer et al. 2011).
- <u>Other Factors</u>: Rose et al, 2013 modeled population dynamics of delta smelt in good and bad years, looking at factors such as salinity, temperature, zooplankton densities, hydrodynamics, and eggs per one year olds. Results suggested that management actions must address multiple stressors and different life stages. Maunder and Deriso (2011) show that recruitment is based on a variety of factors act different life-stages.
- <u>UnTRIM San Francisco Bay-Delta model:</u> a three-dimensional hydrodynamic model of San Francisco Bay and the Sacramento-San Joaquin Delta to predict salinity, tidal flows, and

water levels throughout the Bay-Delta under a wide range of conditions (MacWilliams 2016).

2.2.3.3 Proposed Action

2.2.3.4 Addressing Uncertainty

2.2.4 Non-physical Barriers

Out-migrating salmonids enter the interior Delta through Georgiana Slough, where high rates of predation and entrainment occur. Non-physical barriers can prevent these salmonids from entering Georgiana Slough. Non-physical barriers do not restrict water flow, and therefore provide improved water quality to the interior delta, as well as unimpeded access for recreational boaters.

2.2.4.1 Existing Requirements

- 2009 NMFS BO (Action IV.1.3): consider engineering solutions to further reduce diversion of emigrating juvenile salmonids to the interior and southern delta, and reduce exposure to CVP and SWP export facilities.
- WIIN Act Section 4001: collaborate with DWR to install a deflection barrier at Georgiana Slough and the Delta Cross Channel Gate to protect migrating salmonids, consistent with knowledge gained from activities carried out during 2014 and 2015.

2.2.4.2 Current Science

Studies have shown fish concerns with the interior and southern Delta. DWR has completed studies on non-physical barriers to better understand entrainment at Georgiana Slough. Below is a brief description of these studies.

- Entrainment in the Interior Delta: Fish that enter the interior and southern Delta have lower survival than those using alternative routes (Perry et al 2015). Perry modeled and studied entrainment probabilities in Georgiana Slough and the Delta Cross Channel.
- DWR Bio-Acoustic Fish Fence studies: In 2011 and 2012, DWR completed studies on a bio-acoustic fish fence (BAFF) to study entrainment at Georgiana Slough. The BAFF provided approximately 66% (2011) and 50% (2012) effectiveness in keeping fish in the Sacramento River and not entrained into Georgiana Slough.
- DWR Floating Fish Guidance Structure studies: In 2014, DWR completed a similar study using a floating fish guidance structure (FFGS). At intermediate flows, there was about a 20% reduction of fish into Georgian Slough with the FFGS on. At higher and lower flows, benefits were negligible in the 2014 study.

2.2.4.3 Proposed Action

Based on the studies conducted by DWR, under the Proposed Action, Reclamation would work with DWR to install multiple non-physical barrier technologies at Georgiana Slough, including; bioacoustic fish fence (BAFF), floating fish guidance structure (FFGS), and infrasound fish fence (IFF). Additionally, Reclamation and DWR would investigate ways to encourage migration through Sutter and Steamboat Sloughs.

The barriers would be setup in an array of different combinations at Georgiana Slough, Steamboat Slough, Sutter Slough, and potentially the Delta Cross Channel gates. Steamboat Slough and Sutter Slough may provide increased survival for outmigrating salmonids when compared to the southern portion of the main-stem of the Sacramento River by Georgiana Slough.

2.2.4.4 Addressing Uncertainty

Monitor fish movement and route selection. Fish routing through the barriers would be monitored during installation of the barriers to evaluate effectiveness and route selection of the fish.

2.2.5 Increasing Salvage Efficiency

Reclamation and DWR work to improve the efficiency of salvage operations at the Tracy Fish Facility and the Skinner Fish Facilities. Listed species are salvaged at both Jones and Banks and trucked to the Delta for release.

2.2.5.1 Existing Requirements

- 2009 NMFS BO (Action IV.4.2): develop predator control methods for Clifton Court Forebay that will reduce salmon and steelhead pre-screen loss in Clifton Court Forebay to no more than 40 percent. A series of interim measures have also been required.

2.2.5.2 Current Science

DWR is currently implementing several interim measures to address predation in Clifton Court Forebay, including electrofishing in Clifton Court, weed removal around Clifton Court, dredging (https://www.water.ca.gov/Programs/Bay-Delta/Bay-Delta-Environmental-Compliance/Clifton-Court-Forebay-Dredging-In-Depth-Study), and a predatory fish removal study planned to start in 2018. DWR is also working on predator bioenergetics modeling to inform Clifton Court predation (https://www.water.ca.gov/Programs/Bay-Delta/Bay-Delta-Environmental-Compliance/Clifton-Court-Forebay-Predation-Study).

DWR conducted an electrofishing study from 2016 – 2018 to evaluate removal of predators from Clifton Court Forebay (https://www.water.ca.gov/Programs/Bay-Delta/Bay-Delta-Environmental-Compliance/Clifton-Court-Forebay-Predator-Reduction-Alternative---Electrofishing). It found that most of the predators in Clifton Court were smaller than the size allowed to be kept for fishing by the Department of Fish and Wildlife. As part of this study DWR removed approximately 7,000 pounds of predators from Clifton Court in 2017, and approximately 12,000 striped bass. Predators re-populate Clifton Court through the radial gates after removal efforts. These studies have also found:

- Neither increasing the bag limit for fishing nor building a fishing pier would help remove predators from Clifton Court as most of the predators are smaller than the DFW size limit.
- High pumping rates at the State Water Project improves survival when the radial gates are open.

At the federal Tracy Fish Collection Facility, the Tracy Fish Facility Improvement Program has continued to conduct scientific studies to improve the efficiency of the federal salvage facility to assist in meeting RPA Action IV.4.1. Most predation occurs before fish enter the holding tanks, and after fish are released into the Delta (Don Portz, personal communication). Based on 2009-2010 acoustic tag information, most fish in the Old River that survived to the end of the Delta had been salvaged from the federal water export facility on the Old River and trucked around the remainder of the Delta. (Buchanan, 2013).

- "In general, across both species tested, there tends to be an increase in facility efficiency as the number of Jones Pumping Plant (JPP) pumps in operation increase from 1 to 5, which suggests low pumping conditions may be more detrimental to salvage of Chinook salmon and steelhead. However, most statistical relationships suggesting improvements to salvage with increased pumping were weak due to low sample size, high variability, and the high number of fish that were assigned an unknown fate." (Karp, 2017: https://www.usbr.gov/mp/TFFIP/docs/tracy-reports/ttb-2017-1-juvenile-chinook.pdf)
- "The TFCF has some inefficiencies including predation, louver losses, and trash rack delay. Several observations noted here (residency of striped bass in the primary channel, departure of striped bass from the channel upstream of the trash rack, high rate of predation upstream of and within the facility, and delay of many of the salvaged experimental salmonids by the trash rack, over 75%), suggests opening the trash rack (either by removing panels or adding space between adjacent slats) in the spring when striped bass become migratory, would allow "resident" striped bass to move upstream and leave, and allow entrained fish an easier path to the fish diversion/collection system." (Karp, 2017: https://www.usbr.gov/mp/TFFIP/docs/tracy-reports/ttb-2017-1-juvenile-chinook.pdf)
- "The survival of juvenile Chinook Salmon through the lower San Joaquin River and Sacramento–San Joaquin River Delta in California was estimated using acoustic tags in the spring of 2009 and 2010. The focus was on route use and survival within two major routes through the Delta: the San Joaquin River, which skirts most of the interior Delta to the east, and the Old River, a distributary of the San Joaquin River leading to federal and state water export facilities that pump water out of the Delta. Survival through the southern (i.e., upstream) portion of the Delta was very low in 2009, estimated at 0.06, and there was no significant difference between the Old River and San Joaquin River routes. Estimated survival through the Southern Delta was considerably higher in 2010 (0.56), being higher in the Old River route than in the San Joaquin route. Total estimated survival through the entire Delta (estimated only in 2010) was low (0.05); again, survival was higher through the Old River. Most fish in the Old River that survived to the end of the Delta had been salvaged from the federal water export facility on the Old River and trucked around the remainder of the Delta." (Buchanan, 2013)
- "Results suggest predators are typically distributed evenly amongst all secondary channel components, and their biomass in the secondary channel is above what is typically observed in natural settings. Predators re-colonized the secondary channel within seven days, and, typically, more than one removal effort was necessary to assure the majority of predators were removed. The bioenergetics model indicates predators may have consumed nearly 14,000 fish over the modeled year. However, predator consumption would have been < 0.2 percent of total salvageable fish at the TFCF." "Results of our bioenergetics model suggest that predators in the secondary channel and bypass tubes at the TFCF have a minimal impact on total salvageable fishes." "Re-colonization data suggests, on average, the majority of catfish and striped bass re-colonized in the secondary channel within 4 days after a predator removal. Therefore, as mandated by the most recent NMFS Biological Opinion, we recommend that, at a minimum, single effort predator removals be completed on a weekly

basis when species of concern are present at the TFCF to minimize effects of predators on salvageable fish." (Sutphin, 2014: https://www.usbr.gov/mp//TFFIP/docs/tracy-reports/tracy-rpt-vol-51-predatory-fishes-in-tfcf-system.pdf)

- On average (± 95% confidence interval [CI]), striped bass residence time was 75.4 ± 30.6 d (range = 0.01–289.7 d). Prolonged striped bass residence time suggests velocities in the primary channel, bypass tubes, and secondary channel are not fast enough to guide striped bass into holding tanks; therefore, in order to remove these fish and reduce residence time within the facility, predator removal techniques should be further investigated, refined, and implemented at the TFCF. Results of this study suggest future predator removal efforts should be concentrated in the upper primary channel and secondary channel, which were the areas of the facility where the majority of acoustic detections occurred. (Wu, 2014: https://www.usbr.gov/mp//TFFIP/docs/tracy-reports/tracy-rpt-vol-46-use-of-acoustic.pdf)

2.2.5.3 Proposed Action

2.2.5.4 Addressing Uncertainty

3 Affected Environment and Environmental Consequences

This EA is tiered (40 CFR 1502.20 and 1508.28) from LTO EIS and 2016 ROD and hereby incorporates it by reference. Analyses included in this EA are based on the information and analyses included in the LTO EIS. The LTO EIS and ROD are available online at:

https://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=21883

This section describes the affected environment and evaluates the environmental consequences that may occur with implementation of the Proposed Action and the No Action Alternative. Potential impacts on several environmental resources were examined and found to be minimal or nonexistent. Impacts to these resources would be similar to those in the LTO EIS.

3.1 Water Resources

This section analyzes the affected environment of the Proposed Action compared to the No Action Alternative in order to determine the potential impacts and cumulative effects to the water resources.

3.2 Biological Resources

This section analyzes the affected environment of the Proposed Action compared to the No Action Alternative in order to determine the potential impacts and cumulative effects to biological resources, such as delta smelt and salmonids.

4 Consultation & Coordination

Several Federal laws, permits, licenses and policy requirements have directed or guided the NEPA analysis and decision making process included in this EA. This section describes agencies and or persons consulted in development of this EA.