UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall, Suite 5-100
Sacramento, California 95814-4700

Refer to NMFS No: WCRO-2019-03737

June 10, 2020

William Ness
Senior Project Manager
California South Section
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Nielson Drain Fish Barrier Project

Dear Mr. Ness:

Thank you for your letter of December 10, 2019, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Nielson Drain Fish Barrier Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402; 84 FR 45016).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.

Based on the best available scientific and commercial information, the biological opinion concludes that the proposed project is not likely to jeopardize the continued existence of the federally listed threatened Central Valley spring-run Chinook salmon evolutionarily significant unit (ESU) (*Oncorhynchus tshawytscha*) and threatened California Central Valley (CCV) steelhead distinct population segment (DPS) (*O. mykiss*), and is not likely to destroy or adversely modify CCV steelhead designated critical habitat. For the above species, NMFS has included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project. NMFS also reviewed the likely effects of the proposed action on EFH, pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)), and concluded that the action would adversely affect the EFH of Pacific Coast salmon. Therefore, we have included the results of that review in Section 3 of this document.

Please contact Monica Gutierrez at (916) 930-3657, or via email at Monica.Gutierrez@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

A. Catherine Marcinkevage

Cathy Marcinkevage
Acting Assistant Regional Administrator
California Central Valley Office

Enclosure

cc: 151422-WCR2019-SA00565

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Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Nielson Drain Fish Barrier Project

NMFS Consultation Number: WCRO-2019-03737

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Central Valley spring-run Chinook Salmon ESU (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	N/A (Does not occur within the action area for this species)	N/A
California Central Valley steelhead Distinct Population Segment (DPS (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By: A. Catherine Marcinkevage

Cathy Marcinkevage
Acting Assistant Regional Administrator

Date: June 10, 2020

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1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1. Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the California Central Valley Office.

1.2. Consultation History

In November 2016, Turlock Irrigation District (TID) notified NMFS that Central Valley fall-run Chinook salmon (*Oncorhynchus tshawytscha*) were encountered in TID's canal systems, a false migration pathway with no available route to return to the mainstem San Joaquin River. A rescue effort was coordinated between California Department of Fish and Wildlife (CDFW) and TID to rescue 36 adult salmon. CDFW and TID trucked and released the rescued salmon to the Merced River.

In the fall of 2017, TID notified NMFS that more fall-run Chinook salmon were observed entrained into the canal system. However, due to the difficulty locating and isolating the fish, they were not able to rescue the fish from the canal system. Although it was initially unclear where the salmon had entered the TID canal system, it was later observed that they had entered through both the Harding Drain Culverts and the Nielson Drain Culverts.

Between October 2017 to September 2019, ongoing e-mail correspondence between TID, NMFS, CDFW, and U.S. Fish and Wildlife Service (USFWS) regarding flow regimes, run timing, legal aspects of fish barriers, fish barrier design, installation, maintenance, and reporting occurred.

Between February 2019 and August 2019, regular coordination meetings occurred between TID, NMFS, and CDFW to discuss proposed project details and fish barrier options.

On December 10, 2019, NMFS received an initiation package from the U.S. Army Corps of Engineers (Corps) for the formal section 7 consultation for the Nielson Drain Fish Barrier project. Formal consultation was initiated on this date.

On February 11, 2020, NMFS received an updated biological assessment from the Corps due to changes to the project description and construction activities. This resulted in an update to the initiation date for the proposed project to this date.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). Under the MSA, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

We considered whether or not the proposed action would cause any other activities that would have consequences on Central Valley spring-run Chinook salmon or California Central Valley steelhead or their critical habitat and determined that it would not. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur.

The Corps is the lead Federal action agency for this project to permit the proposed activities under the jurisdiction of Section 404 of the Clean Water Act. The applicant, TID, is proposing to install a fish barrier at the Nielson Drain Culvert. The project site is located approximately 5.5 miles east of the community of Crows Landing, and situated at the western terminus of Nielson Drain where it connects to Hilmar Drain that flows out towards the San Joaquin River, in Merced County (Figure 1). The Nielson Drain has two parallel, 42-inch-diameter, corrugated metal pipes and discharge into an approximately 100-foot-long cove, off the Hilmar Drain Extension, which flows approximately 3,900 feet to the main channel of the San Joaquin River. The culverts have flapper valves attached to the outlet end of the pipeline. The Nielson Drain flows as a result of agricultural runoff. Water in the Nielson Drain enters the eastern portion of the project area through two culverts under a levee. Each culvert has a flap gate on the waterside of the levee. The culverts outfall into a cut on the bank of the Hilmar Drain.

Water flows into the Hilmar Drain approximately 120 feet to the west. There is no indication that the Nielson Drain is a realigned naturally occurring channel. Its route does not follow a natural drainage pattern on older topographic maps where the natural topography is still evident. Downstream of the culverts, the ordinary high water mark (OHWM) of the Nielson Drain is the same elevation as the Hilmar Drain and there is no barrier between them. The OHWM of the Nielson Drain was identified in the field based on destruction of terrestrial vegetation and scour. The Nielson Drain, downstream of the culverts, was excavated in the OHWM of the Hilmar Drain. The reach of the Hilmar Drain in the project area is a natural drainage.

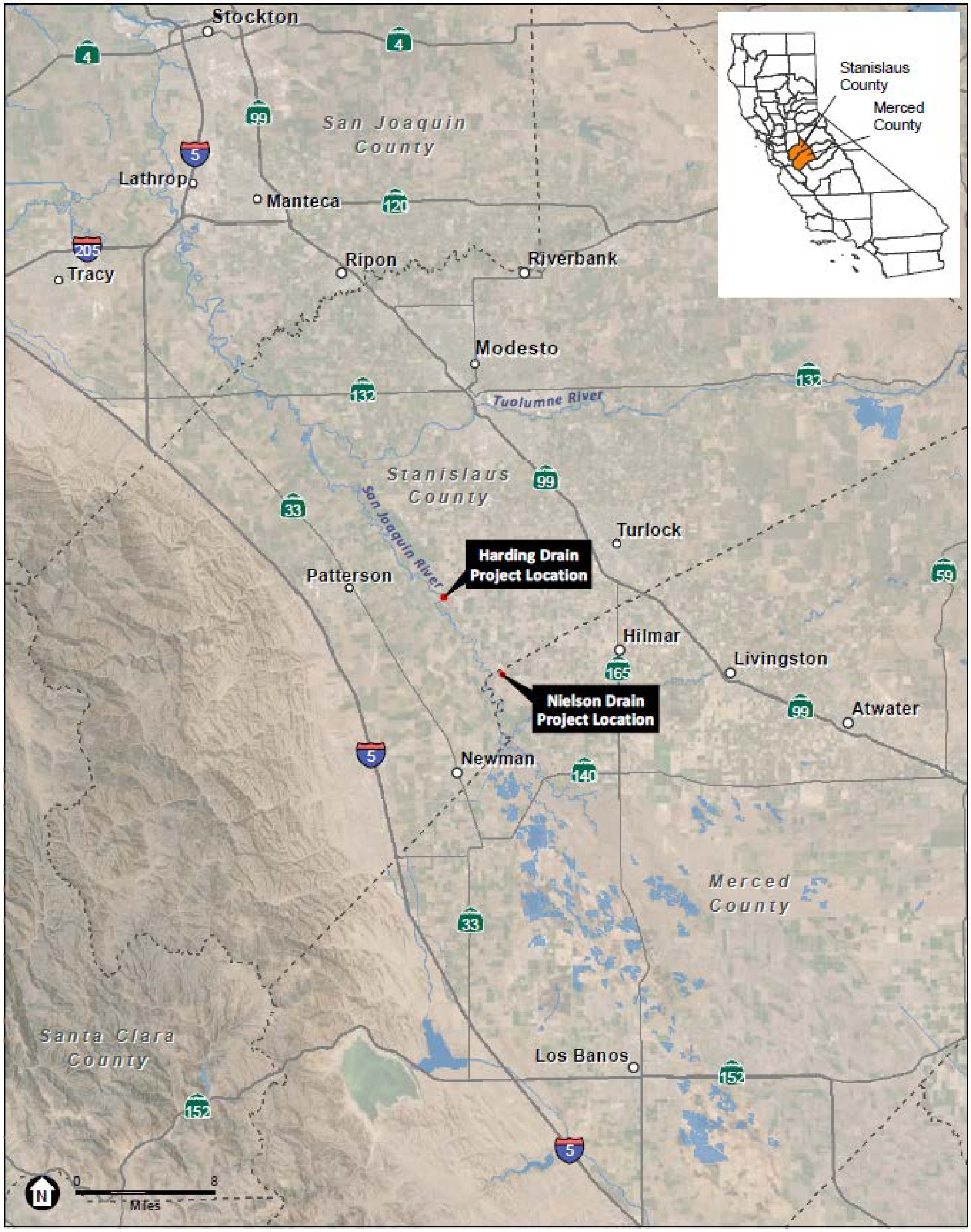

Figure 1. Project site location for Nielson Drain (TID 2020).

The barrier at the Nielson Drain would be a swinging picket weir structure. This structure would be a roughly 10-foot-long by 33-foot-long, reinforced concrete box installed at the existing outlets of the 42-inch culverts that run through the Central Valley Flood Protection Board levee to maintain drainage from the Nielson Drain to the Hilmar Drain Extension. The downstream side of the concrete box would contain three 10-foot-long, adjustable aluminum weirs with a swinging panel of geogrid hung from above on the downstream side of each weir to at least 12 inches below the crest. Should debris pass over the weir from upstream, the geogrid would be pushed out and away from the face of the weir, allowing the debris through while still preventing fish from entering the box. The central 10-foot-long weir would be an aluminum slide gate that could be fully opened at the end of the spawning season for fall/late fall-run Chinook salmon.

The fish barrier would consist of a cast-in-place reinforced concrete box surrounding the existing drain outlet, with a long-crested weir on the downstream side of the box. The concrete walls and long-crested weir would be formed in place and poured using a concrete pumper truck. A galvanized steel beam and walkways would be positioned above the weir using a crane. Geogrid would be hung from the beam down in front of the concrete weir. The geogrid would have a rubber J-seal frame for edge protection. Bypass gates would be installed in the weir to allow water to pass unimpeded through the box when necessary. A permanent vehicle path would not be constructed for the Nielson Drain, as the existing levee slope would be sufficient to allow for construction and maintenance access.

Rock riprap would be placed on the downstream side of the fish screen foundation to mitigate scour. The contractor would place 12-inch angular rock rip rap at least 18 inches in thickness in the disturbed areas up to 40 feet downstream of the new fish screen and on the adjacent disturbed embankment slopes. Gravel and/or soil would be used to fill voids in rip-rap that may otherwise provide structure for nonnative predatory fish.

Equipment required for construction of the fish barrier base may include an excavator to dig trenches, a small bulldozer to level the ground surface, a flatbed truck to provide material to erect forms, concrete delivery trucks, and a concrete pumping truck. Alternately, should soil conditions allow, an excavator would dig the trenches and a precast foundation would be purchased and delivered to the site on a flatbed truck and placed using a crane. The equipment to be used in support of construction of the proposed action would be based on the requirements of the project's construction contractor. Specific equipment likely to be necessary is identified below. However, TID anticipates that the following or similar types of equipment would be used on-site:

- Excavator
- Bulldozer
- Dump trucks
- Forklift
- Crane
- Flatbed truck
- Concrete pumper truck
- Concrete delivery trucks
- Roller screed

Construction is anticipated to require four weeks. The sequential major construction activities associated with the Proposed Action are as follows:

- Mobilize construction equipment and materials
- Clear and grub the site
- Construct cofferdam
- Excavate for the fish barrier foundation
- Install the fish barrier foundation
- Install fish barrier walls, gates, walkways, and screen panels

Dewatering Activities

To isolate the project site from Hilmar Drain and the San Joaquin River, and to facilitate dewatering for construction, a temporary earthen cofferdam will be constructed on the river side of the levee and the levee slide gate shut off valves will be closed to prevent upstream drainage from entering the construction area. Dewatering will be accomplished with drainage pumps moving residual or seepage water from the construction area to adjacent ground on the landside of the levee to the adjacent agricultural fields. Water will soak into the agricultural field or will evaporate. Water will not drain back into Hilmar or Nielson Drains or the river. Construction of the temporary earthen cofferdams may include the use of an excavator to create temporary berms using imported soil or if water levels allow (at 6 feet or below), an AquaDam may be used.

The cofferdam is approximately 70 feet long and 10 feet wide at the top, which will require approximately 280 yards of material if an earthen dam is created. The earthen cofferdam will be removed following construction. Prior to installation, sediment/turbidity curtains would be deployed to protect water quality on the San Joaquin River side of the work activities. Fill material used onsite will be clean native soil, free from any organic material or rocks larger than 3-inches in diameter compacted to 90% relative compaction in no greater than 12 inch lifts.

If the AquaDam is used, it would be filled with onsite water using portable pumps with intakes equipped with a 1.75-millimeter mesh screen. The dam would be positioned at the top of the bank and unrolled into the water. The dam would then be connected to pumps and fill the inner chambers with water. The dam would conform the bottom of the drain preventing water seepage. Removal would occur in reverse and water would be pumped out of the dam. If feasible, water will be pumped to the landside of the levee in the same manner as the nuisance water as described in the dewatering section above. However, due to the large amount of water being stored in the AquaDam, pumping to land may be infeasible and water may be required to be pumped back into the drain. If so, turbidity would be monitored per the conservation measures and the sediment/turbidity curtain would remain in place to prevent turbid water from reaching the river.

Operations and Maintenance

Operation of the Nielson Drain fish barrier would involve opening the slide gates during very large flows into the Nielson Drain, to maximize the capacity of the drain and prevent inundation of adjacent fields (August 1 through February 28).

Large flows through the Nielson Drain may raise the upstream water level enough that the pumps turn on or the upstream field-drain culverts into the Nielson Drain become submerged. In this case, the bypass slide gate in the weir would be opened to lower the drain's water to their normal operating levels. Hydraulic calculations show that these large flows should exceed 60 cubic feet per second (cfs) before the slide gate needs to be opened. Based on historic daily averages for the last 5 years, this scenario only occurred 1.2 percent of the time.

During the March 1 through July 31 period, gates at the fish barrier will remain open. It is unlikely that salmonids will be entrained during this time. In the District's experience, during the irrigation season (March 1 through October 31) the Hilmar Drain Extension does not attract fish up to the Nielson Drain outlet due to several factors as described below:

a. The observably wide, slow, and shallow profile of the water in the Hilmar Drain Extension to the San Joaquin River.

b. The water levels in the San Joaquin River, which are typically not high enough to reach the outlet of the Nielson Drain during these months.

c. The low spills into the Nielson Drain which result from the desire of irrigators and the District to efficiently utilize water with minimal losses.

If a salmonid is indeed entrained into the system, the District will coordinate with CDFW and NMFS on a resolution on the operations of the new fish barrier or implementation of another alternative available at that time. In the event that listed salmonids are encountered in the canals during this period, the District will reevaluate their operations so that fish no longer become entrained in the future.

District staff currently visually monitor the Nielson Drain on a daily basis during the irrigation season to watch for emergent issues including any fish inside the channel. The District intends to continue these activities as part of the operations of the fish barrier and will notify CDFW and NMFS if any listed fish species are encountered inside the drain.

The Nielson Drain fish barrier would require monthly maintenance visits to manually brush the hanging screen. The fish barrier would be cleaned using a long handled bristle brush to brush the clinging debris from off the swinging picket barrier. If debris that is not buoyant enough to make it over the weir that gets caught inside the structure box, the District will briefly halt flows by shutting the isolation gates in the levee and have a pumper truck pump out the box. Any material not removed by the pumper truck will be hand lifted out of the drained box before putting the fish barrier back into service. As the box will be isolated from Hilmar Drain Extension by the fish barrier, no impacts will occur to listed fish. Other maintenance requirements include periodic inspection and cleaning or replacement of downstream riprap that was placed as erosion control around the foundation. In addition, vegetation abatement would be conducted periodically to keep the area around the fish barrier clear.

Construction of the fish barrier would require the alteration, or loss, of shaded riverine aquatic habitat (SRA). The loss of SRA would result in the loss of foraging habitat and refugia for listed salmonids. Since the acreages are below the 1/10th of an acre threshold required for mitigation for the Corps, no compensatory mitigation will be required for the project site. However, the project proponent will replace trees on-site at a 1:1 ratio to compensate for loss of SRA habitat. The area of loss for SRA would be 0.05 acres for Nielson Drain. Additional information regarding revegetation is described in the conservation measures section below.

Conservation Measures

The following are minimization measures that will be incorporated into the proposed project:

1) Conduct Worker Awareness Training - Before implementing site-specific actions, the action agency will conduct an education program for all TID and contractor employees regarding the federally listed species that may be encountered in the project areas of the action, and required practices to avoid and protect those species. A NMFS-appointed representative will be identified to answer employees' and contractors' questions regarding avoidance and protection measures to be addressed in a timely manner.

2) Develop and Implement a Spill Prevention Plan - The construction contractor will prepare and implement a spill prevention plan for the project. The plan will describe measures to minimize the risk that hazardous materials (e.g., oils, transmission and hydraulic fluids, cement, fuel) will enter the San Joaquin River or contaminate adjacent riparian areas.

3) Develop and Implement a Hazardous-Materials Management and Spill Response Plan - TID will ensure that any hazardous materials are stored in the staging areas. An impermeable membrane will separate the materials from the ground, and the hazardous materials will be contained to prevent the discharge of pollutants to groundwater and runoff water. In case of a leak or spill of fuel or hazardous waste, TID will:

    a. Stop work immediately.

    b. In compliance with state and Federal laws and regulations, arrange for repair and cleanup of the leak or spill by qualified individuals at the time of occurrence, or as soon as it is safe to do so, according to the spill response plan.

    c. Notify regulatory agencies of any leak or spill within 24 hours.

    TID will properly contain and dispose of any unused or leftover hazardous products off-site. Hazardous materials, such as vehicle fuels and lubricants, will be used and stored in designated staging areas away from the waterways, according to applicable local, state, and federal regulations. Construction vehicles and equipment will be checked daily for leaks and will be maintained properly to prevent contamination of soil or water from external grease and oil or from leaking hydraulic fluid, fuel, oil, and grease.

4) Manage Sedimentation and Turbidity - Turbidity curtains will be installed or similar methods will be used during in-channel work to control silt and sediments, where needed.

5) Conduct Biological Monitoring - A qualified biological monitor will be present during vegetation clearing, grubbing, pruning, and trimming at the site at the start of construction, midway through construction, and at the close of construction to monitor implementation of conservation measures and water quality.

6) Revegetation - Disturbed habitats will be revegetated with native seeds and plants reflective of the target plant community where feasible following construction.

7) Inspections of the Nielson Fish Barrier - To inform uncertainties regarding the function of the Nielson fish barrier, TID will perform daily inspections during the first year's fall-run Chinook salmon spawning season (August 1 to February 28) when the slide gates are closed. The inspections will include the following steps:

   a. Completion of a daily inspection log including (in table form) date and time, water depth on the river side of the fish barrier and on the Nielson Drain side of the facility, debris present on the exclusion screen (including any sediment retained in the screen openings or in the sump of the facility), fish present and where they are located, operational adjustments made, maintenance performed and the observer's name.

   b. Should fish be found impinged on the exclusion screen or entrained behind it, CDFW and NMFS should be contacted within 24-hours.

   c. Submission of a copy of the inspection log at the end of the season to NMFS who will review the operations and make recommendations for the next year's operation, if any.

8) To minimize risk of stranding adult CV spring-run Chinook salmon and CCV steelhead, as well as unlisted Central Valley fall/late fall-run Chinook salmon, into the TID canal system or within the fish barrier infrastructure, TID or its contractor will develop and implement a fish monitoring plan. The plan will include the following steps:

   a. The TID canal system and the area immediately upstream of each fish barrier structure will be visually monitored for presence of stranded adult salmonids on a bi-weekly basis throughout the year, and during high-flow events that may increase the risk of stranding.

b. If any stranded salmonids are observed, NMFS and CDFW Sacramento Offices will be immediately contacted. The purpose of the contact is to allow the agencies to review the activities resulting in fish stranding and to determine if additional protective measures are required.

c. If stranded salmonids are found alive, TID staff will work with CDFW to identify a rescue strategy. If CDFW determines that a fish rescue is necessary, CDFW will work with TID staff to plan and implement a rescue of stranded fish from the TID canal system back into the San Joaquin River. If fish become entrained into the system, TID will reevaluate their operations and fish barrier design.

9) In-channel construction activities that could affect designated critical habitat for anadromous salmonids will be limited to the low-flow period to minimize the potential for adverse effects on federally listed anadromous salmonids during their emigration period. In-water work would occur June 15 – September 15 in critical, dry, or below normal water year types, and July 1 – September 15 in above normal or wet water year types.

10) To reduce the potential for fish stranding or minimize the potential for harm during cofferdam dewatering activities, TID or its contractor will develop and implement a fish rescue plan. The plan will include the following steps:

a. Before closure of the cofferdam, a qualified fisheries biologist will conduct seining within the cofferdam using a small-mesh seine to direct and move fish out of the cofferdam area. Upon completion of seining, the entrance to the cofferdam will be blocked with a net to prevent fish from entering the cofferdam isolation area before the cofferdam is completed.

b. Once the cofferdam is completed and the area within the cofferdam is closed and isolated, additional seining will be conducted within the cofferdam to remove any remaining fish, if present.

c. Once all noticeable fish have been removed from the isolated area, portable pumps with intakes equipped with a 1.75-millimeter mesh screen will be used to dewater to a depth of 1.5 to 2 feet.

d. A qualified biologist will implement further fish rescue operations using electrofishing and dip nets. All fish captured will be placed in clean 5-gallon buckets and/or coolers filled with San Joaquin River water, transported downstream of the construction area, and released back into suitable habitat in the San Joaquin River with minimal handling.

e. After all fish have been removed using multiple seine passes (as necessary), portable pumps with screens (see above) will be used for final dewatering. NMFS, USFWS, and CDFW will be notified at least 48 hours before the fish relocation.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the regulatory definition of "destruction or adverse modification," which means "a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation of critical habitat for CCV Steelhead uses the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.

- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species, or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

This biological opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The biological opinion also examines the condition of critical habitat throughout the designated area, evaluates the value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that value for the conservation of the listed species.

Table 1. Description of species, current Endangered Species Act (ESA) listing classifications, and summary of species status.

Species	Listing Classification and Federal Register Notice	Status Summary
Central Valley spring-run Chinook salmon ESU	Threatened, 70 FR 37160; June 28, 2005	According to the NMFS 5-year species status review (NMFS 2016b), the status of the CV spring-run Chinook salmon ESU, until 2015, has improved since the 2010 5-year species status review. The improved status is due to extensive restoration, and increases in spatial structure with historically extirpated populations (Battle and Clear creeks) trending in the positive direction. Recent declines of many of the dependent populations, high pre-spawn and egg mortality during the 2012 to 2016 drought, uncertain juvenile survival during the drought are likely increasing the ESU's extinction risk. Monitoring data showed sharp declines in adult returns from 2014 through 2018 (CDFW 2018).

Species	Listing Classification and Federal Register Notice	Status Summary
California Central Valley steelhead DPS	Threatened, 71 FR 834; January 5, 2006	According to the NMFS 5-year species status review (NMFS 2016a), the status of CCV steelhead appears to have remained unchanged since the 2011 status review that concluded that the DPS was in danger of extinction. Most natural-origin CCV populations are very small, are not monitored, and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to natural-origin fish. The life-history diversity of the DPS is mostly unknown, as very few studies have been published on traits such as age structure, size at age, or growth rates in CCV steelhead.

Table 2. Description of critical habitat, Listing, and Status Summary.

Critical Habitat	Designation Date and Federal Register Notice	Description
California Central Valley steelhead DPS	September 2, 2005; 70 FR 52488	Critical habitat for CCV steelhead includes stream reaches of the Feather, Yuba and American rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks, the Sacramento River, as well as portions of the northern Delta. Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the ordinary high-water line. In areas where the ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. PBFs considered essential to the conservation of the species include: Spawning habitat; freshwater rearing habitat; freshwater migration corridors; and estuarine areas. Although the current conditions of PBFs for CCV steelhead critical habitat in the Central Valley are significantly limited and degraded, the habitat remaining is considered highly valuable.

2.2.1. Global Climate change

One major factor affecting the rangewide status of the threatened and endangered anadromous fish in the Central Valley and their aquatic habitats is climate change. Lindley et al. (2007) summarized several studies (Hayhoe et al. 2004, Dettinger et al. 2004, Dettinger 2005, VanRheenen et al. 2004, Knowles and Cayan 2002) on how anthropogenic climate change is expected to alter the Central Valley, and based on these studies, described the possible effects to anadromous salmonids. Climate models for the Central Valley are broadly consistent in that temperatures in the future would warm significantly, total precipitation may decline, the variation in precipitation may substantially increase (i.e., more frequent flood flows in large rain events and also critically dry years with little to no precipitation), and snowfall would decline significantly (Lindley et al. 2007). Climate change is having, and will continue to have, a negative impact on salmonids throughout the Pacific Northwest and California (Battin et al. 2007).

Warmer temperatures associated with climate change reduce snowpack and alter the seasonality and volume of seasonal hydrograph patterns (Cohen et al. 2000). Central California has shown trends toward warmer winters since the 1940s (Dettinger and Cayan 1995). An altered seasonality results in runoff events occurring earlier in the year due to a shift in precipitation falling as rain rather than snow (Roos 1991, Dettinger et al. 2004). Specifically, the Sacramento River Basin annual runoff amount for April to July has been decreasing since about 1950 (Roos 1987, 1991). Increased air temperatures influence the timing and magnitude patterns of the hydrograph.

The magnitude of snowpack reductions is subject to annual variability in precipitation and air temperature. The large spring snow water equivalent (SWE) percentage changes, late in the snow season, are due to a variety of factors including reduction in winter precipitation and temperature increases that rapidly melt spring snowpack (VanRheenen et al. 2004). Factors modeled by VanRheenen et al. (2004) show when the melt season shifts to earlier in the year, it will result in a large percent reduction of spring SWE (up to 100 percent in shallow snowpack areas). Additionally, an air temperature increase of 3.8°F (2.1°C) is expected to result in a loss of about half of the average April snowpack storage (VanRheenen et al. 2004). The decrease in spring SWE (as a percentage) is forecast to be greatest in the region of the Sacramento River watershed, at the north end of the Central Valley, where snowpack is shallower than in the more southern San Joaquin River watersheds.

Modeling also indicates that stream habitat for cold-water species declined with climate warming and remaining suitable habitat may only exist at higher elevations (Null et al. 2013). Climate warming is projected to cause average annual stream temperatures to exceed 24°C (75.2°F) slightly earlier in the spring, but notably later into August and September. The percentage of years that stream temperatures exceeded 24°C (for at least 1 week) is projected to increase, so that if air temperatures rise by 6°C, most Sierra Nevada rivers would exceed 24°C for a certain number of weeks every year.

Based on an analysis of an ensemble of climate models and emission scenarios and a reference temperature from 1951 to 1980, the most plausible projection for warming over Northern

California is 4.5°F (2.5°C) by 2050 and 9°F (5°C) by 2100, with a modest decrease in precipitation (Dettinger 2005). Because the runs are restricted to holding and spawning at low elevations because of impassable rim dams, if climate warms by 9°F (5°C), it is questionable whether any Central Valley Chinook salmon populations can persist (Williams 2006). Chinook salmon in the Central Valley are currently at the southern limit of their range, and warming would shorten the period in which the low elevation habitats used by naturally producing Chinook salmon are thermally acceptable. This should particularly affect fish that emigrate as fingerlings, mainly in May and June, and especially those in the San Joaquin River and its tributaries.

As stream temperatures warm due to climate change, the growth rates of juvenile steelhead could increase in some systems that are currently relatively cold, but potentially at the expense of decreased survival due to higher metabolic demands and greater presence and activity of predators. Stream temperatures that are currently marginal for spawning and rearing may become too warm to support wild steelhead populations. Central Valley salmonids are highly vulnerable to drought conditions. The increased in-river water temperature resulting from drought conditions is likely to reduce the availability of suitable holding, spawning, and rearing conditions in Clear Creek and in the Sacramento, Feather, and Yuba rivers. During dry years, the availability of thermally suitable habitats in CV spring-run Chinook salmon river systems without major storage reservoirs (e.g., Mill, Deer, and Butte creeks) is also likely to be reduced. Multiple dry years in a row could potentially devastate Central Valley salmonids. Prolonged drought due to lower precipitation, shifts in snowmelt runoff, and greater climate extremes could easily render most existing CV spring-run Chinook salmon habitat unusable, either through temperature increases or lack of adequate flows. The droughts that occurred from 2007 to 2009, and from 2012 to 2015, were likely factors in the recent widespread decline of all Chinook salmon runs (including CV spring-run Chinook salmon) in the Central Valley (Williams et al. 2011, Michel et al. 2015). The increase in the occurrence of critically dry years also would be expected to reduce salmonid abundance, as, in the Central Valley, low flows during juvenile rearing and outmigration are associated with poor survival (Kjelson and Brandes 1989, Baker and Morhardt 2001, Newman and Rice 2002). In summary, climate change is expected to exacerbate existing stressors and pose new threats to Central Valley salmonids, including CCV steelhead, by reducing the quantity and quality of inland habitat (Lindley et al. 2007).

In addition to habitat effects, climate change may also impact Central Valley salmonids through more indirect ecosystem effects. For example, warmer water temperatures would likely increase the metabolism of warm water predators, reducing the survival of juvenile salmonids as they traverse the freshwater system to reach the Pacific Ocean (Vigg and Burley 1991). And an analysis by Lindley et al. (2009) that examined fall-run Chinook salmon found that unusual oceanic conditions led to poor growth and survival for juvenile salmon entering the ocean from the Central Valley during the spring of 2005 and 2006 and most likely contributed to low returns in 2008 and 2009. This reduced survival was attributed to weak upwelling, warm sea surface temperatures, low prey densities, and poor feeding conditions in the ocean. When poor ocean conditions are combined with drought conditions in the freshwater environment, the productivity of salmonid populations can be significantly reduced. Although it is unclear how these unusual ocean conditions affected CCV steelhead, it is highly likely they were adversely impacted by a combination of poor ocean conditions and drought (NMFS 2011).

In summary, observed and predicted climate change effects are generally expected to be detrimental on a large scale to all of the species addressed in this biological opinion. Unless offset by improvements in other factors, the status of the species and the functionality of their critical habitat is likely to continue to decline over time. The climate change projections referenced above cover the time period between the present and approximately 2100. While there is uncertainty associated with climate projections, uncertainty that increases over time, the direction of predicted climate change trends is relatively certain (McClure et al. 2013).

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The Nielson Drain project site is located where the Nielson Drain meets the Hilmar Drain Extension in northern Merced County, just south of the border with Stanislaus County (Figure 2). The nearest paved road is Central Avenue, with access to the project site provided by the dirt road on top of the drain levee. The Nielson Drain Culverts—two parallel 42-inch-diameter, corrugated metal culverts that pass through the levee to the Hilmar Drain Extension leading to the San Joaquin River—are located in the levee on the east side of the Hilmar Drain Extension.

The action area includes the 100-foot-long cove of Neilson Drain Culverts that discharge into Hilmar Drain that flows approximately 3,900 feet into the main channel of the San Joaquin River. The Hilmar Drain and San Joaquin River confluence is part of the action area as this is the area where listed fish enter and access the Nielson Drain outlet. In addition, this area represents the area of anticipated impacts from the proposed project activities.

CV spring-run Chinook salmon and CCV steelhead have the potential to occur in the action area during the proposed action's period of construction and long-term operations. Designated critical habitat occurs in the action area for CCV steelhead. CV spring-run Chinook salmon critical habitat does not occur in the action area and will not be discussed further in this biological opinion because it will not be affected by the action.

Figure 2. Proposed Action Area (TID 2020).

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

2.4.1. *Occurrence of Listed Species and Critical Habitat in the Action Area*

The federally listed anadromous species that use and occupy the action area are migrating adult and juvenile CCV steelhead and CV spring-run Chinook salmon, and the action area is within designated critical habitat for CCV steelhead. The San Joaquin River mainstem in the action area is the primary migration corridor for both adult and juvenile CV spring-run Chinook salmon and CCV steelhead life stages spawned in the San Joaquin River Basin to the Delta, which contains important rearing habitat for juveniles. The life history strategies of CCV steelhead are extremely variable between individuals, and it is important to take into account that CCV steelhead are iteroparous (i.e., can spawn more than once in their lifetime) (Busby et al. 1996), and therefore may be expected to emigrate back down the system after spawning. All anadromous fish that utilize the San Joaquin River Basin must also pass by this location at least twice to successfully complete their life histories.

2.4.1.1. *CCV steelhead migration timing*

Migrating adult CCV steelhead are present from July to March through the San Joaquin River, with highest abundance between December and January (Table 1). Small, remnant populations of CCV steelhead are known to occur in the Stanislaus River and the Tuolumne River and their presence is assumed on the Merced River due to proximity, similar habitats, historical presence, and otolith chemistry studies verifying at least one steelhead in the limited samples collected from the river (Zimmerman et al. 2008). Outmigrating juveniles from these tributaries would have to pass through the action area during their emigration to the ocean. Juveniles would emigrate from February through June, with the core of their migration occurring March through May.

The proposed construction period for the proposed action is from June 15 to September 15 in Critical, Dry, or Below Normal water year types, and July 1 to September 15 in Above Normal or Wet water year types. These windows will avoid the peaks of adult CCV steelhead and juvenile migration periods in the San Joaquin River. Presence of adults for both CV spring-run and CCV steelhead could be present during the opening of the slide gates (March 1 through July 31).

Table 1. The temporal occurrence of (a) adult and (b) juvenile CCV steelhead at locations in the Central Valley.

(a) Adult Migration

Time Period and Location	Early Jan	Late Jan	Early Feb	Late Feb	Early Mar	Late Mar	Early Apr	Late Apr	Early May	Late May	Early Jun	Late Jun	Early Jul	Early Jul	Early Aug	Late Aug	Early Sep	Late Sep	Early Oct	Late Oct	Early Nov	Late Nov	Early Dec	Late Dec
[1]Sacramento R. at Fremont Weir	L	L	L	L	L	N	N	N	N	N	N	L	L	L	L	M	H	H	H	M	L	L	L	L
[2]Sacramento R. at RBDD	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M	M	H	M	L	L	L	L
[3]Mill & Deer Creeks	M	M	H	M	M	L	L	L	L	L	L	L	N	N	N	N	N	N	M	H	H	L	L	L
[4]Mill Creek at Clough Dam	L	L	M	H	M	M	L	L	N	N	N	N	N	N	N	N	N	L	M	H	H	H	M	M
[5]San Joaquin River	H	H	M	M	L	L	N	N	N	N	N	N	L	L	L	L	M	M	M	M	M	M	H	H

(b) Juvenile Migration

Time Period and Location	Early Jan	Late Jan	Early Feb	Late Feb	Early Mar	Late Mar	Early Apr	Late Apr	Early May	Late May	Early Jun	Late Jun	Early Jul	Early Jul	Early Aug	Late Aug	Early Sep	Late Sep	Early Oct	Late Oct	Early Nov	Late Nov	Early Dec	Late Dec
[1,2]Sacramento R. near Fremont Weir	L	L	L	L	M	M	M	M	M	M	M	M	L	L	L	L	L	L	M	M	M	M	L	L
[6]Sacramento R. at Knights Landing	H	H	H	H	M	M	M	M	L	L	L	L	N	N	N	N	N	N	N	N	L	L	L	L
[7]Mill & Deer Creeks (silvery parr/smolts)	L	L	L	L	M	H	H	H	H	H	L	L	N	N	N	N	N	N	L	L	L	L	L	L
[7]Mill & Deer Creeks (fry/parr)	L	L	L	L	L	L	M	M	H	H	H	H	N	N	N	N	N	N	M	M	M	M	M	M
[8]Chipps Island (clipped)	M	M	H	H	M	M	L	L	L	L	N	N	N	N	N	N	N	N	N	N	N	N	L	L
[8]Chipps Island (unclipped)	M	M	M	M	H	H	H	H	H	H	M	M	L	L	N	N	N	N	N	N	N	N	L	L
[9]San Joaquin R. at Mossdale	N	N	L	L	M	M	H	H	H	H	L	L	N	N	N	N	N	N	L	L	N	N	N	N
[10]Mokelumne R. (silvery parr/smolts)	L	L	M	M	M	M	H	H	H	H	M	M	M	M	N	N	N	N	N	N	N	N	N	N
[10]Mokelumne R. (fry/parr)	N	N	L	L	L	L	L	L	M	M	H	H	M	M	N	N	N	N	N	N	N	N	N	N
[11]Stanislaus R. at Caswell	L	L	M	M	H	H	M	M	M	M	L	L	N	N	N	N	N	N	N	N	N	N	N	N
[12]Sacramento R. at Hood	L	L	H	H	H	H	H	H	H	H	H	N	N	N	N	N	N	N	N	N	L	L	L	L

Sources: [1](Hallock 1957); [2](McEwan 2001b); [3](Harvey 1995); [4]CDFW unpublished data; [5]CDFG Steelhead Report Card Data 2007; [6]NMFS analysis of 1998-2011 CDFW data; [7](Johnson and Merrick 2012); [8]NMFS analysis of 1998-2011 USFWS data; [9]NMFS analysis of 2003-2011 USFWS data; [10]unpublished EBMUD RST data for 2008-2013; [11]Oakdale RST data (collected by FishBio) summarized by John Hannon (Reclamation) ; [12](Schaffter 1980).

Darker shades indicate months of greatest relative abundance.
Relative Abundance: H = High M = Medium L = Low N = Not Present

2.4.1.2 CCV steelhead critical habitat

The PBFs for CCV steelhead critical habitat in the action area include freshwater migration corridors and rearing habitat. The freshwater migration utility in the action area is of fair quality, since flows of the lower San Joaquin River are typically of adequate magnitude, quality, and temperatures to support adult and juvenile migration. Most importantly, this section of CCV steelhead critical habitat serves as a migration corridor for all of the adults and juveniles produced and supported by the San Joaquin River and its major tributaries.

During the summer months, however, migration and rearing habitat is of poor quality due to unsuitable water temperatures and low flows. In addition, rearing habitat is poor as the San Joaquin River is leveed and channelized. The floodplain habitat that would otherwise normally exist has been largely removed near the action area due to the high levees, which limits the value of the area for juvenile rearing. Migratory habitat for adults and juveniles would likely not be impacted because the project footprint is off of the main channel and would not become an obstacle to migration functionality.

Even though the habitat has been substantially altered and its quality diminished through years of human actions, its value remains high for the CCV steelhead DPS. A large fraction of the CCV steelhead smolts originating in the San Joaquin River Basin will likely pass downstream through the action area within the San Joaquin River mainstem channel, particularly if there is a fish barrier at the Head of Old River (placed from April to May) to prevent smolt entrance into that route. Likewise, adults migrating upstream to spawn are likely to pass through the action area within the mainstem of the San Joaquin River to reach their upstream spawning areas in the San Joaquin River basin. Therefore, it is of critical importance to the long-term viability of the CCV steelhead to maintain a functional migratory corridor and freshwater rearing habitat through the action area to sustain the Southern Sierra Diversity Group, and provide the necessary spatial diversity needed to aid in recovery.

2.4.1.3 CV spring-run Chinook salmon

Typical CV spring-run Chinook salmon life history patterns have adults returning to freshwater basins in March through June (Table 2), depending on the water year. Capitalizing on springtime runoff, adults travel to holding pools, where available, to over-summer. Adults arrive in an immature state and hold over the summer months and develop gonads until ready to spawn in late summer through mid-autumn.

CV spring-run Chinook salmon are considered functionally extirpated from the Southern Sierra Nevada diversity group despite their historical abundance in the San Joaquin River Basin (NMFS 2016). There have been observations of low numbers of spring-time running fish returning to major San Joaquin River tributaries that exhibit some typical spring-run life history characteristics (Franks 2014). While the genetic disposition of such fish remains inconclusive, the implementation of reintroduction of the CV spring-run Chinook salmon into the San Joaquin River has begun and has resulted in approximately 200,000 juvenile spring-run Chinook salmon (NMFS 2020). These juveniles are imprinted in the upper San Joaquin River mainstem below Friant Dam, and are expected to return as adults when volitional passage is achieved and river conditions are suitable (NMFS 2016). In May 2019, a total of 114 adult CV spring-run Chinook salmon broodstock cultivated at the San Joaquin River Conservation and Research Facility were released by CDFW into Reach 1A of the San Joaquin River. While the exact amount of adult and juvenile CV spring-run Chinook salmon migrating through the action area is unknown, the population numbers mentioned above is a good indicator of their presence in the action area.

Based on known CV spring-run Chinook salmon life history timing and limited information of use of the San Joaquin River Basin, and limited information available from SJRRP observations, returning adults are expected to travel through the action area from March through June. Juveniles are expected in the action area November through May as they emigrate through the action area to the Delta. Exact timing of CV spring-run Chinook salmon use of the action area would depend on in-river water being adequate in quality and temperature. The proposed construction period for the Project's actions in the action area is from June 15 to September 15 in Critical, Dry, or Below Normal water year types, and July 1 to September 15 in Above Normal or Wet water year types. Therefore, the likelihood that either adult or juvenile life history stages of CV spring-run would overlap with this timing is very small. However, the opening of the gates from March 1 through July 31 would overlap with adult migration timing and could entrain and strand adults during operations.

Table 2. The temporal occurrence of adult (a), adult holding (b), adult spawning (c), and juvenile (d) Central Valley spring-run Chinook salmon in the Sacramento River.

(a) Adult Migration

Time Period and Location	Early Jan	Late Jan	Early Feb	Late Feb	Early Mar	Late Mar	Early Apr	Late Apr	Early May	Late May	Early Jun	Late Jun	Early Jul	Early Jul	Early Aug	Late Aug	Early Sep	Late Sep	Early Oct	Late Oct	Early Nov	Late Nov	Early Dec	Late Dec
Sac. River basin[a,b]	N	N	N	N	M	M	M	M	H	H	H	H	M	M	M	M	M	M	L	N	N	N	N	N
Sac. River Mainstem[b,c]	N	L	L	L	M	M	M	M	M	M	M	M	M	M	L	L	N	N	N	N	N	N	N	N
Mill Creek[d]	N	N	N	N	L	L	M	H	H	H	H	M	M	L	L	N	N	N	N	N	N	N	N	N
Deer Creek[d]	N	N	N	N	L	L	M	H	H	H	H	M	M	N	N	N	N	N	N	N	N	N	N	N
Butte Creek[d,g]	N	N	L	M	M	M	M	H	H	H	H	M	L	N	N	N	N	N	N	N	N	N	N	N
(b) Adult Holding[a,b]	N	N	N	L	L	M	M	H	H	H	H	H	H	H	H	M	M	L	L	N	N	N	N	N
(c) Adult Spawning[a,b,c]	N	N	N	N	N	N	N	N	N	N	N	N	N	N	L	M	H	H	M	L	N	N	N	N

(d) Juvenile Migration

Time Period and Location	Early Jan	Late Jan	Early Feb	Late Feb	Early Mar	Late Mar	Early Apr	Late Apr	Early May	Late May	Early Jun	Late Jun	Early Jul	Early Jul	Early Aug	Late Aug	Early Sep	Late Sep	Early Oct	Late Oct	Early Nov	Late Nov	Early Dec	Late Dec
Sac. River Tribs[e]	M	M	M	M	M	M	N	N	N	N	N	N	N	N	N	N	N	N	M	M	H	H	H	H
Upper Butte Creek[f,g]	H	H	H	H	M	M	M	M	M	M	L	L	N	N	N	N	N	N	L	L	L	L	H	H
Mill, Deer, Butte Creeks[d,g]	H	H	H		M	M	M	M	M	M	L	L	N	N	N	N	N	N	L	L	L	L	L	L
Sac. River at RBDD[c]	H	H	L	L	L	L	L	L	L	N	N	N	N	N	N	N	N	N	N	N	H	H	H	H
Sac. River at KL[h]	M	M	M	M	H	H	H	H	M	M	N	N	N	N	N	N	N	N	N	N	M	M	H	H

Sources: [a]Yoshiyama et al. (1998); [b]Moyle (2002); [c]Myers et al. (1998); [d]S. T. Lindley et al. (2004); [e]CDFG (1998); [f]McReynolds, Garman, Ward, and Plemons (2007); [g]P. D. Ward, McReynolds, and Garman (2003); [h]Snider and Titus (2000)

Note: Yearling spring-run Chinook salmon rear in their natal streams through the first summer following their birth. Downstream emigration generally occurs the following fall and winter. Most young-of-the-year spring-run Chinook salmon emigrate during the first spring after they hatch.

Darker shades indicate months of greatest relative abundance.
Relative Abundance: H = High M = Medium L = Low N = Not Present

2.4.2 Factors Affecting Listed Species and Critical Habitat in the San Joaquin River

The action area encompasses a small portion of the area utilized by ESA-listed species. Many of the factors affecting these species in the action area are considered the same as throughout their range, as discussed in section 2.2 *(Rangewide Status of the Species and Critical Habitat)* and section 2.4 *(Environmental Baseline)* of this biological opinion. Specifically, levee armoring and channelization, alteration of river flows and timing, reduction of riparian corridors and SRA vegetation and the introduction of point and non-point contaminants are the major issues, and are incorporated here by reference. Other factors that impact listed species and critical habitat specific to the action area are discussed below.

2.4.2.1 San Joaquin River Basin water resources

The San Joaquin River is the longest river in California, covering 366 miles, but is considered California's second largest river according to average total annual flow (the Sacramento River being the largest). The San Joaquin River has an average mean flow of 6 million acre feet per year compared to the Sacramento River's 18 million acre feet (Reclamation, 2016). It drains the central and southern portions of the Central Valley and joins the Sacramento River near the center of California to form the Delta, the largest estuary on the west coast of the United States. The San Joaquin River is primarily fed (receiving two thirds of its water) by the melting snowpack of the Sierra Nevada Mountains.

The primary storage reservoir on the San Joaquin River is the Friant Dam, which was completed in 1944. Friant Dam created Millerton Lake/Reservoir and can hold more than 500 thousand acre feet in water storage. Friant Dam diverts Sierra Nevada snowmelt water into two canals, the Friant-Kern Canal and the Madera Canal, both of which primarily support the irrigation needs of agriculture as part of the Central Valley Project (CVP). Except for releases to manage floods and to meet the requirements of riparian water rights holders, the entirety of San Joaquin River's flow is impounded by the Friant Dam and directed into the canals for distribution. From the high degree of water management of the San Joaquin River, in a typical year, all of the San Joaquin River's flows were allocated to water users. Historically, the river ran dry annually for a 40-mile stretch, only connecting to the Delta during flood releases from Millerton. In recent years, mandated river restoration flows have reconnected the San Joaquin River to the Delta (see section 2.4.2.3, *The San Joaquin River Restoration Program*).

2.4.2.2 San Joaquin River diversions

The Patterson Irrigation District (PID) Fish Screen Intake is located near the City of Patterson, in Stanislaus County, California. The project is located upstream of West Stanislaus Irrigation District (WSID) project, on the west bank of the San Joaquin River, between Merced and Tuolumne rivers. The diversion consists of seven pumps, six vertical turbine pumps and one horizontal centrifugal pump, with a combined pumping capacity of 195 cfs. PID's original pump station facility used an unscreened intake that had the ability to entrain listed anadromous fish as they migrated through the area. The existing pump station facility could not be retrofitted with a fish screen that would comply with NMFS and the California Department of Fish and Wildilfe's (CDFW) fish screen criteria. As a result, PID constructed a new 195 cfs pump station diversion with a screen with reinforced concrete that is 144 feet long supported on 422 steel piles. The fish screen includes ten stainless steel, high profile bars.

Banta Carbona Irrigation District (BCID) Fish Screen and Fish Bypass System is located near the City of Tracy and is downstream from the San Joaquin River and Stanislaus River confluence. The diversion has a 250 cfs capacity. The fish screen facility consists of a V-shaped screen located within the leveed canal close to the river and 18 panel screens installed vertically in a V configuration with 9 panels to a side. Each panel is 6 feet 1-inch tall and 11-feet 6-inches wide. Fish pass the screens and are pumped through a Hidrostal fish pump to the fish return pipeline on the north levee. This pipeline returns fish back to the river downstream from the diversion point. The positive barrier fish screen is fully consistent with the fish screen criteria of the regulatory agencies including NMFS, CDFW, and the USFWS.

2.4.2.3 The San Joaquin River Restoration Program

The SJRRP is the result of a settlement that was reached in 2006 on an 18-year lawsuit between federal agencies, the Natural Resources Defense Council, and the Friant Water Users Authority (SJRRP, 2009). The settlement is based on two goals: 1) Restore and maintain fish populations in "good condition" in the mainstem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally-reproducing and self-sustaining populations of salmon and other fish; and 2) Reduce and avoid adverse water supply impacts to all Friant Division long-term contractors caused by the interim and restoration flows provided for in the settlement.

As previously identified, some critical recovery actions identified in the NMFS recovery plan are achieved through the implementation of the settlement goals. Though this settlement and the SJRRP actions are restricted to the restoration area, the San Joaquin River mainstem from Friant Dam to the Merced River, the achievement of volitional fish passage from the Delta to the base of Friant Dam would increase the use of the San Joaquin River mainstem within the action area of this project by both adult and juvenile salmonid migration.

2.4.3 NMFS Salmon and Steelhead Recovery Plan Action Recommendations

The NMFS Recovery Plan that includes both CCV steelhead and CV spring-run Chinook salmon (NMFS, 2014) identifies recovery goals for the San Joaquin River Basin populations whose range includes the proposed action area. Recovery efforts focus on addressing several key stressors that are vital to both CCV steelhead and CV spring-run Chinook salmon: (1) elevated water temperatures affecting adult migration and holding; (2) low flows and poor fish passage facilities, affecting attraction and migratory cues of migrating adults; and (3) possible catastrophic events (e.g., fire or volcanic activity).

2.4.3.1 CCV Steelhead DPS

The NMFS Recovery Plan (NMFS, 2014) strategy for CCV steelhead lists the San Joaquin River's eastside tributaries (Stanislaus, Tuolumne, and Merced rivers) as Core 2 populations (meaning these watersheds have the potential to support viable populations, due to lower abundance, or amount and quality of habitat) downstream of major dams, and as candidates to reach viable population status if reintroduced upstream of the dams, and lists the San Joaquin River, below Friant Dam, as a candidate to reach viable population status.

2.4.3.2 CV Spring-run Chinook salmon

The NMFS Recovery Plan (NMFS, 2014) indicates that for CV spring-run Chinook salmon, re-establishing two viable populations in the San Joaquin River Basin would be necessary for recovery. The action area is considered a priority for re-introduction for CV spring-run Chinook salmon and is a migratory corridor to the upper reaches of the San Joaquin River, below Friant Dam.

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

The following is an analysis of the potential short-term and long-term effects to listed fish species that may occur as a result of implementing the proposed action on the San Joaquin River. For our analysis, we have used the presence of listed species in the action area to determine the risk each species and life stage may face if exposed to project impacts. The expected effects of the proposed action include impacts due to: (1) water quality, (2) dewatering activities, (3) habitat loss/modification, (4) and operations and maintenance.

2.5.1 Effects to species: Construction impacts and operations and maintenance

2.5.1.1 Construction Impacts

Water Quality: Sediment and Turbidity

Construction activities are likely to result in increases in turbidity, suspended sediment concentrations, and contaminant concentrations. Construction activities are expected to disturb sediments and soils within Hilmar Drain and flow into the San Joaquin River. Any construction-related erosion or disturbance of sediments and soils would increase downstream turbidity and sedimentation in the project area, if soils were transported in river flows.

The changes in abundance, distribution, and survival of fish populations have been linked to levels of turbidity and silt deposition. Prolonged exposure to high levels of suspended sediment could create a loss of visual capability in fish in aquatic habitats within the project area, leading to reduced feeding and growth rates. Such exposure could also result in a thickening of the gills, potentially causing the loss of respiratory function; in clogging and abrasion of gills; and in increased stress levels, which in turn could reduce tolerance to disease and toxicants (Waters

1995). Turbidity also could result in increased water temperature and decreased dissolved oxygen (DO) levels, especially in low-velocity pools, which can cause stressed respiration. High levels of suspended sediments could also cause redistribution and movement of fish populations in the San Joaquin River, and could diminish the character and quality of the physical habitat important to fish survival. Deposited sediments can reduce water depths in stream pools and can contribute to local reduction in habitat carrying capacity for juvenile and adult fish (Waters 1995). Increased sediment loading downstream from construction areas could degrade food-producing habitat by interfering with photosynthesis of aquatic flora, and could displace aquatic fauna upon which juvenile salmonids depend.

Many fish, including salmonids (Chinook and steelhead), are visual feeders and turbid waters reduce the ability of these fish to locate and capture prey. Some fish, particularly juveniles, could become disoriented and leave the areas where their main food sources are located, ultimately reducing growth rates. Prey of fish populations, such as macroinvertebrates, could be adversely affected by declines in habitat quality (water quality and substrate conditions) caused by increased turbidity, decreased DO content, and an increased level of pollutants.

Avoidance of adverse habitat conditions by fish is the most common response to increases in turbidity and sedimentation (Waters 1995). Fish are not expected to occupy areas unsuitable for survival unless they have no other option. Therefore, increased turbidity attributed to construction activities could preclude fish from occupying habitat required for specific life stages. A review by Lloyd (1987) indicated that several behavioral characteristics of salmonids can be altered by even relatively small changes in turbidity (10 to 50 nephelometric turbidity units [NTUs]) that are expected to result from this proposed project. Salmonids exposed to slight to moderate increases in turbidity exhibited prey avoidance, reduced feeding rates, and reduced use of overhead cover. Reaction distances of rainbow trout to prey were reduced with increases of turbidity of only 15 NTUs over an ambient level of 4 to 6 NTUs in experimental stream channels (Barret et al. 1992).

During installation of the fish barrier, there could be an increase in sediment and turbidity. NMFS anticipates turbidity events would occur during construction. These in-water work activities would occur during the periods of mid-June to mid-September for wetter water years or July 1 to mid-September for drier water years. These periods coincide with when CCV steelhead are least likely to be present in the action area. Adult CCV steelhead may commence their upstream migration as early as October and juveniles would not likely be migrating downstream during this time. In addition, there is likely to be exposure to low numbers of CV spring-run adults or juveniles resulting from the reintroduction efforts based on the expected timing of their life histories. Implementation of water quality measures such as a turbidity curtain downstream of the project area would minimize impacts to listed salmonids.

Actions that result in sediment and turbidity impacts taking place during the in-water work window are expected to have minimal effects on listed salmonids due to minimization measures in place and the likelihood of their presence in the action area is considered unlikely.

Water Quality: Contaminants

During construction, the potential exists for spills or leakage of toxic substances that could enter the waterways. Refueling, operation, and storage of construction equipment and materials could result in accidental spills of pollutants (e.g., fuels, lubricants, sealants, and oil). Adverse effects to listed fish may result from point and non-point source chemical contaminant discharges within the action area. These contaminants include, but are not limited to cement, oil, lubricants, and gasoline product discharges. These contaminants may adversely affect fish reproductive success and survival rates. Fish could also be exposed to legacy contaminants during sediment disturbing activities such as dredging, if the soils disturbed by the project have a contamination history, and hazardous product runoff from vehicles and equipment used during construction.

Even low concentrations of contaminants found in typical construction sites can cause short-term or long-term effects to fish. The severity of these effects depends on the contaminant, the concentration, duration of exposure, and sensitivity of the affected life stage. Sublethal effects include increased susceptibility to disease that reduces the overall health and survival of the exposed fish. A long-term effect of contamination is reduced prey availability. Invertebrate prey species survival can be reduced therefore making food less available for fish. Also, fish consuming infected prey can absorb toxins directly. However, the cofferdam would isolate the project area and other water quality measures such as a Stormwater Pollution Prevention Plan (SWPPP) and the accidental spill prevention and containment plan would minimize the exposure of contaminants to listed salmonids.

Thus, the potential effects associated with contaminants are expected to be avoided as a result of the implementation of the water quality conservation measures and in-water work window.

Dewatering and Fish Relocation Activities

Fish have the potential to become entrapped behind the cofferdam during the dewatering activities, resulting in injury or death, and/or require handling for relocation, which may result in harassment, injury or death. Fish capture and relocation would be necessary during dewatering activities if listed fish are present and found in the enclosed area of the cofferdam. A qualified biologist would follow appropriate minimization measures, as described above in this opinion, to capture and relocate the fish. Each step during the capture/relocation process could also induce physiological stress even when a skilled fish biologist performs the relocation under optimal conditions.

The capture and relocation of salmonids associated with the dewatering activities is expected to adversely affect a small number of CCV steelhead and CV spring-run Chinook salmon likely to be present in the action area. The implementation of the in-water work window coincides during a time when listed salmonids are least likely present in the action area, therefore numbers exposed to dewatering activities are expected to be extremely low.

Habitat Loss/Modification

Construction of the fish barrier would require the alteration, or loss, of SRA. The loss of SRA would result in reduced survival and fitness and potentially refugia for listed fish from predators and high flows. The area of loss would be small (0.05 acres) and the conservation measures described in the project description would minimize impacts to listed fish. Also, this area is far off from the main channel, and at best could be considered to offer non-natal rearing of low to moderate quality habitat when water levels are high. Therefore, impacts to this habitat and its support of listed fish would be minimal.

Operations and Maintenance

Operations

The new fish barrier slide gates will remain closed from August 1 through February 28 to achieve its intended purpose of restricting access to the drain by fall-run Chinook salmon. This is the period when the District has previously observed fish entrained in the canals. The gates will be open from March 1 through July 31, and has potential to allow CV spring-run Chinook salmon access. District staff would observe the Nielson Drain on a daily basis during the irrigation season (March 1 through October 31) to watch for emergent issues including any fish inside the channel. Although the District has never encountered an adult CCV steelhead or CV spring-run Chinook salmon inside the canal system, there is still likelihood of this occurring as a result of the overlap of adult spring-run Chinook salmon migration period (March through June). Because the operations of the fish barrier is expected to coincide with the timing of the adult spring-run Chinook salmon and steelhead some of the time, there is opportunity that they could become entrained into the system and become entrapped, which would require capture and relocation to ensure their survival and reproductive success. All capture and handling activities carry the chance fish will be injured or suffer mortality, even when the captures and transports are performed by skilled fisheries staff with appropriate equipment. Without rescue, the fish would likely perish in the drain. Because part of the operations schedule is to monitor whether fish enter the drain while the fish screen is open (March 1 – July 31), it is likely CV spring-run Chinook salmon adults will be observed and CDFW/NMFS contacted for further instructions. Thus, a small number of fish is expected to be entrained each year.

Adult CCV steelhead migration occurs mostly between October through February, and thus would be protected from entering the drain given the proposed operations schedule. However, during high flood events in the Nielson Drain (above 60 cfs), the District may need to open the gates anytime from August to February. This could present an opportunity for CCV steelhead to become entrained if they migrated into the Hilmar Drain and to Nielson Drain. Hydraulic calculations show that these large flows should exceed 60 cfs before the slide gate needs to be opened. Based on historic daily averages for the last 5 years, this scenario only occurred 1.2 percent of the time. Because of the rarity of large flows scenarios that would attract steelhead during their migration timing while the barrier gates are open, the installation of the fish barrier is expected to provide some benefit to the CCV steelhead DPS if it is operated as proposed, compared to current conditions without a fish screen, as the pathway to the drain is open and steelhead are at risk to being entrained. Therefore, adverse effects to CCV steelhead from the operations of the fish screen are expected to occur 1.2 percent of the time.

Maintenance

The fish barrier would require monthly maintenance visits to manually brush the hanging screen. The fish barrier would be cleaned using a long handled bristle brush to brush the clinging debris from off the swinging picket barrier. If debris that is not buoyant enough to make it over the weir that gets caught inside the structure box, TID will briefly halt flows by shutting the isolation gates in the levee and have a pumper truck pump out the box. Any material not removed by the pumper truck will be hand lifted out of the drained box before putting the fish barrier back into service. Since the box will be isolated from Hilmar Drain Extension by the fish barrier, no listed fish will be exposed to the maintenance debris removal from behind the barrier. Other maintenance requirements include periodic inspection and cleaning or replacement of downstream riprap that was placed as erosion control around the foundation. These maintenance activities would result in minimal impacts to water quality because the box would be isolated from the wetted channel.

2.5.2 Project Effects on CCV steelhead Critical Habitat

The project is expected to adversely impact two PBFs of critical habitat for CCV steelhead (freshwater rearing habitat and freshwater migration corridors).

The proposed project is expected to cause short-term, long-term, and permanent effects on critical habitat for CCV steelhead. Potential project effects would impact 0.05 acres of habitat and include temporary water quality degradation from localized increases in turbidity and suspended sediment, habitat loss/modification of critical habitat, rip rap placement, and in-channel disturbance from excavation of substrate and placement of the permanent fish barrier. Long-term effects to PBFs of designated critical habitat such as loss of functional migratory corridor is expected from the operations of the fish barrier (likelihood of fish becoming entrained during periods when gates are open).

2.6. Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

2.6.1 Agricultural Practices

Agricultural practices in the action area may adversely affect riparian habitats through upland modifications of the watershed that lead to increased siltation, reductions in water flow, or agricultural runoff. Grazing activities from cattle operations can degrade or reduce suitable critical habitat for listed salmonids by increasing erosion and sedimentation as well as introducing nitrogen, ammonia, and other nutrients into the watershed, which can flow into the receiving waters of the associated watersheds. Stormwater and irrigation discharges related to both agricultural and urban activities contain numerous pesticides and herbicides that may adversely affect listed salmonids reproductive success and survival rates if not properly treated before discharge (Dubrovsky et al. 1998, Daughton 2003).

2.6.2 Increased Urbanization

Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased growth would place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities. Some of these actions, particularly those which are situated away from waterbodies, would not require Federal permits, and thus would not undergo review through the ESA section 7 consultation process with NMFS.

Increased urbanization also is expected to result in increased recreational activities in the region. Among the activities expected to increase in volume and frequency is recreational boating. Boating activities typically result in increased wave action and propeller wash in waterways. This potentially would degrade riparian and wetland habitat by eroding channel banks and mid-channel islands, thereby causing an increase in siltation and turbidity. Wakes and propeller wash also churn up benthic sediments thereby potentially re-suspending contaminated sediments and degrading areas of submerged vegetation. This in turn would reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids moving through the system. Increased recreational boat operation is anticipated to result in more contamination from the operation of gasoline and diesel powered engines on watercraft entering the associated water bodies.

2.6.3 Rock Revetment and Levee Repair Projects

Depending on the scope of the action, some non-federal riprap projects carried out by state or local agencies do not require federal permits. These types of actions, as well as illegal placement of riprap, are common occurrences within the watershed. The effects of such actions result in continued degradation, simplification, and fragmentation of riparian and freshwater habitat and is difficult to reverse on a large-scale.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; and/or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1 Status of the CCV Steelhead DPS and Designated Critical Habitat

The 2016 status review (NMFS 2016) concluded that overall CCV steelhead should remain listed as threatened, as the DPS is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Further, there is still a general lack of data on the status of individual wild CCV steelhead populations. There are some encouraging signs, as several hatcheries in the Central Valley (such as Mokelumne River), have experienced increased returns of CCV steelhead over the last few years. There has also been a slight increase in the percentage of wild CCV steelhead in salvage at the south Delta fish facilities, and the percent of wild fish in those data remains much higher than at Chipps Island. Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin River Basin continue to show an overall very low abundance, and fluctuating return rates. The NMFS Recovery Plan (NMFS 2014) strategy for CCV steelhead lists the San Joaquin River's eastside tributaries below rim dams (Stanislaus, Tuolumne, and Merced rivers) as Core 2 populations, and as candidates to reach viable population status if reintroduced upstream of the dams. It also lists the San Joaquin River, below Friant Dam, as a candidate to reach viable population status. Since the action area serves as a migratory corridor to these eastside tributaries, it has potential to affect the success of these recovery actions.

2.7.2 Status of the CV spring-run Chinook salmon

The CV spring-run Chinook salmon ESU is also listed as threatened under the ESA but is considered extirpated from the San Joaquin River basin (NMFS, 2016). The NMFS 2016 5-Year Status Review re-evaluated the status of CV spring-run Chinook salmon and concluded that the species should remain listed as threatened (NMFS 2016). The NMFS Recovery Plan (NMFS 2014) indicated that for CV spring-run Chinook salmon, re-establishing two viable populations in the San Joaquin River Basin would be necessary for recovery. Through recovery plan implementation and SJRRP reintroduction efforts (SJRRP 2018), CV spring-run Chinook salmon are expected to use the action area as a migration pathway. Risk of entrainment for CV spring-run Chinook salmon adults could occur when adults are migrating upstream the San Joaquin River and led into the Hilmar Drain Extension. However, the likelihood is low due to the lack of observations of CV spring-run Chinook salmon in the canals during their adult migration period.

2.7.3 Status of the Environmental Baseline and Cumulative Effects in the action area

Small remnant populations of CCV steelhead currently exist in the eastside tributaries of the San Joaquin River and use the action area as a migratory corridor. Migrating adult CCV steelhead are present from July to March through the San Joaquin River, with highest abundance between December and January. Based on known CV spring-run Chinook salmon life history timing and limited information of use of the San Joaquin River Basin, and limited information available from SJRRP observations, returning adults are expected to travel through the action area from March through June. For CCV steelhead and CV spring-run Chinook, the San Joaquin migratory corridor is an essential piece of the recovery strategy (NMFS 2014), which provides for two viable populations for each species to be established in the San Joaquin River Basin. Currently, the San Joaquin River, although degraded due to levees and lack of floodplain habitat, is still an important migratory corridor for the recovery of these species.

The Cumulative Effects section of this opinion describes how continuing or future effects such as the discharge of point and non-point source chemical contaminant discharges and increased urbanization affect the species in the action area. These activities typically result in habitat fragmentation, and conversion of complex nearshore aquatic habitat to simplified habitats that incrementally reduces the carrying capacity of migratory corridors.

2.7.4 Summary of Project Effects on listed species and critical habitat

NMFS finds that the construction, operations, and maintenance of the fish barrier would result in minimal effects to the population of CCV steelhead and CV spring-run Chinook salmon moving past the confluence of the Hilmar Drain and San Joaquin River. The gates will be closed (except during flood control episodes) from August 1 to February 28 and will be open from March 1 through July 31. The exposure to entrainment to CV spring-run Chinook salmon adults could occur when the gates are open, which overlaps the adult upstream migration timing.
There is an anticipated benefit to migrating adult steelhead in the foreseeable future as the Neilson Drain barrier would be closed from August to February, keeping adult steelhead from going up a false migration pathway. On the rare occurrence (1.2 percent), the barrier would be open with sufficient flows to attract adult CCV steelhead during their migration. District staff would observe the Nielson Drain on a daily basis during the irrigation season (March 1 through October 31st) to watch for any anadromous fish inside the channel. The proposed project is expected to cause short-term, long-term, and permanent effects on critical habitat for CCV steelhead. There will be short-term construction related effects and long-term operational impacts to critical habitat for CCV steelhead such as loss of functional migratory corridor.

1) Construction-related Effects

During construction, adverse effects are expected to occur to listed salmonids during dewatering and relocation activities, when fish are present. Construction would occur during the summer months, when the abundance of individual fish is low and outside of the migrating adult and juvenile timing period. In addition, during construction activities, degraded water quality is expected to occur, including sediment and turbidity, but with the implementation of mitigation measures, impacts would be minimized to listed species.

2) Operations and Maintenance Effects

Low numbers of adult CCV steelhead and CV spring-run Chinook salmon would be exposed to entrainment into Neilson Drain as a result of the operations of the fish barrier. Exposure to CCV steelhead would occur when the barrier is open during flood control purposes (when flows exceed 60 cfs). CV spring-run Chinook salmon would be exposed to entrainment risk during their upstream migration (March to June) when fish barrier gates are open (March to July).

2.7.5 Risk to ESU/DPS

The proposed project would have minimal impacts to the overall DPS for CCV steelhead and ESU for CV spring-run Chinook salmon. Some benefits of the project would minimize entrainment into TID canals. Short-term impacts would occur during construction but this would occur when listed species are least likely present. Conservation measures would be implemented to minimize adverse impacts to critical habitat. Long-term impacts could occur if listed species are entrained into the TID canals. However, future modifications of the barrier and operations would be implemented if listed fish are encountered in the canals, which would provide benefits to both CCV steelhead and CV spring-run Chinook salmon.

Combining the minimal, adverse, and beneficial effects (closure of gates August through February) associated with the proposed action described above, environmental baseline, cumulative effects, and status of the species and critical habitat, the proposed project is not expected to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing their numbers, reproduction, or distribution; or appreciably diminish the value of designated critical habitat for the conservation of the species.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' opinion that the proposed action is not likely to jeopardize the continued existence of CCV steelhead and CV spring-run Chinook salmon, or destroy or adversely modify designated critical habitat for CCV steelhead.

2.9. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1. Amount or Extent of Take

NMFS cannot, using the best available information, quantify and track the amount or number of individuals that are expected to be incidentally taken per species because of the variability and uncertainty associated with the population sizes of the species, annual variation in the timing of migration, and variability regarding individual habitat use of the action area. However, it is possible to express the extent of incidental take in terms of ecological surrogates for those elements of the proposed action that are expected to result in incidental take.

These ecological surrogates are measureable, and the Corps can monitor the ecological surrogates to determine whether the level of anticipated incidental take described in this incidental take statement is exceeded.

In the opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

2.9.1.1. Incidental take associated with operations of the fish barrier

NMFS expects during the operations of the fish barrier, closures would occur between August 1 to February 28, except during flood events. Gates will remain open from March 1 to July 31. NMFS expects the following species and life stages to be present during the periods when the gates are open:

1. Adult CCV steelhead
2. Adult CV spring-run Chinook salmon

The listed species identified above would be exposed to the operations of the fish barrier. NMFS expects incidental take would be in the form of harassment, injury, and mortality resulting from entrainment and/or handling of fish in the event that fish are captured/relocated from the canals. Because of the variability and uncertainty associated with the population sizes of the species, annual variation in the timing of migration, and variability regarding individual habitat use of the action area, the actual number of individuals that are expected to be incidentally taken per species is not known, though expected to be low during the operations of the fish barrier. However, it is possible to estimate the extent of incidental take in terms of an ecological surrogate. Because unlisted fall-run Chinook salmon have been the only identified species entrained in the canals, they will be used as the ecological surrogate. In 2016, 36 adult fall-run Chinook salmon were rescued from the canals. Since fall-run Chinook salmon are higher in abundance than CCV steelhead and CV spring-run Chinook salmon in the San Joaquin River Basin, and these listed species have not been observed being entrained in the District's canals, and because the exact source location of entrainment occurring is unknown between Nielson Drain and Harding Drain, we estimate the actual numbers of individuals taken for each species would be much lower. In addition, we expect that if listed fish are encountered in the canals at any time, then modifications to the design of the barrier and/or operations would occur. Incidental take would be considered exceeded if/when numbers of individuals exceed the surrogate amount of 36 individuals for either CCV steelhead or CV spring-run Chinook salmon, which would trigger the need to reinitiate consultation on the Project.

2.9.2. Effect of the Take

In the opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species, or destruction or adverse modification of critical habitat.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1) Measures shall be taken by the Corps or its applicant to minimize and reduce the number and duration of adverse effects to listed species and their critical habitat during operations of the proposed project.

2) Measures shall be taken by the Corps, or its applicant, to prepare and provide NMFS with a plan and a report describing how listed species in the action area would be protected and/or monitored and to document the observed effects of the operations on listed species.

2.9.4. Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The Corps or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1) The following terms and conditions implement reasonable and prudent measure 1:

   a) The swinging exclusion panel shall be set no more than 1-inch from the face of the weir to minimize the potential for fish to nose up behind the material and pass over the weir.

   b) The existing pumps shall discharge into the proposed exclusion barrier structure box. When the levee drain slide gates are shut and the pumps are turned on, the exclusion barrier will continue to operate. In the event that flows from the drain exceed the design capacity for the exclusion barrier of 60 cfs during floods, the center slide gate shall be raised and/or the weir boards removed and the flood waters will be allowed to pass under the swinging picket barrier. In this event an inspection of the area for entrained fish and, if necessary, a fish salvage shall be done prior to closing the gate and/or putting the weir boards back in place at the end of the flood event.

   c) Protrusions such as bolts, gate operators, and exclusion material that are in the flow path of the fish, or are in areas where fish may have the potential to be present, shall be rounded, ground smooth, or have end treatments to minimize the risk of lacerations and other injuries to fish.

   d) If the experimental barrier fails to prevent anadromous fish from entering the Neilson Drain, future modification shall occur to lengthen the hanging overlap of the swinging geogrid exclusion panel to the face of the weir boards. Adjustments shall be made to optimize exclusion of fish upstream and passage of debris downstream as determined by monitoring results for fish exclusion and debris passage.

   e) Future modification of the material type used for the swinging exclusion panel shall occur if monitoring results indicate fish are moving upstream past the installed panel or debris is not able to move downstream due to the material properties of the current swinging exclusion panel.

f) Maintenance activities shall occur for the first year of operation during the months of the unlisted CV fall-run Chinook salmon adult migration and spawning season (August 1 through February 28) and include daily inspection and removal of any debris attached to or around the hanging barrier mesh.

g) The swinging exclusion panel shall include weights on the bottom of the panel to ensure that the panel returns to the closed position after debris passes through the barrier. Any weighted element added to the swinging exclusion panel shall not be designed with components that can come into contact with the fish in such a way as to entrain or cause laceration, injury or mortality.

h) During fish rescue activities, a qualified fish biologist shall be present onsite to make observations, and capture/relocate fish if they become entrained in the canals. Only fish biologists trained in salmonid capture and relocation shall remove and relocate fish during fish rescue activities.

2) The following terms and conditions implement reasonable and prudent measure 2:

a) In addition to the monitoring plan as described in the conservation measures section of the project description, daily post construction monitoring shall occur for the first year of operation and during the first high flow event, such as the one recorded during the spring of 2017. This monitoring shall determine the efficacy of this innovative design at excluding fish from entering the outfall box, existing culverts, and the Nielson Drain.

b) Daily inspection during the first year after installation shall occur to maintain operations consistent with fish exclusion requirements. After the first year of installation, daily inspections shall occur from March 1st to September 1st and weekly inspections shall occur from September 1st through February 28th. Monitoring includes but is not limited to:

i. Inspection reports shall be made for incidents where fall-run Chinook salmon, CV spring-run Chinook salmon, or CCV steelhead, are encountered in the Nielson Drain canal or adjoining canals or when any adjustments or maintenance is done to the exclusion barrier. The inspection reports shall include the date, time, temperature, weather conditions, debris observed in the Nielson exclusion barrier, fish observed in the barrier or in the drains or canals upstream, and any maintenance, adjustments or modification actions taken at the exclusion barrier.

ii. Inspection reports shall be submitted to NMFS at the end of the CV spring-run Chinook salmon migration season.

iii. Notification shall occur within 24-hours of observation of CCV steelhead or CV spring-run Chinook salmon injured, trapped or killed around or behind the exclusion barrier.

c) Any modification details of the design prior to installation shall be submitted for review to the appropriate NMFS biologist and NMFS engineer prior to installation.

2.10. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1) The Corps should continue supporting and promoting aquatic and riparian habitat restoration and fish passage projects within the San Joaquin River and other watersheds, especially those with listed aquatic species. Practices that avoid or minimize adverse effects to listed species should be encouraged.

2) The Corps should continue to work cooperatively with other State and Federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid habitat restoration and fish passage projects.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Nielson Fish Barrier project.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The geographic extent of salmon freshwater EFH is described as all water bodies currently or historically occupied by PFMC managed salmon within the USGS 4th field hydrologic units identified by the fishery management plan (PFMC, 2014). This designation includes the Lower San Joaquin River (HUC 18040002) for all runs of Chinook salmon that historically and currently use these watersheds (spring-run, fall-run, and late fall-run). The Pacific Coast salmon fishery management plan also identifies Habitat Areas of Particular Concern (HAPCs): complex channel and floodplain habitat, spawning habitat, thermal refugia, estuaries, and submerged aquatic vegetation, of which, the HAPC for complex channel and floodplain habitat is expected to be adversely affected by the proposed action. Because of the extensive urbanization that has occurred in the California Central Valley over the last 100 years, the San Joaquin River in the action area has been leveed and channelized and is currently degraded habitat for complex channel and floodplain HAPC.

3.2. Adverse Effects on Essential Fish Habitat

Effects to the HAPC for complex channel and floodplain habitat are discussed in the context of effects to critical habitat PBFs as designated under the ESA and described in section 2.5.2. A list of adverse effects to these EFH HAPCs is included in this EFH consultation, which are expected to be similar to the impacts affecting critical habitat, including: sediment and turbidity, in-channel disturbance from placement of the fish barrier, and habitat loss/modification.

Sediment and turbidity

- Degraded water quality

In-channel disturbance from placement of the fish barrier

- Channel disturbance and excavation associated from placement of the fish barrier

Habitat loss/modification

- Permanent habitat loss due to placement of the fish barrier
- Reduced habitat complexity
- Reduced water quality due to construction activities
- Reduced potential for riparian and aquatic vegetation
- Reduced potential for complex channel from operations
- Reduced potential of migratory corridor from entrainment

3.3. Essential Fish Habitat Conservation Recommendations

To address the adverse effects mentioned above, the conservation measures as described in the project description would suffice in minimizing impacts to EFH. Therefore, no additional practical measures are provided.

3.4. Supplemental Consultation

The Corps must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. Data Quality Act Documentation and Pre-Dissemination Review

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the Corps. Other interested users could include TID. Individual copies of this opinion were provided to the Corps. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2. Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3. Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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