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-2023-00269

May 18, 2023

Matt Hirkala
Project Manager
California Delta Section
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Smith Canal Gate Project, second re-initiation

Dear Mr. Hirkala:

Thank you for your letter of March 13, 2023, requesting a second re-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 Lower San Joaquin River Feasibility Study Smith Canal Gate Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR Part 402, as amended; 84 Fed. Reg. 44976, 45016 (August 27, 2019)).

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. Enclosed we provide NMFS's review of the potential effects of the proposed action on EFH for Pacific Coast Salmon in the project section, as designated under the MSA. The document concludes that the project will adversely affect the EFH of Pacific Coast Salmon in the action area and includes EFH Conservation Recommendations.

As required by section 305(b)(4)(B) of the MSA, the U.S. Army Corps of Engineers (Corps) must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS EFH Conservation Recommendations unless NMFS and the Corps have agreed to use alternative time frames for the Corps' response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Corps must explain its reasons for not following the Recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the

measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)). In your response to the EFH portion of this consultation, we ask that you clearly identify the number of Conservation Recommendations accepted.

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*), threatened California Central Valley steelhead distinct population segment (DPS) (*O. mykiss*), or the threatened southern DPS of North American green sturgeon (*Acipenser medirostris*), and is not likely to destroy or adversely modify their designated critical habitats. For the above species, NMFS has included an incidental take statement with reasonable and prudent measures and terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project.

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
Assistant Regional Administrator
California Central Valley Office

Enclosure

cc: Copy to File: 151422-WCR2023-SA00011

UNITED STATES DEPARTMENT OF COMMERCE
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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

Lower San Joaquin River Feasibility Study – Smith Canal Gate

NMFS Consultation Number: WCRO-2023-00269

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 (Does not occur within the action area for this species)
California Central Valley steelhead Distinct Population Segment (DPS (*O. mykiss*)	Threatened	Yes	No	Yes	No
Southern DPS of North American green sturgeon (*Acipenser medirostris*)	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
Assistant Regional Administrator for California Central Valley Office

Date: May 18, 2023

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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 Part 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 Part 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 NMFS California Central Valley Office.

1.2. Consultation History

On June 7, 2016, NMFS issued a biological opinion on the overall Lower San Joaquin River Feasibility Study (LSJRFS). NMFS concluded that the project was not likely to jeopardize the continued existence of the federally listed species and designated critical habitats. The Smith Canal Gate project is one component of the larger LSJRFS project, but a full detailed description and design for the Gate was not available at that time.

On November 6 and 7, 2018, NMFS and the U.S. Army Corps of Engineers (Corps) had discussions over the phone and via email regarding how to move forward with the Smith Canal Gate consultation, after new information was developed for the project description and Gate design.

On November 27, 2018, NMFS and the Corps had a conference call to review a draft Biological Assessment (BA) of the Smith Canal Gate project.

On April 4, 2019, NMFS received an initiation package requesting formal section 7 consultation for the Smith Canal Gate Project. Upon review of the biological assessment, NMFS provided the Corps with a list of questions that needed to be clarified in order to analyze the effects of the proposed action.

On May 9, 2019, upon review of the Corps' response email to the information requested by NMFS, NMFS initiated formal consultation.

On October 18, 2019, NMFS issued a biological opinion to the Corps, concluding the proposed action was not likely to jeopardize the continued existence of the federally listed species and not likely to destroy or adversely modify their designated critical habitats.

On October 13, 2020, the San Joaquin Area Flood Control Authority (SJAFCA) received technical assistance from NMFS via email to extend the Year 1 in-water work window from July 15 to November 15, 2020, to accommodate installation of all sixty-four foundation piles (2020 season). Based on the information received from SJAFCA, the proposed project related activities from pile driving (behind a cofferdam) and barge/boat traffic would remain unchanged from NMFS' 2019 biological opinion, therefore re-initiation was not warranted. In-water work was completed on November 9 and all equipment used for in-water work was demobilized on November 10, 2020, thereby completing all Year 1 in-water work activities within the extended in-water work window.

On February 5, 2021, the Corps had a call with NMFS to review additional potential modifications of the in-water construction activities for Year 2.

On February 26, 2021, the Corps requested re-initiation of formal consultation of Smith Canal Gate project, as a result of the changes to the proposed action described below in section 1.3.1, and consultation was initiated on this date.

On April 30, 2021, NMFS issued an updated biological opinion to the Corps, concluding the proposed action was not likely to jeopardize the continued existence of the federally listed species and not likely to destroy or adversely modify their designated critical habitats.

On October 14, 2022, the Corps, SJAFCA and their attorneys and consultants (KSN, Inc., and ECORP Consulting) requested an extension of the in-water work window after October 15, 2022, in order to continue work on the project. NMFS denied the request and informed the Corps and SJAFCA that re-initiation of consultation would be necessary.

On December 23, 2022, NMFS reviewed and provided comments on a draft BA from SJFCA's consultants, KSN Inc., and ECORP Consulting, Inc.

On January 4, 2023, NMFS reviewed the revised BA from SJFCA's consultants, ECORP Consulting, Inc.

On March 1, 2023, representatives from NMFS, SJFCA, KSN Inc., and ECORP Consulting, Inc., conducted a site visit to Smith Canal to discuss and review the current status of the project.

On March 7, 2023, NMFS, Corps, SJFCA, and ECORP, Consulting, Inc. discussed the project scope and agreed to additional minimization measures for the project.

On March 13, 2023, the Corps requested the second re-initiation of formal consultation of Smith Canal Gate project, as a result of the changes to the proposed action described below in section 1.3.1, and consultation was initiated on this date.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019

Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

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). We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not. 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).

The Corps is the lead Federal agency for authorizing this action, known as the Lower San Joaquin River Feasibility Study (LSJRFS), a component of which includes the Smith Canal Gate Project (Project), pursuant to section 404 of the Clean Water Act of 1972, as amended and Section 10 of the Rivers and Harbors Appropriation Act of 1899. The Central Valley Flood Protection Board and SJAFCA are the non-Federal project sponsors partnering with the Corps on the Project. SJAFCA is requesting authorization to complete the Smith Canal Gate portion of the Project located in the San Joaquin River, City of Stockton, San Joaquin County, California (Figure 1).

The proposed action would implement flood risk-reduction measures in the vicinity of the Smith Canal and the San Joaquin River in, and adjacent to, the City of Stockton. The proposed action would consist primarily of completing a partially constructed fixed flood wall filled with granular material that would extend approximately 800 feet from the north tip of Dad's Point to the east bank of the San Joaquin River at the Stockton Golf and Country Club. The fixed floodwall features a recently constructed 50-foot-wide gate that can be closed when high flow events are forecasted to approach or exceed design operating water surface elevations (8.0 feet NAVD88). During high flow and/or high tide events, the gate structure would isolate Smith Canal from the San Joaquin River and allow existing levees to function as a secondary flood risk-reduction measure. The gate would be closed only as needed for flood control to prevent flood flows from entering Smith Canal, and would otherwise remain open to allow for recreation, navigation, and tidal movement in and out of Smith Canal.

Construction of the project, as originally proposed, was anticipated to require two years of in-water construction; however, additional assessments made by the Project team in 2019 (during the pre-project Test Pile Program [TPP]) determined that the project would likely require three years of in-water work to complete (i.e., 2020, 2021, and 2022). Contractor progress at the completion of Year 3 (2022) in-water work has demonstrated that up to four additional in-water work seasons (2023 through 2026) may be required to complete the project (including two

partially overlapping seasons for the warranty inspection (2024-2025) and warranty repair period (2025-2026). Information gathered from project construction to date indicates pile driving for each fixed floodwall cell takes approximately 2-3 weeks to complete. Five north wall and eleven south wall cells remain to be completed. Assuming a best-case scenario of two weeks for each wall cell, flat sheet pile driving alone will take 32 weeks (eight months). Assuming a worst-case scenario of three weeks for each wall cell, flat sheet pile driving will take up to 48 weeks (11 months).

Five additional north floodwall cells and 11 south floodwalls cells would be installed to complete construction of the approximately 800 linear foot long sheet pile flood wall. Additional infrastructure would include placement of fill materials, installation of protection piles, dredging for installation of fill materials (rock slope protection (RSP)/rip rap) around the gate structure and installation of fender piles near the gate foundation corners.

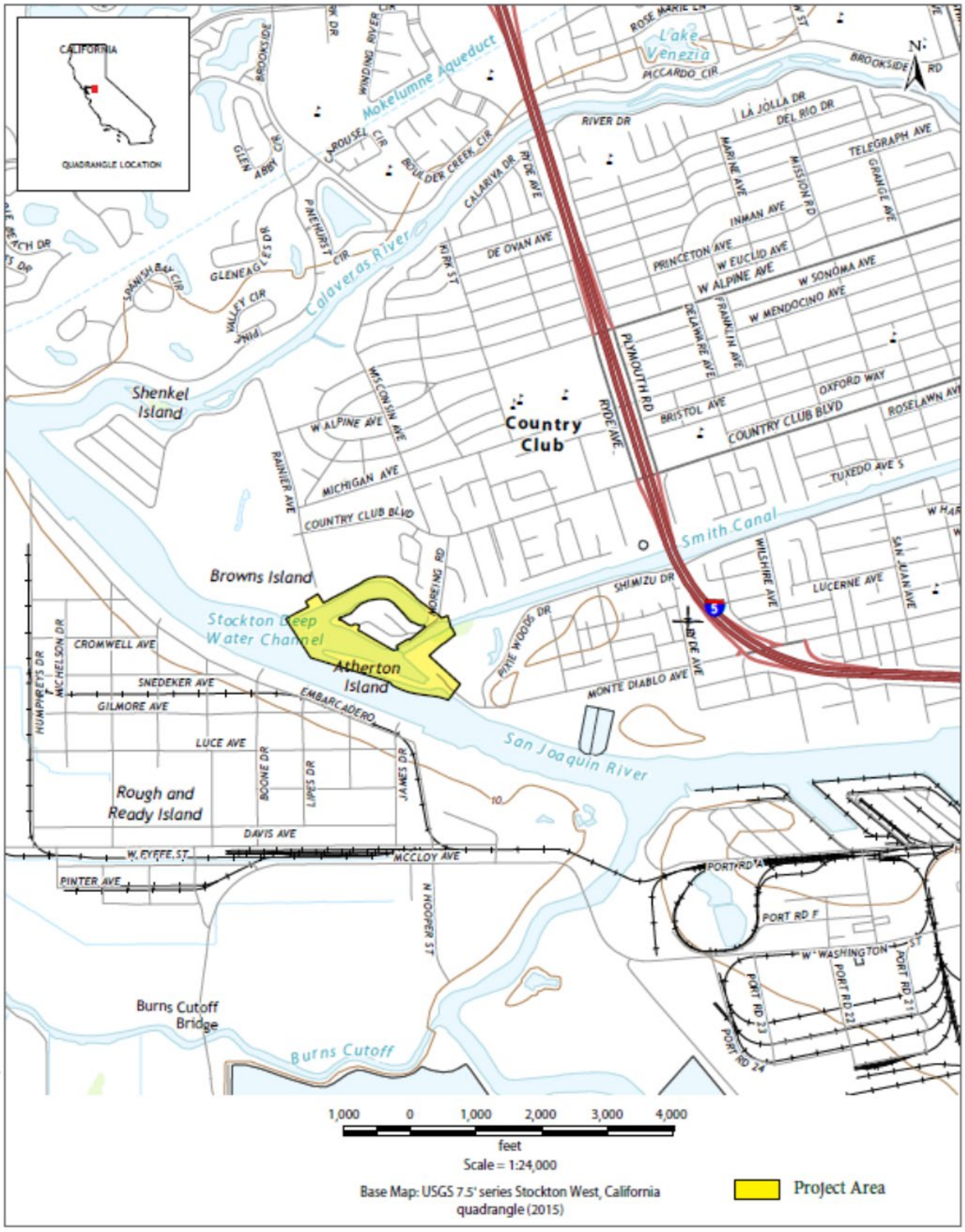

Figure 1. Proposed project area.

Construction Materials

Two staging areas would be used for the project: at the Louis Park parking area near the boat launch at the base of Dad's Point, and a second located approximately one mile up the San Joaquin River. Construction materials to be used are 85-foot long steel flat sheet piles for the fixed cellular wall, 36" diameter steel pipes for the protection and fender piles and, riprap boulders for scour protection. Other materials imported to the site could include incidental construction support materials, aggregate base rock, asphalt, concrete, and hydroseed. Materials would be brought to the project site via truck or barge, depending on the location of the staging area, the size, or amount of the material being brought to the site. Barges or boats will be used to deliver materials and equipment via the San Joaquin River and the Stockton Deep Water Ship Channel (DWSC).

Debris from dredging, clearing, and grubbing between the connection of the gate structure and the shoreline would be hauled to one of two permitted disposal sites: the Lovelace Materials Recovery Facility in Manteca, California, approximately 12.5 miles from the project site, or the North County Recycling Center and Sanitary Landfill in Lodi, California, approximately 22 miles from the project site. Alternatively, dredged material could be disposed of at an upland site with no connectivity to waters of the United States. Any upland disposal site selected would be closer to the project site than the two facilities described above.

Operation of Watercraft

Boats (less than 30 feet long) will ferry labor and small equipment to the project area during all months of the year. Travel distances are anticipated to be between 0.3 and 1.2 nautical miles. These trips will facilitate access from staging areas to the uncompleted cells on the north and south floodwalls. SJAFCA also proposes to continue to use small boats to perform biological and environmental monitoring during all months of the year.

The Project will use floating barges/platforms to stage cranes, pile drivers, and materials. Cranes operating from platform decks move and place gate materials into the ring cofferdam in all months of the year. Platforms have no propulsion systems and generate no noise. Tugboats will move barges/platforms into position for cranes to accomplish various construction activities.

Cofferdam Removal

The temporary metal sheet pile cofferdam that was installed for construction and installation of the gate structure is anticipated to be deconstructed and removed in Year 4 (2023). The contractor will mobilize to the cofferdam site with a crane and material barge that will be placed into position by a tugboat. Once in position, a vibratory hammer suspended from the crane will be used for the cofferdam sheet pile extraction process. The sheets would be removed in pairs. There are approximately 68 pairs of sheet piles forming the cofferdam. SJAFCA anticipates two material barge trips are needed to transport the sheet piles to the lay down yard where they will be offloaded from the material barge by a land-based crane and stored. The cofferdam removal process is anticipated to take approximately two weeks to complete.

Gate Structure - RSP Installation, Warranty Testing, and Repairs

The area around the gate structure will be dredged to facilitate installation of rock slope protection (RSP). RSP would be placed around the gate structure foundation to provide scour protection. SJAFCA proposes to place 0.386-acre (1,200 tons) of 18-inch minus RSP material around the gate foundation (Gate RSP) to prevent scour of the gate foundation over time. Interstitial spaces in the Gate RSP will be filled with 6-inch minus rock to avoid creating potential fish predator habitat (i.e., predator refugia) in the RSP voids. Most Gate RSP (0.363 acre or 15,811 ft²) will be placed 1 to 10 feet below the existing bottom elevation of Smith Canal/Atherton Cove as a blanket of one to two feet thick (deep RSP). The outer-most periphery of the Gate RSP blanket (0.023 acre or 1,002 ft²) will be placed at or above existing bottom elevation (surficial RSP). SJAFCA expects the deep RSP area will backfill to the pre-activity bottom elevation with native sediments due to tidal exchange and river flows. RSP placement will be isolated from San Joaquin River and Atherton Cove by installation of a turbidity curtain to comply with turbidity limits in Project permits (i.e., no more than 50 NTUs above background).

RSP will also be placed where the south and north floodwalls meet land at Dad's Point and the Stockton Golf Course, respectively. The same methods provided above for Gate RSP will be used for installation of RSP at these terminal wall locations. RSP placement at Dad's Point and the golf course was analyzed in a previous NMFS consultation.

The completed gate would be tested and put into service before the northern side of the fixed wall is completed to ensure recreational boat access between Atherton Cove and the San Joaquin River. Following the completion of Project construction, SJAFCA will inspect the operable and fixed elements of the gate and wall structure for damage and/or deficiencies and, if necessary, conduct minor repairs. Above-water inspections would be performed by personnel from vantage points at the top of the floodwalls (north and south), from small watercraft, and from catwalks above the gate leaves/doors. Subsurface inspections may also be performed by divers or by using remotely operated vehicles (ROVs) fitted with video equipment. Deficiencies identified during the warranty testing period would be remedied during the in-water work windows. Warranty repair work would likely (depending on the nature of work required) require gate dewatering and rewatering, and repairs made to necessary facilities. Subsurface repairs would be implemented by divers or by ROVs. Repairs anticipated would include seal replacements, fastener replacements, bearing repairs or replacements, coating repairs above the waterline, and adjustments to the gate hinges by divers or ROVs.

Fixed Wall Construction - Remaining Installation

Fixed wall construction will consist of (a) continued installation of the southern cellular sheet pile wall structure consisting of 11 cells (cells A, B, and R through Z) between Dad's Point and the existing gate structure ring cofferdam and (b) installation of five cells (cells DD through HH) along the northern cellular sheet pile wall structure. The fixed wall consists of two cellular steel sheet pile walls that would be driven into the riverbed by vibratory or impact hammer. The floodwall cells are 29 feet wide at the connection between cells and 34 feet wide at the widest part of each cell. The floodwall would have a top elevation of 15.0 feet (NAVD88), extending 10 feet above the mean water level at the entrance to Smith Canal. Granular material would be

installed between the walls using a front-end loader operating from the previously completed cells of the wall. The granular material would consist of a sand and gravel mixture. The contractor intends to install flat sheets used to form the cellular floodwall using only vibratory pile-driving methods when site conditions are favorable. An impact hammer will be used on the cellular floodwall sheet piles when vibratory methods are ineffective.

The north end of the fixed wall would be integrated into the existing FEMA-accredited levee near the Stockton Golf and Country Club. This integration would be designed so that it would not affect the integrity of the existing levee system. Sheet pile wing walls would be driven along the levee perpendicular to the north end of the fixed wall, and the wing walls would be tied into the end of the fixed walls using interlocking sheet piles. Interlocking sheet piles would also be used at the Dad's Point tie-in, connecting the southern-most cell of the fixed wall to two parallel sheet pile walls driven into the end of Dad's Point.

Upon completion of construction, a locked security gate would be installed at the south end of the fixed wall on Dad's Point and at the north end of the fixed wall at the Stockton Golf and Country Club. The gate would be eight feet high and prevent public access to the fixed wall and gate structure. Access to the gate structure through the security gate would be limited to SJAFCA and authorized maintenance representatives.

Once construction of the fixed wall is complete, thirty-six 36" steel pipe pile dolphins would be installed on the San Joaquin River side of the wall to protect it from boats colliding into the wall, and four 36-inch diameter fender piles would be installed near each corner of the gate foundation, on both the San Joaquin River and Smith Canal sides of the gate structure. The pipe piles would be driven using a barge-mounted impact hammer or vibratory hammer. The dolphin piles would be spaced every 16 feet on each side of the gate structure and would be placed approximately 55 feet away from the centerline of the fixed wall. The fender piles would have a floating fender that would move up and down the pile with the tide, and all four fender piles would have a solar-powered light-emitting diode navigation light mounted on top.

Planter boxes would also be installed along the top edge of the Atherton Cove and Smith Canal side of the fixed wall. The planter boxes would be designed to allow vegetation to hang down over the top half of the wall, but would not extend below the water surface. Construction of the fixed wall would be staggered over two years in order to comply with the in-water work period from July 1 to November 30 in 2023 and 2024. The remaining southern and northern portions of the fixed wall would be installed during the third and fourth years of construction. The northern floodwall would not be completed until the gate structure has been tested to confirm operability, the miter gate leaves are opened, and the cofferdam is removed.

Work to construct the remaining fixed wall would be done using barge-mounted or land-based equipment. The granular material would be delivered to the construction site by a truck or barge using a crane equipped with a clamshell bucket.

Riprap Placement

Once the fixed wall is constructed, approximately 3,400 tons of riprap (approximately 200 linear feet) would be placed along the banks at the Stockton Golf and Country Club (approximately

100 linear feet on each side of the fixed wall). Additionally, 230 linear feet around the tip of Dad's Point headlands. Riprap ≥ 18 inches would be of a gradation of sizes to minimize large voids. The wall tie-ins are designed to be stable, but the riprap would be needed for scour protection during flood events. The riprap would be placed using either an excavator or a clamshell bucket.

Completion of Cone Penetration Tests

Approximately 13 Cone Penetration Tests (CPTs) (twelve in-water and one on land) near the floodwall and seepage cutoff wall alignments (on Dad's Point) will be completed to better characterize the geological composition of the Project area and to satisfy Corps' requirements. The proposed 13 CPTs will supplement the 5 CPTs previously conducted in October, 2019 and authorized under NMFS' October 18, 2019 biological opinion. Completed CPTs will be used to further inform the design depths for floodwall flat sheet piles, protective pipe piles, and levee embankment and seepage analyses at Dad's Point. No impact or vibratory hammer is used to advance the sleeve or sensor. Rather, it is hydraulically pushed at a consistent rate of approximately 1-inch per second to the target depth. The CPT sensor is then removed, and a concrete grout plug is injected into the sleeve to seal the created void. The sleeve is withdrawn, leaving the concrete plug deeply (generally, no shallower than 10 feet below bottom elevation) embedded in the bottom sediment profile. The top of the concrete plug will not contact the waters of the San Joaquin River or Atherton Cove.

Construction Timing

SJAFCA originally anticipated that construction of the project would last approximately two years. This timeline was evaluated in the October 18, 2019, biological opinion. SJAFCA then requested two additional years to finish project construction which was evaluated in the April 30, 2021, biological opinion. Many aspects of the project were completed between 2019-2022, however numerous aspects remain uncompleted and are the subject of this fourth biological opinion. This biological opinion addresses the remaining components for Year 4 (2023), Year 5 (2024), Year 6 (2025) and Year 7 (2026).

There are three primary periods for construction and evaluation of the Project, listed below:

1) In-water work for Year 4 (2023) and Year 5 (2025). In-water work will occur from July 1 through November 30 with the following timing conditions:
    a. Flat sheet piles could be impacted from July 15 to November 30, a maximum of 5,000 impacts per day, regardless of local water temperatures;
    b. Pipe piles (aka dolphins and fenders) could be impact driven from July 15 through October 15, a maximum of 5,000 impacts per day, regardless of local water temperatures; and
    c. Vibratory driving of flat sheet piles and/or pipe piles will occur from July 1 to November 30, regardless of local temperatures;
    d. Under no circumstances would more than 5000 impact strikes occur per workday, with any combination of pile types installed.
2) In-water work for warranty testing and repairs in Year 5 (2024), Year 6 (2025), and Year 7 (2026). Warranty testing of the gate structure would occur during Year 5 (2024) from

July 1 to November 30. Warranty testing in Year 6 (2025) would occur from July 15 to October 15th. Warranty repairs would occur, if necessary, in Year 6 (2025) and Year 7 (2026) between July 15 to October 15.

3) Project-related boating and barging would occur year-round from Year 4 (2023) through Year 7 (2026), as needed.

Construction of the Project, as described in the third biological opinion (April 30, 2021), was anticipated to require two additional years of construction; however, following subsequent assessments in 2022, SJAFCA determined that the Project would likely require four additional years to complete. The critical elements for completion of Project construction in Year 4 (2023) and Year 5 (2024) are finishing construction of the southern wall extending from the gate structure to Dad's Point, and finishing the northern wall to the golf course. These sections of the wall, which will be constructed in-water, are anticipated to take approximately five months in Year 4 (2023) and five months in Year 5 (2024). To facilitate this schedule, the in-water work window would be extended from July 1 to November 30th.

Year 4 (2023) and 5 (2024) will include (a) continued installation of the southern cellular sheet pile wall structure consisting of 11 cells (cells A, B, and R through Z) between Dad's Point and the existing gate structure and (b) continued installation of the northern cellular sheet pile wall structure consisting of five cells (cells DD through HH).

Two seasons of gate warranty testing would be performed during the in-water work windows of Years 5 (2024) and Year 6 (2025) following completion of Project construction, and two seasons of warranty repairs would be performed during the in-water work seasons of the years following gate testing (Years 6 and 7 [2025 and 2026]). Following the completion of Project construction, SJAFCA will inspect the gate for damage and/or deficiencies and, if necessary, conduct minor repairs. All activities associated with the inspections and repairs will be limited to the gate structure and Project facilities.

Summary of the Vibratory and Impact Pile Driving Activities

Vibratory and impact pile driving methods will be used for the construction of the remaining cells and installation of dolphins and fenders. For all sheet pile and pipe pile driving, piles would be driven to the maximum depth possible using a vibratory hammer prior to using an impact hammer. It is anticipated that all sheet piles can be driven to target depths using only vibratory methods. However, based on existing site conditions and experience gathered by SJAFCA during project construction in Year 2 (2021) and Year 3 (2022), it is likely that impact hammering will be needed to reach required depths due to existing geotechnical conditions along the wall alignment.

Construction of the dolphins will require the use of both vibratory and likely impact pile driving Steel pipe piles and sheet piles will be placed into the river channel first via vibratory pile driving, and then via impact pile driving for final setting and then load testing during the in-water work window of July 15 to October 15. Most in-water pile driving will be accomplished with a barge-mounted crane. When construction is complete, vibratory methods will be used to remove all temporary support piles and cofferdam sheet piles. For the sides of the cofferdam on the inlet/outlet sides of the gate, a diver will cut the sheet piles to the level of the gate structure

floor and the sheets will be removed using a crane. The contractor will excavate and remove the portion of the pipe that is within Dad's Point after installing a concrete plug on the Smith Canal side. A summary of pile driving activities is summarized in Table 1.

Table 1. Summary of pile driving activities, per year, in Year 4 (2023) and Year 5 (2024). The five month vibratory pile driving period encompasses the three month impact period

Structure	Number of Piles	Pile Description	Type of Pile Driving	Environment	Estimated Duration
Dolphins and fenders	40	36-inch diameter steel pipe piles	Vibratory and impact	In water	5 month (vibratory) 3 month (impact)
Fixed cellular sheet pile wall New installation	≈215 sheets	AS-500-12.7 sheet piles	Vibratory and impact	In water	5 month (vibratory) 4.5 month (impact)
Fixed cellular sheet pile wall Finished/reset	≈ 563 sheets	AS-500-12.7 sheet piles	Vibratory and impact	In water	5 month (vibratory) 4.5 month (impact)

The impact pile driving assumptions for the Proposed Action allow for up to 5,000 strikes per day from July 15 through October 15 for the 36" pipe piles, and up to 5,000 strikes per day from July 15 through November 30 for flat sheet piles. Impact driving may be used for installation of the flat sheet piles and pipe piles once they have been vibrated to the maximum depth possible. The analysis assumes that various combinations of pipe piles and sheet piles could be driven on the same day with the same pile driver any given pile or combination of piles between July 15 and October 15. Under no circumstances would more than 5000 impact strikes occur in one workday, regardless of the type(s) of pile(s) driven.

Long-Term Operation and Maintenance

Once complete, the gate structure would be tested during times when boat traffic is expected to be light. During this testing, the gate would be closed and then reopened. Once the gate structure is fully operational, the gate will normally remain open to allow for tidal movement, navigation, and recreation. It would be closed as needed for flood control purposes, testing, inspection, and maintenance. For flood control purposes, the gate would be closed only during high flow and high tide events forecasted to exceed the design operating water surface elevation (8.0 feet NAVD 88); events that typically occur between November and April. The gate would be operated as needed during these times to prevent high tides from entering Smith Canal. If a high tide event is anticipated, the gate would be closed at the lowest tide prior to the forecasted high tide. The gate would remain closed until the water level in the San Joaquin River drops down to the water level in Smith Canal, at which point the gate would open. Currently, an urban area of approximately 3,430 acres drains into Smith Canal via nine storm drain pump stations. In the event that rainfall occurs while the gate is closed and causes the water level in Smith Canal to be higher than the Delta, the pump stations that pump into Smith Canal from the surrounding developed areas would be shut off until the gate is opened.

Table 2. Number of gate hypothetical closures that would have occurred between 1983 and 2013 based on stage data from the Burns Cutoff Gage Station. The number of closures over this 30-year period would have ranged from 0 to 19 times per year, with no closures occurring in 23 of those years.

Table 2. Number of days with stage greater than 8 feet NAVD88.

Year	No. Days with Stage ≥ 8.0 Feet NAVD88	Year	No. Days with Stage ≥ 8.0 Feet NAVD88
1983	19	1998	13
1984	2	1999	0
1985	0	2000	0
1986	4	2001	0
1987	0	2002	0
1988	0	2003	0
1989	0	2004	0
1990	0	2005	0
1991	0	2006	8
1992	0	2007	0
1993	0	2008	0
1994	0	2009	0
1995	0	2010	0
1996	0	2011	1
1997	12	2013	0

Based on the information presented in Table 2, it is assumed that there would be two closures per year on average for flood control purposes. This is a conservative estimate based on historical days that were above 8 feet NAVD88. In general, the gate would not need to be closed at a precise point in the tidal cycle. However, if a significant local rain event was predicted to occur at the same time as flood stage on the San Joaquin River near Stockton, timing of gate closure would need to be more precise to maximize storage space for local runoff behind the fixed wall. To be prepared for such an event, SJAFCA would develop a gate operation plan. The plan would include procedures for predicting when river stage would be high and when local rain events might be significant. For example, each year prior to November 1, SJAFCA would obtain tide prediction tables to determine the timing of peak tides. These high tides would be used to develop an "alert" table to help plan activities during the winter months. In addition, because rainfall and runoff affect water surface elevation, daily stage predictions generated by DWR would be monitored. This information would help determine when the gate would be closed for flood control purposes. The gate operation plan would consider that gate closure should occur earlier (at low tide potentially days before the flood flows are expected to arrive) if new storms were predicted for the region. The operation plan would consider scenarios of combined high stage on the San Joaquin River and significant local stormwater runoff.

Routine inspection and maintenance of the gate structure and associated equipment would be conducted on an annual basis to ensure that flood risk-reduction would be provided by the operation of the gate structure. This inspection and maintenance would be conducted on the gate's abutment seals, motors, hinges, and panels. Maintenance of the fixed wall structure corrosion protection system would take place every two years. The fill material in the fixed wall would be inspected annually, and additional fill material would be added as required.

Floating debris that has accumulated behind the fixed wall would be regularly removed. The frequency of debris removal would depend on the rate of accumulation, to be determined by regular visual monitoring of the site and collection of information from adjacent residents. Based on the information gathered, SJAFCA would schedule and implement a regular debris removal program, removing debris from the project site as frequently as needed to comply with the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins' direction that "[w]ater shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses."

Water hyacinth (*Eichhornia crassipes*) also would be regularly removed from the areas on the Atherton Cove and Smith Canal side of the fixed wall through development and implementation of a water hyacinth control program to ensure that the cover of water hyacinth in the project area does not increase beyond existing conditions. The frequency of water hyacinth removal would depend on the rate of vegetation growth and accumulation, to be determined by regular visual monitoring of the site. Based on the information gathered, SJAFCA would schedule and implement a regular removal program, removing hyacinth from the project site during the growing season, which is generally from March to early December. During the growing season, mechanical harvesting would be conducted using an aquatic weed harvester whenever cover of water hyacinth reaches 20 percent in the most affected areas behind the fixed wall. The percent cover would be visually estimated from the shoreline.

Conservation Measures

SJAFCA will implement conservation and water quality measures as described in the April 30, 2021, NMFS biological opinion. These are also described in Appendix A. In addition to the Appendix A conservation measures, SJAFCA will also implement the following conservation measures in order to specifically minimize impacts associated with the extended in-water work window, incremental increase in boat and barge operation outside the construction window, removal of the 1,000 impact strikes per day condition, implementation of the CPTs, placement of the gate RSP, and implementation of the gate warranty period testing and repair:

- A California Department of Fish and Wildlife (CDFW)-approved fisheries biologist with stop-work authority will be on-site during all barge movements to monitor for erratically behaving fish within 500 feet of the tugboat; if any erratically behaving fish are observed, the biologist will temporarily halt the barge movement and contact NMFS to identify the appropriate corrective actions (e.g., reduce the tugboat motor's revolutions per minute (RPMs), monitor underwater noise levels to ensure RMS values do not exceed 150 dB RMS beyond 100 m of the tugboat).
- All Project boats (including tugboats) will obey the posted speed limit of 5 mph (4.3 knots) within Smith Canal.

- All Project boats (including tugboats) will avoid rapid acceleration within the Action Area.
- All Project boat motors (including tugboats) will be turned off when not in use;
- Movement all Project boats (including tugboats) will be restricted to the minimum amount necessary to complete the intended work;
- All pile-driving activities will be monitored by a qualified fisheries biologist to ensure that no ESA-listed fish present in the Action Area and exhibiting signs of distress;
- The contractor will implement a "soft start" method (i.e., initially driving the pile with low hammer energy and increasing hammer energy as necessary) at the beginning of each pile-driving day or after extended periods of inactivity to allow fish to leave the work area before underwater noise levels associated with impact strikes reach their full force;
- The contractor will deploy a bubble curtain around all piles being driven with an impact hammer after September 15 to further minimize sound exposure levels (SEL) values, cumulative (cSEL) values, and the frequency with which the "effective quiet" value of 150 dB SEL is exceeded;
- Impact pile driving will be limited to flat sheet piles from July 1-July 14 and during October 16-November 30 (i.e., no pipe piles will be driven with an impact hammer during this period).
- Impact pile driving after October 15 will be limited to the period between two hours after sunrise and two hours before sunset.
- Underwater noise levels will be monitored during all impact and vibratory pile driving for all pile types during the periods July 1-14 and October 16-November 30 to ensure compliance with the underwater noise ecological surrogates for peak, RMS, and, for impact driving, cSEL levels;
- During the period of October 16-November 30, the distance to compliance for the underwater noise ecological take surrogates will be reduced to:

    – Lpeak: no more than 206 dB peak beyond a 12 m radius from the source.

    – cSEL: no than 187 dB cSEL beyond an 80 m radius from the source.

    – RMS: no more than 150 dB RMS beyond a 350 m radius from the source.

- Monitoring will be conducted during all pile driving activities by a qualified biologist with authority to stop the project if sound thresholds are exceeded. NMFS will be notified if the thresholds are exceeded and the contractor will take corrective action to comply with the thresholds before reinitiating pile driving activities.
- NMFS will be notified, via email, each time a switch is made from vibratory to impact hammer after October 15 through November 30, so that NMFS can conduct a site visit.
- A fisheries biologist with work-stop authority will be present during the placement of Gate RSP and will halt construction if ESA-listed fishes are observed within or near the work area.
- A turbidity curtain will be deployed around the active work area during the placement of Gate RSP to minimize turbidity increases in the vicinity of the work area.
- A fisheries biologist will monitor all in-water work associated with CPT drillings, including backfilling of the CPT bore holes, to ensure that no ESA-listed fish are injured

or killed and to monitor water quality to ensure compliance with the turbidity and pH thresholds required in all Project-related permits and authorizations.
- Water-based CPT locations will be isolated from the San Joaquin River and Smith Canal/Atherton Cove using turbidity curtains, and water turbidity monitored, to ensure no exceedance of water quality standards per existing project permit limits.
- All dewatering during gate warranty period testing will be performed under the supervision and guidance of a qualified fisheries biologist.
- Water quality will be monitored by a qualified fisheries biologist during all in-water work activities, including during the extended in-water work window, cone penetration testing, and Gate RSP placement in accordance with the 2019 and revised 2021 BO and 401 WQC.

Habitat Mitigation

The permanent placement of 0.386-acre of RSP around the gate foundation will occur within CCV steelhead and southern Distinct Population Segment (sDPS) green sturgeon designated critical habitat. To partially offset the impact to critical habitat SJAFCA will purchase salmonid credits at a 3:1 ratio (mitigation:impact) from a NMFS approved conservation bank. For the permanent occupation of 0.386-acres of tidal perennial habitat, SJAFCA will purchase 1.16 credits. This purchase will be in addition to compensatory mitigation previously purchased by SJAFCA to satisfy compensatory mitigation agreements from previously completed NMFS consultations.

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 incidental take statement (ITS) that specifies the impact of any incidental taking and includes 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 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(s) of critical habitat for (species) use(s) 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 biological 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 range wide 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.

2.1.1. Conservation Banking in the Context of the ESA Environmental Baseline

Conservation (or mitigation) banks present a unique situation in terms of how they are used in the context of the *Effects Analysis* (section 2.5) and the *Environmental Baseline* (section 2.4) in ESA Section 7 consultations.

When NMFS is consulting on a proposed action that includes conservation bank credit purchases, it is likely that physical restoration work at the bank site has already occurred and/or that a Section 7 consultation occurred at the time of bank establishment. A traditional interpretation might suggest that the overall ecological benefits of the conservation bank actions belong in the *Environmental Baseline*. Under this interpretation, where proposed actions include credit purchases, it would not be possible to attribute their benefits to the proposed action,

without double-counting. Such an interpretation does not reflect the unique circumstances that conservation banks serve. Specifically, conservation banks are established based on the expectation of future credit purchases. Conservation banks would not be created and their beneficial effects would not occur in the absence of this expectation.

For these reasons, it is appropriate to treat the beneficial effects of the bank as accruing in connection with and at the time of specific credit purchases, not at the time of bank establishment or at the time of bank restoration work. This means that, in formal consultations on projects within the service area of a conservation bank, the beneficial effects of a conservation bank should be accounted for in the *Environmental Baseline* after a credit transaction has occurred. More specifically, the *Environmental Baseline* section should mention the bank establishment (and any consultation thereon) but, in terms of describing beneficial effects, it should discuss only the benefits attributable to credits already sold. In addition, in consultations that include credit purchases as part of the proposed action, the proportional benefits attributable to those credit purchases should be treated as effects of the action. Conversely, where a proposed action does not include credit purchases, it will not receive any direct offset associated with the bank. This approach preserves the value of the bank for its intended purposes, both for the value of the credits to the bank proponent and the conservation value of the bank to listed species and their critical habitat.

2.2. Rangewide Status of the Species and Critical Habitat

This 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' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species.

2.2.1. Species Listing and Critical Habitat Designation History

The descriptions of the status of species and conditions of the designated critical habitats in this opinion are a synopsis of the detailed information available on NMFS' West Coast Regional website.

The following federally listed species Evolutionarily Significant Units (ESUs) or Distinct Population Segments (DPSs) and designated critical habitat occur in the action area and may be affected by the proposed action (Table 3 and 4):

Table 3. Description of species, current Endangered Species Act (ESA) listing classifications, and summary of species status.

Species	Listing Classification and Federal Register Notice	Status Summary
Southern DPS of North American green sturgeon	Threatened, 71 FR 17757; April 7, 2006	According to the NMFS 5-year species status review (NMFS 2015) and the 2018 final recovery plan (NMFS 2018), some threats to the species have recently been eliminated, such as take from commercial fisheries and removal of some passage barriers. Also, several habitat restoration actions have occurred in the Sacramento River Basin, and spawning was documented on the Feather River. However, the species viability continues to face a moderate risk of extinction because many threats have not been addressed, and the majority of spawning occurs in a single reach of the main stem Sacramento River. Current threats include poaching and habitat degradation. A recent method has been developed to estimate the annual spawning run and population size in the upper Sacramento River so species can be evaluated relative to recovery criteria (Mora *et al.* 2017).
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).
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 becoming endangered. 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 4. Description of critical habitat, Listing, and Status Summary.

Critical Habitat	Designation Date and Federal Register Notice	Status Summary
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.
Southern DPS of North American green sturgeon	October 9, 2009; 74 FR 52300	Critical habitat includes the stream channels and waterways in the Delta to the ordinary high water line. Critical habitat also includes the main stem Sacramento River upstream from the I Street Bridge to Keswick Dam, the Feather River upstream to the fish barrier dam adjacent to the Feather River Fish Hatchery, and the Yuba River upstream to Daguerre Dam. Critical habitat in coastal marine areas include waters out to a depth of 60 fathoms, from Monterey Bay in California, to the Strait of Juan de Fuca in Washington. Coastal estuaries designated as critical habitat include San Francisco Bay, Suisun Bay, San Pablo Bay, and the lower Columbia River estuary. Certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) are included as critical habitat for sDPS green sturgeon. PBFs considered essential to the conservation of the species for freshwater and estuarine habitats include: food resources, substrate type or size, water flow, water quality, migration corridor; water depth, sediment quality. In addition, PBFs include migratory corridor, water quality, and food resources in nearshore coastal marine areas. Although the current conditions of PBFs for sDPS green sturgeon critical habitat in the Central Valley are significantly limited and degraded, the habitat remaining is considered highly valuable.

2.2.1.1 Global Climate Change

One major factor affecting the rangewide status of the threatened and endangered anadromous fish in the Central Valley and aquatic habitat at large is climate change. 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). Projected warming is expected to affect Central Valley Chinook salmon. Because the runs are restricted to low elevations as a result of impassable rim dams, if climate warms by 5°C (9°F), it is questionable whether any Central Valley Chinook salmon populations can persist (Williams 2006).

CV spring-run Chinook salmon adults are vulnerable to climate change because they over-summer in freshwater streams before spawning in autumn (Thompson *et al.* 2011). CV spring-run Chinook salmon spawn in the tributaries to the Sacramento and San Joaquin Rivers, and those tributaries without cold water refugia (usually input from springs) will be more susceptible to impacts of climate change. Although CCV steelhead will experience similar effects of climate change to Chinook salmon, because they are also blocked from the majority of their historical spawning and rearing habitat, the adverse effects may be even greater in some cases. In the Central Valley, summer and fall temperatures downstream of dams in many streams already exceed the recommended temperatures for optimal growth of juvenile steelhead, which range from 14°C to 19°C (57°F to 66°F). The Anderson Cottonwood Irrigation Dam (ACID) is considered the upriver extent of sDPS green sturgeon passage in the Sacramento River. The upriver extent of sDPS green sturgeon spawning, however, is approximately 30 kilometers downriver of ACID where water temperature is higher than ACID during late spring and summer. Thus, if water temperatures increase with climate change, temperatures adjacent to ACID may remain within tolerable levels for the embryonic and larval life stages of sDPS green sturgeon, but temperatures at spawning locations lower in the river may be more affected.

In summary, observed and predicted climate change effects are generally detrimental to the species (McClure 2011, Wade *et al.* 2013), so unless offset by improvements in other factors, the status of the species and critical habitat is likely 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 projections, which increases over time, the direction of change 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 action area remains consistent with that as described in the October, 2019, and April, 2021, biological opinions and as described below.

Since the proposed action includes the purchase of mitigation credits from a conservation bank, the Action Area also includes the areas affected by mitigation banks that have service areas relevant to the project areas. These include the Fremont Landing Conservation Bank, which is a 100-acre site along the Sacramento River (Sacramento River Mile 78 through 80); the Bullock

Bend Mitigation Bank, which is a 116.15-acre site along the Sacramento River (Sacramento River Mile 80); Cosumnes Floodplain Mitigation Bank, which is a 472-acre site at the confluence of the Cosumnes and Mokelumne rivers (Mokelumne River Mile 22); and Liberty Island Conservation Bank, which is a 186-acre site located at the south end of the Yolo Bypass on Liberty Island in the Delta.

The project is located in the City of Stockton and unincorporated San Joaquin County, California. The project area includes Atherton Island, Atherton Cove, Louis Park (including Dad's Point), the Stockton Golf and Country Club, and the portions of the San Joaquin River in the immediate vicinity. The area north of Smith Canal, Atherton Island, Atherton Cove and Stockton Golf and Country Club, is located in unincorporated San Joaquin County. Louis Park, including Dad's Point, is in the City of Stockton.

Atherton Island is at the west end of Smith Canal, and Louis Park is southeast of Atherton Island at the mouth of the Canal. Dad's Point, a land bar that is an extension of Louis Park, is southwest of the mouth of Smith Canal and separates the Louis Park boat launch area from the San Joaquin River (Figure 2). Atherton Cove is a dead-end slough of the river that extends north and east around Atherton Island, and the Stockton Golf and Country Club is along the north bank of the river and southwest shore of Atherton Cove, to the northwest of Smith Canal.

The action area includes waters of the San Joaquin River that are within 1,000 feet upstream and downstream of proposed in-water construction areas. This area represents the potential area of impacts from the proposed project, in addition to noise effects based on pile-driving noise during similar construction activities (Figure 2). CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon have the potential to occur in the action area during the proposed action's period of construction and long-term operations. Designated critical habitats occur in the action area for CCV steelhead and the sDPS of North American green sturgeon. CV spring-run Chinook salmon critical habitat does not occur in the action area and will not be discussed further in this biological opinion.

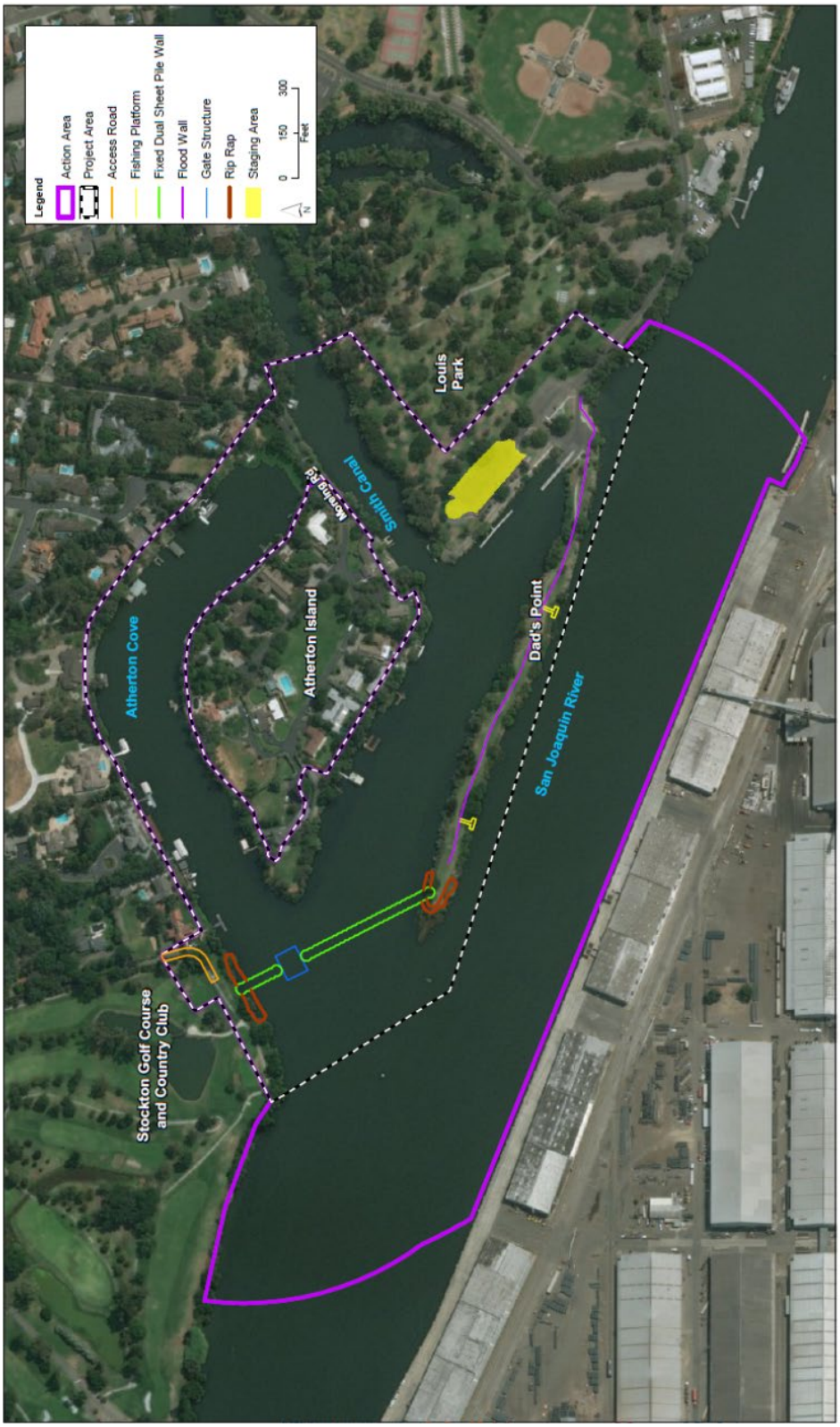

Figure 2. Proposed Action Area (BA 2018)

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. Previously Completed Construction Components of Smith Canal

The following activities completed under the previous biological opinions will be used to inform the anticipated effects of similar activities on the listed species for the remainder of the proposed action (Year 4 to Year 7, 2023-2026). From Year 1 through Year 3 (i.e., 2020, 2021, and 2022), SJAFCA completed approximately 65 percent of the Proposed Project as described below. In 2019, SJAFCA completed the test pile program:

Test Pile Program (2019)

During 2019 activities, SJAFCA conducted a test pile program during the in-water work window (July 15-November 1), which involved vibratory and impact driving a single 20-inch steel flat web sheet pile and "H" pile in three separate locations along the alignment of the cellular sheet pile wall across the mouth of Atherton Cove. The in-water work window specific for this test pile driving was through November 11 only. The purpose of the TPP was to ascertain site-specific subsurface conditions and responses. During the test pile program, SJAFCA evaluated peak and cumulative sound exposure levels during pile driving operations with and without bubble curtain and conducting five cone penetration tests across the cellular sheet pile wall alignment.

Year 1 (2020) Project Activities

Year 1 activities consisted primarily of mobilization of labor, equipment, and materials at the staging area and gate location at the mouth of Smith Canal, installation of a ring cofferdam to isolate the gate construction area, installation of foundation pipe piles for the gate structure, and seasonal demobilization of the in-water work area.

Year 2 (2021) Project Activities

Year 2 Project activities included installation of the gate foundation within the ring cofferdam, grading and installation of a sheet pile floodwall along the length of Dad's Point in Louis Park, dredging near the tip of Dad's Point, installation of 19 of 26 southern floodwall cells (cells A through S) between the ring cofferdam and the tip of Dad's Point, and installation of fishing pier piles on Dad's Point.

Year 3 (2022) Project Activities

Year 3 Project activities included installation of and work on the operable gate structure within the ring cofferdam, installation of seven southern floodwall cells (cells T through Z, installation of 3 of 8 northern floodwall cells (cells AA through CC) between the ring cofferdam and the Stockton Golf and Country Club, placement of granular fill within 19 south floodwall cells (cells A through S, Figure 1), installation of fishing pier decks on Dad's Point.

2.4.2. 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 juvenile, subadult and adult sDPS green sturgeon. The action area is within designated critical habitat for CCV steelhead and green sturgeon. 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. 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. Juvenile (including subadult) sDPS green sturgeon may be present throughout the Delta during every month of the year, whereas spawning and post-spawn adults are unlikely to migrate through the action area because their primary migratory route between the ocean and upstream spawning habitats lies predominantly in the Sacramento River and its tributaries.

2.4.2.1 CCV steelhead

The life history strategies of steelhead are 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. As such, the determination of the presence or absence of CCV steelhead in the Delta accounted for both upstream and downstream migrating adult steelhead (kelts).

Adult CCV steelhead enter freshwater in August (Moyle, 2002) and peak migration of adults moving upriver occurs in August through September (Table 4, Hallock et al. 1957). Adult CCV steelhead will hold until flows are high enough in the tributaries to migrate upstream where they will spawn from December to April (Hallock et al. 1961). After spawning, most surviving steelhead kelts migrate back to the ocean and reach the Sacramento River during March and April, and have a high presence in the Delta in May. Migrating adult CCV steelhead through the San Joaquin River are present from July to March, with highest abundance between December and January (Table 5). 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 recent 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 this proposed action in the mainstem San Joaquin portion of the action area is from July 1 through November 30 for in 2023 and 2024. The proposed warranty testing period is from July 1 through November 30 in 2024 and from July 15 to October 15 in Year 2025. The proposed warranty repair work is from July 15 to October 15 in 2025 and 2026. This will overlap with the adult CCV steelhead migration period in the San Joaquin River Basin (i.e., the months of September, October, and November).

However, the long-term operations of the project's flood control gates in Smith Canal may overlap with both adult migration upstream, and juvenile migration downstream as this is likely to occur during the winter when river levels are expected to rise in response to high tides or flood events, which will also likely trigger fish movements. Additionally, the environmental effects of the long-term vegetation policies along the proposed action's levees will overlap with fish presence into the future. Because of the close proximity of the canal to San Joaquin River, a migratory corridor for fish, it is possible that fish can enter the canal through the cove.

Table 5. The temporal occurrence of (a) adult and (b) juvenile California Central Valley steelhead at locations in the Central Valley. Darker shades indicate months of greatest relative abundance.

(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 2001); [3](Harvey 1995); [4]CDFW unpublished data; [5]CDFG Steelhead Report Card Data 2007; [6]NMFS analysis of 1998-2011 CDFW data; [7](Johnson & 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 Symbol Key: H = High M = Medium L = Low N = Not Present

2.4.2.1.1. 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, 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 due to the project timing because the work window is mostly outside of their migration periods.

Even though the habitat has been substantially altered and its quality diminished through years of human actions, its conservation 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 to aid in recovery.

2.4.2.2. CV spring-run Chinook salmon

Typical CV spring-run Chinook salmon life history patterns have adults returning to freshwater basins in March (Table 6). Capitalizing on spring-time runoff, adults travel to holding pools where available in preparation 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.

Until recently, CV spring-run Chinook salmon were considered functionally extirpated from the Southern Sierra Nevada diversity group despite their historical abundance in the San Joaquin River Basin (NMFS 2016a). There have been observations of low numbers of spring-time running Chinook salmon returning to major San Joaquin River tributaries that exhibit some typical spring-run life history characteristics. 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 wild-spawned juvenile spring-run Chinook salmon since 2016 (NMFS 2021). These juveniles are imprinted to 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 2016a). Additionally, CV spring-run Chinook salmon adults have returned to the San Joaquin River Restoration Program area for three

consecutive years (2019, 2020, and 2021) (NMFS 2021; SJRRP preliminary data from Zachary Sutphin, Bureau of Reclamation, April 2021).

Based on known CV spring-run Chinook salmon life history timing and limited information of use of the San Joaquin River Basin, juveniles are expected in the action area November through May during their emigration. Returning adults are expected to travel through the action area from March through June. Timing of CV spring-run Chinook salmon use of the action area would depend on in-river water being adequate in quality and temperature. Life history stage timelines are expected to differ slightly between the Sacramento River and San Joaquin River basins. The proposed construction period for the Project's actions in the mainstem San Joaquin River portion of the action area is from July 1 through November 30 in Years 4 (2023) and 5 (2024) and mid-July through mid-October in Years 6 (2025) and 7 (2026). There is little likelihood that either adult or juvenile life history stages of CV spring-run would overlap with this timing. However, the long-term operations of the proposed project's flood control gates in Smith Canal would overlap with both adult migration upstream, and juvenile migration downstream as this is likely to occur during the winter when river levels are expected to rise in response to high tides or flood events, which will also likely trigger fish movements.

Table 6. The temporal occurrence of adult (a) and juvenile (b) 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	Late 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	Late 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 Symbol Key: H = High M = Medium L = Low N = Not Present
(Used for reference for the San Joaquin River). Darker shades indicate months of greater relative abundance.)

2.4.2.3. sDPS green sturgeon

Adult sDPS green sturgeon enter the San Francisco Bay starting in February, have been recorded in San Pablo Bay in March (Heublein et al., 2008), and in the Sacramento River system between late February and late July (Moyle et al., 1995). In general, sDPS green sturgeon enter the San Francisco Bay estuary in winter and continue upstream to their spawning grounds from mid-winter to late-summer. Spawning occurs from April to July in the mainstem Sacramento River (Poytress et al. 2015) and Feather River (Seesholtz et al. 2015). Adults have been recorded out-migrating from the Sacramento River in the fall (November to December) and summer (June to August) (Heublein et al., 2008). It has been suggested that spawning may also occur in the San

Joaquin River (Moyle et al. 1995) however, this was based on a 1-year study in the 1960's collecting a large number of young green sturgeon during the summer at a shallow shoal area in the lower San Joaquin River (Radtke 1966). Data on sDPS green sturgeon distribution is extremely limited and out-migration appears to be variable occurring at different times of year. Seven years of CDFW catch data for adult sDPS green sturgeon show that they are present in the Delta during all months of the year. Adult and juvenile sDPS green sturgeon are therefore assumed to be present in the Delta year-round (Table 7).

Prior to October 2017, all accounts of sDPS green sturgeon sightings in the San Joaquin River Basin were anecdotal at best or misidentified white sturgeon (Gruber et al. 2012, Jackson et al. 2016). During late October in 2017, an adult sDPS green sturgeon was sighted in the Stanislaus River near Knights Ferry by a fish biologist and its identity was genetically confirmed by genetic analysis of green sturgeon environmental DNA in the surrounding water (Breitler, 2017). This is the first confirmed sighting of a green sturgeon in a San Joaquin River tributary, and indicates that adults are able to pass upstream of the proposed action area given river flows of suitable quality and amount. In addition, on April 11, 2020, another adult green sturgeon was captured within the boundaries of the San Joaquin River Restoration area (just upstream with the Merced River confluence in the vicinity of Hills Ferry, California)(Root et al. 2020). Spawning activities in the San Joaquin River Basin have not been recorded and production of juveniles from the Stanislaus River is not considered likely in the near future. However, implementation of recovery actions, increased protections under the ESA since listing may improve conditions leading to and potential recolonization in the San Joaquin Basin.

While the San Joaquin River Basin may not currently produce juvenile sDPS green sturgeon, juveniles may use both estuarine and freshwater portions of the Delta to rear for one to three years prior to exiting the system and entering the Pacific Ocean. During this period, they may range and stray up non-natal waterways searching for appropriate food resources, water quality conditions, and shelter. Therefore, foraging juveniles, subadults, and adults may be found in the San Joaquin River mainstem at the location of the proposed action at nearly any time of year, depending on the local water depth, temperature, and quality.

For the purpose of analyzing the impacts of this action, both adult and juvenile sDPS green sturgeon are expected to occur in the action area, but in low numbers. The Delta serves as an important migratory corridor for adults during their spawning migrations, and as year-round rearing habitat for juveniles. Both non-spawning adults and subadults use the Delta and estuary for foraging during the summer. Since there are no physical barriers to sDPS green sturgeon moving into the action area from the waters of the Delta adjacent to the action area during their rearing or foraging behaviors, presence in the action area is seen as feasible and likely.

Since adult, subadult, and juvenile sDPS green sturgeon may be present in the Delta year-round, the construction period will overlap with their presence. Likewise, the long-term operations of the proposed project flood control gates in Smith Canal will overlap with adult, subadult, and juvenile presence in the Delta during the winter when river levels are expected to rise in response to high astronomical tides or flood events occur and the gates are operated. Likewise, the environmental effects of the long-term vegetation policies along the proposed project levees will overlap with fish presence into the future.

Table 7. The temporal occurrence of (a) adult, (b) larval (c) juvenile and (d) subadult coastal migrant sDPS of green sturgeon. Locations emphasize the Central Valley of California. Darker shades indicate months of greatest relative abundance.

(a) Adult-sexually mature (≥145 – 205 cm TL for females and ≥ 120 – 185 cm TL for males)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Upper Sac. River[a,b,c.i]												
Feather, Yuba Rivers[k]												
SF Bay Estuary[d,h,i]												

(b) Larval and juvenile (≤10 months old)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RBDD, Sac River[e, j]												
GCID, Sac River[e, j]												

(c) Older Juvenile (> 10 months old and ≤3 years old)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
South Delta*[f]												
Sac-SJ Delta[f]												
Sac-SJ Delta[e]												
Suisun Bay[e]												

(d) SubAdult/non-sexually mature (approx. 75 cm to 145 cm for females and 75 to 120 cm for males)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pacific Coast[c,g]												
San Francisco and San Pablo Bay												

Relative Abundance: = High = Medium = Low

* Fish Facility salvage operations

Sources: [a]USFWS (2002); [b]Moyle *et al*. (1992); [c]Adams *et al*. (2002) and NMFS (2005); [d]Kelly *et al*. (2007); [e]CDFG (2002); [f]IEP Relational Database, fall midwater trawl green sturgeon captures from 1969 to 2003; [g]Nakamoto *et al*. (1995); [h]Heublein (2009); [i]Gleason et al. 2008, [j]Poytress *et al.* (2011, 2012), [k]Alicia Seesholtz, DWR, personal communication.

2.4.2.4. sDPS green sturgeon critical habitat

The action area is close to the southernmost extent of sDPS green sturgeon designated critical habitat in freshwater, which ends just north of the confluence of the San Joaquin River and the

Stanislaus River. There is little data regarding the services this portion of their critical habitat offers sDPS green sturgeon, except that the San Joaquin River is believed to have historically supported sDPS green sturgeon populations and therefore they must have used this area for migration and perhaps also for foraging and rearing to some degree.

The PBFs of sDPS green sturgeon critical habitat included within the action area are: (1) food resources; (2) adequate water flow regime for all life stages; (3) water quality; (4) and adequate water depth for all life stages. The San Joaquin River mainstem in this section has sufficient depth to support even adult passage, though as stated before only one adult has been observed in the Stanislaus River to date. Spawning in the San Joaquin River Basin may not be currently possible for sDPS green sturgeon given the extent of degradation prevalent throughout the San Joaquin River Basin. Therefore, juveniles are not expected to be produced in this system for some time; however, juveniles produced by the Sacramento River Basin could range into this area during their long rearing period in the Delta.

Even though the habitat has been substantially altered and its quality diminished through years of human actions, its conservation value remains high for sDPS green sturgeon. Due to a deficiency of monitoring data directed at this species, an unknown fraction of the sDPS population utilizes the middle and upper San Joaquin River reaches within the Delta. Currently even less is known about utilization of the San Joaquin River upstream of the Delta. However, designated critical habitat occurs in the action area and includes the San Joaquin River upstream to the limits of the legal Delta (Vernalis) on the San Joaquin River. Preservation of the functionality of the PBFs within this region is important to the long-term viability of the sDPS green sturgeon population by providing suitable habitat for the rearing of juveniles, and the foraging and migratory movements of adults.

2.4.3. 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 associated shaded riverine aquatic (SRA) vegetation and the introduction of point and non-point contaminants and are incorporated here by reference. Other factors that impact listed species and critical habitat specific to the action area are discussed below.

2.4.3.1. San Joaquin River Basin water resources

The San Joaquin River is the longest river in California, covering 366 miles, and is considered California's second largest river in California according to average total annual flow (the Sacramento River being the largest). The San Joaquin River has an average mean flow of six 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 Friant Dam, 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. See the existing Coordinated Long-term Operation of the CVP and SWP, and their effects on ESA-listed species and their critical habitats that have been analyzed in the 2009 NMFS CVP Operations Biological Opinion (NMFS 2009) for more information on the effects of federal and state water management on listed species under NMFS jurisdiction. In a typical year, all of the San Joaquin River's flows were allocated to water users. Following, construction of Friant Dam and associated water management practices, 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*) unless there is a "call" on Friant from CVP Exchange Contractors which can lead to dewatering of the River during some drought years.

2.4.3.2. 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 with a combined pumping capacity of 195 cubic-feet-per-seconds (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 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 nine panels to a side. Each panel is 6'1" tall and 11'6" 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 U.S. Fish and Wildlife Service.

2.4.3.3. 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 settlement goal #1. Though this settlement and the SJRRP actions are limited to the restoration area (the San Joaquin River mainstem from Friant Dam to the Merced River) the restoration of volitional fish passage would increase the use of the San Joaquin River mainstem within the action area of this project by both adult and juvenile salmonid migration.

2.4.3.4. Mitigation banks

There are several conservation or mitigation banks approved by NMFS with service areas that include the action area considered in this opinion. These banks may offer salmonid credits or credits that would benefit salmonid habitat.

Bullock Bend Mitigation Bank: Established in 2016, the Bullock Bend Mitigation Bank is a 116.15-acre floodplain site along the Sacramento River at the confluence of the Feather River (Sacramento River Mile 80) and is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. There are salmonid floodplain restoration, salmonid floodplain enhancement, and salmonid riparian forest credits available. To date, there have been 12.5 of 119.65 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for CV spring-run Chinook salmon, CCV steelhead as analyzed in this opinion, and sDPS green sturgeon.

Cosumnes Floodplain Mitigation Bank: Established in 2008, the Cosumnes Floodplain Mitigation Bank is 472-acre floodplain site at the confluence of the Cosumnes and Mokelumne Rivers (Mokelumne River Mile 22) and is approved by NMFS to provide credits for impacts to CCV steelhead. There are shaded riverine aquatic, floodplain riparian, and floodplain mosaic wetlands credits available. To date, there have been 22.39 of 38.13 floodplain credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for CCV steelhead as analyzed in this opinion.

Fremont Landing Conservation Bank: Established in 2006, the Fremont Landing Conservation Bank is a 100-acre site near the confluence of the Feather River and the Sacramento River, at river mile 78 through 80, on the west bank of the Sacramento River. It is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. Out of 100 acres of potential credits, 28.283 acres have been sold/withdrawn and the ecological value (increased rearing habitat for juvenile salmonids) of these credits are part of the environmental baseline. All features of this bank are designated critical habitat for CCV steelhead as analyzed in this opinion.

Liberty Island Conservation Bank: Established in 2010, the Liberty Island Conservation Bank is a 186-acre site located at the southern end of the Yolo Bypass on Liberty Island in the Delta. Out of the credits relating to salmonid restoration or preservation, 27.67 acre have been sold/withdrawn. It is approved by NMFS to provide credits for impacts to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. There are riparian shaded aquatic, salmonid preservation, and salmonid restoration credits available, and the ecological value of the sold credits (increased rearing habitat for juvenile salmonids) are part of the environmental baseline. All features of this bank are designated critical habitat for CCV steelhead as analyzed in this opinion.

2.4.4. NMFS Salmon and Steelhead Priority Recovery Plan Action

NMFS' Recovery Plan for 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 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., catastrophic wildfire).

2.4.4.1. 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 downstream of major dams, and as candidates to reach viable population status if reintroduced upstream of the dams, and lists the San Joaquin River, downstream of Friant Dam, as a candidate to reach viable population status.

2.4.4.2. CV Spring-run Chinook salmon

The 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.

2.4.4.3. sDPS green sturgeon

The San Joaquin River is not known to currently support sDPS green sturgeon spawning. Currently, he San Joaquin River Basin is not a main focus of their recovery plan. Nonetheless, sDPS green sturgeon occupy the lower San Joaquin River to an unknown extent as evidenced by the detection of an individual adult in the Stanislaus River in October 2017. This highlights that passage for adults is possible during certain river conditions. However, the recovery plan is not likely to be modified to include recovery recommendations until adult spawning or juvenile reproduction occurs (NMFS, 2018) which is problematic due to the absence of green sturgeon monitoring activities in the watershed.

2.4.5. Summary of Monitoring and Effects from Year 2 (2021) and Year 3 (2022) Activities of Smith Canal Gate Project

This biological opinion is the third reinitiation of ESA consultation with NMFS (2021, 2019, 2016). Over the course of construction of the project under these opinions, SJAFCA completed construction of approximately 65 percent of the total project by October, 2022. These in-water completed components include: completion of the gate, completion of 19 cells in the flood wall. Monitoring during construction analyzed numerous variables associated with water quality and underwater noise levels.

2.4.5.1 Summary of Underwater Noise Levels from Pile Driving as Measured in 2021 and 2022

A summary of underwater noise levels and the distance to compliance with the BO-specified thresholds are provided in Table 8 for Year 2 (2021) for vibratory pile driving events.

RMS

Table 8. Measured underwater peak and RMS noise levels for unattenuated vibratory pile-driving events and distance to NMFS' 2019 BO thresholds in Year 2 (2021) of construction.

Year	Number of Piles Driven	Pile Types	Noise Level (dB re:1µPa)* Peak Max	Noise Level (dB re:1µPa)* RMS Average	Distance to Threshold (m) Peak Max	Distance to Threshold (m) RMS Average
2021 (Year Two) July 1 – November 30	109	Flat and H-piles	199.1	113.4	1.8	< 1
2021 July 1-14 Only	9	H-piles	176	91.1	0.2	< 1
2021 October 16-November 30 Only	41	Flat and H-piles	166.5	120.8	0.04	< 1

* Values calculated at a distance of 10 meters from the pile.

The highest instantaneous peak values measured during vibratory driving in 2021 was 190.2 dB dB (Table 8). Based on these Project-specific data, peak underwater noise levels did not exceed 206 dB beyond 1.8 m and, therefore, were below the 18 m threshold.

Of the 69 daily average RMS values measured in 2021 and 2022, 78% (n=54) reached the threshold RMS value of 150 dB within 10 m of the flat sheet being driven with an impact hammer and all 69 daily average RMS values reached the threshold value of 150 dB within 300 m of the flat sheets being driven. In no cases did the daily average RMS values exceed 150 dB

beyond the Project-specific allowable take distance of 2,154 m as specified in the 2021, NMFS biological opinion.

Peak

Sixty-nine daily maximum peak values measured in 2021 and 2022; 86% (n=59) reached the threshold peak value of 206 dB within 1 meter of the flat sheet being driven with an impact hammer. Moreover, all 69 daily maximum peak values reached the peak value of 206 dB within 4.9 meters of the flat sheets being driven. The calculated maximum distance to compliance associated with the maximum peak value was 1.8 m. During the first two weeks of July 2021 and the period of October 16-November, 2021, maximum instantaneous peak values did not exceed 176 dB and all measurements were in compliance with the 206 dB threshold within 0.2 m of the piles being installed (Table 8). In no cases did the peak values exceed 206 dB beyond the NMFS-specified "no take" threshold of 10 m nor the Project-specific allowable take distance of 18 m.

Cumulative SEL

No cSEL value could be calculated for 40 of the 69 impact driving days because all SEL values were below the effective quiet value of 150 dB. Of the remaining 29 daily cSEL values measured in 2021, and 2022, 72% (n=21) reached the threshold cSEL value of 187 dB within 10 m of the flat sheet being driven with an impact hammer and all 29 daily cSEL values reached the threshold 187 dB within 60 meters of the flat sheets being driven. In no cases did the cSEL values exceed 187 dB beyond the Project-specific allowable take distance of 1,597 m.

Water Quality

Routine water quality monitoring at locations upstream and downstream of the Project area was conducted during in-water work periods in Years 1, 2, and 3 (2020-2022). Turbidity was measured at two locations: (1) approximately 300 linear feet east of the Project site, and (2) approximately 300 linear feet west of the Project site. All water quality measurements were made near the eastern bank of the San Joaquin River and at mid-depth in the water column.

A summary of results for water quality monitoring for paired upstream and downstream turbidity measurements collected during Years 1 through 3 (2020–2022) of in-water construction are provided in Table 9. None of the downstream turbidity measurements taken from 2020–2022 exceeded the 150 NTU limitation for waters of the Central Delta, as specified in Condition 3.c. of the 401 WQC. The largest increase in downstream turbidity above ambient conditions during the first of in-water construction activity was 61.4 NTU in 2021, which occurred on November 16, 2021. This increase was a one-time event, however, which was the result of simultaneous barge movement and dredge activity; downstream increases in turbidity were typically less than 10 NTU during the first three years of monitoring. Aside from a single measurement on November 16, 2021, the take limit of 50 NTUs above ambient (i.e., upstream) specified in Condition 1.a of the NMFS BO was not exceeded during Years 1–3 of in-water construction activity.

Table 9. Results of Paired Water Quality Measurements Collected during the Smith Canal Gate Project, Years 2020–2022

Year	Turbidity (NTU) Upstream	Turbidity (NTU) Downstream	Turbidity (NTU) Increase above Ambient
2020	0.34 – 67.3	2.48 – 51.2	32.3
2021	0.0 – 63.9	0.0 – 86.4	61.4
2022	1.92 – 27.24	1.85 – 24.30	18.62

A turbidity curtain was deployed at all times during in-water work activity to minimize turbidity outside the turbidity curtain. The most notable increases in turbidity measured at the monitoring locations resulted from barge movements using the tugboat. However, barge movements were infrequent activities that typically lasted a few minutes. The increases in turbidity were generally confined to within a short distance (typically less than 150 feet) of the tugboat and barge, were short in duration (e.g., within 15 minutes).

No construction-related fuels or other materials were observed outside the cofferdam during Year 1 in-water work activities. As reported in the 2020 and 2021 annual reports (ECORP 2020, 2022b), minor accidental spills of non-hazardous clarity hydraulic fluid caused by a leaking hydraulic cylinder seal on the vibratory hammer occurred inside the cofferdam on September 21, 2020, and was contained within the cofferdam until it was cleaned up in accordance with the contractor's spill prevention plan (Shimmick 2020).

During Year 2 of in-water work activities, a minor (less than 5 gallons) accidental spill of non-hazardous clarity hydraulic fluid resulted in a patchy vegetable oil sheen inside and about 10 feet outside the turbidity curtain on August 5 (approximately 0.5 gallon). Another minor spill of non-hazardous vegetable-based clarity hydraulic fluid occurred on October 29, 2021 when a hydraulic hose became caught on dredging equipment and pulled loose and released hydraulic fluid onto the barge, of which 0.5 gallon spilled into the water.

During Year 3 of in-water work activities, minor spills (less than 5 gallons) of non-hazardous clarity hydraulic fluid occurred on August 20 and September 9, 2022, however neither of these spills reached the water.

On each occasion, the contractor followed the spill prevention plan's requirements for a minor spill, which included containment, recovery of spilled material, and cleanup. Disposal of the recovered material occurred per recommendations from California Office of Emergency Services and San Joaquin County.

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 effects to listed fish species that may occur as a result of implementing the proposed action on the San Joaquin River.[1] 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) noise exposure, (3) habitat loss/modification, (4) and operations and maintenance. As described in section 2.1 Analytical Approach, we use completed construction components of Year 2 (2021) and Year 3 (2022) as best available information to inform the anticipated effects of the proposed action (Year 4 through Year 7, 2023-2026).

2.5.1. Effects to species: Water quality, noise exposure, RSP placement, Cone Penetration Tests, effects of structures, operations and maintenance, boat traffic

2.5.1.1 Construction Impacts

Water Quality: Sediment and Turbidity

Construction activities could result in turbidity, suspended sediment concentrations, and contaminant concentrations. Construction activities could disturb sediments and soils within and adjacent to waterways. These activities, including construction of the new tidal gate, use of staging areas, installation of sheet piles, wildlife viewing platforms, riprap placement, and placement of excavated material, could disturb sediments and soils within and adjacent to waterways. 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. During the long-term period of gate operations, the narrow gate opening (~50 feet) will create a higher velocity flow through the structure than currently exists through the undeveloped channel during each tidal cycle. NMFS expects that elevated turbidities will occur in association with this higher velocity until the surrounding channel substrate has come to an equilibrium between heavier and coarser sediments lining the scour hole and the redistribution of the lighter material more prone to resuspension into other areas of the channel. It is unknown how long this process will take, and what level of turbidity is likely to occur as a result.

The 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

[1] As stated previously, there are no other activities associated with this project.

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 a reduction in 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.

Many fish, including salmonids (Chinook salmon 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 Dissolved Oxygen (DO) content, and an increased level of pollutants.

Avoidance of adverse habitat conditions by fish is the most common result of 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 avoidance, loss of station in the stream, 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 sheet piles, riprap placement, and dredging, there would be an increase in sediment and turbidity. The Smith Canal structure is anticipated to take four additional years for completion, with the majority of the work occurring over two, five-month long (July 1 - November 30) in water work windows (Year 4 (2023) and Year 5 (2024)). During warranty testing/inspection, which is anticipated to occur episodically over a five-month long period (July 1 through November 30) in Year 5 and over a three-month long period (July 15 through October 15) in Year 6 (2025), there would be an increase in sediment and turbidity. During the repair period (if needed), which is anticipated to occur episodically over a 3 ½ month long period (July 15 through October 15) in Year 6 (2025) through Year 7 (2026), there would be an increase in sediment and turbidity. During these periods, NMFS anticipates short-term, localized (no more than 300 feet upstream and downstream) construction related turbidity events will occur. In addition, based on Year 1, 2, and 3 (2020-2022) water quality monitoring information, the turbidity levels stayed below the threshold of 50 NTUs above background.

In-water work activities that would result in increased sediment and turbidity would occur from July 1 to November 30 (2023 and 2024) and July 15 to October 15 (2025 and 2026). This period

coincides with the period when CCV steelhead are less likely to be present in the action area although adult CCV steelhead may commence their upstream migration as early as October. Juvenile CCV steelhead would not likely be migrating downstream during this time. There is likely to be no exposure to any CV spring-run Chinook salmon adults based on the expected timing of their life histories. Juvenile and adult CCV steelhead and CV spring-run Chinook salmon are not expected to occur in the project site during the in-water work window due to unsuitable habitat conditions such as warm water temperatures. These species are only likely present within the action area during migration which is largely outside of the proposed construction window. The separation in timing will limit the potential for CV spring-run Chinook salmon and CCV steelhead to be impacted by construction activities. NMFS expects that foraging adult sDPS green sturgeon and rearing juvenile sDPS green sturgeon could be present in the Delta. However, diminished water quality (low DO, low flow, and increased water temperatures) in the action area would likely preclude presence of green sturgeon during the in-water work window.

Installation of the sheet piles and platform pilings is expected to result in short-term, localized increases in turbidity. Therefore, there could be some impacts to the listed species if present during the removal of the cofferdam and ongoing floodwall construction activities. Since in-water work will be extended in Year 4 (2023) and Year 5 (2024), the probability of in-water work overlapping with listed salmonid presence increases and the potential for exposure to elevated turbidity increases. Although the risk of contact is still low, this increases the risk for exposure, resulting in non-lethal adverse effects, including behavioral responses such as displaced feeding and migration delays, for small numbers of each species.

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 ammonia/ammonium, pesticides and herbicides, and oil and gasoline product discharges. Oil and gasoline product discharges may be introduced into the waterways from shipping and boating activities and from urban activities and runoff. 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.

High concentrations of contaminants can cause short-term and 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, only a small number of salmonids would be expected to be exposed to such effects because of the timing of in-water work.

Green sturgeon may be more susceptible to aquatic contaminants since they are benthic foragers. The prey base (green sturgeon food resources) are likely to bioaccumulate some of the contaminants listed in the 303(d) list for impaired waters that are present in the Smith Canal, as green sturgeon are bottom feeders. Studies on white sturgeon found that bioaccumulation of pesticides and other contaminants adversely affect growth and reproductive development (Feist et al. 2005). However, green sturgeon occurrence in the relatively shallow water of the action area during sediment disturbance is likely to be limited because the species tends to occupy deeper water during the day.

With the continued implementation of the water quality conservation measures (as described in the project description), the potential effects from exposure to contaminants are expected to be avoided.

Noise Exposure

2.5.1.2 Vibratory and Impact Pile Driving

Installation of the dolphins, fenders, and construction of flood walls (aka cell walls) will require the use of vibratory and impact pile driving. Table 10 provides a summary of all pile driving activities for the proposed action. During the construction period, steel pipe piles and steel sheet piles will be installed in the river via vibratory pile driving methods to the maximum depth possible or desired, and then via impact pile driving, as necessary, for final setting and then load testing. To ensure in-water pile driving work is completed in two construction seasons, SJAFCA estimated up to 5,000 impact strikes per day are necessary. Most in-water pile driving will be accomplished with a barge-mounted crane. Water depths in the pile driving locations are assumed to be variable but less than five meters overall.

Pile driving near or in water has the potential to kill, injure, and cause delayed death to fish through infection of minute internal injuries, or cause sensory impairments leading to increased susceptibility to predation. The pressure waves generated from driving piles into river bed substrate propagate through the water and can damage a fish's swim bladder and other internal organs by causing sudden rapid oscillations in pressure, which translates to rupturing or hemorrhaging tissue in the bladder when the air in swim bladders expand and contract (Gisiner 1998, Popper, Carlson et al. 2006). Sensory cells and other internal organ tissue may also be damaged by pressure waves generated during pile driving activities as sound reverberates through a fish's viscera (Caltrans 2015). In addition, morphological changes to the form and structure of auditory organs (saccular and lagenar maculae) have been observed after intense noise exposure (Hastings and Popper 2005). Smaller fish with lower mass are more susceptible to the impacts of elevated sound fields than larger fish, so acute injury resulting from acoustic impacts are expected to scale upward based on the mass of a given fish. Since juveniles and fry have less inertial resistance to a passing sound wave, they are more at risk for non-auditory tissue damage (Popper and Hastings 2009) than larger fish (yearlings and adults) of the same species. Beyond immediate injury, multiple studies have also shown responses in the form of behavioral changes in fish due to human-produced noises (Wardle et al. 2001, Slotte et al. 2004, Popper and Hastings 2009).

Impact Pile Driving, Effects of Pipe Piles – July 15-October 15

Both flat sheet and pipe piles will be subject to impact driving, however adverse effects from pipe piles are considerably more pronounced than sheet piles and represent a worse-case scenario during the in-water work window. Because pipe piles represent a worse-case scenario they are the focus of this analysis. Based on recommendations from the Fisheries Hydroacoustic Working Group (FHWG), NMFS uses an interim dual metric criteria to assess onset of injury for fish exposed to pile driving sounds (NMFS 2008, Caltrans 2015, Caltrans 2019). The interim thresholds of underwater sound levels denote the expected instantaneous injury/mortality and cumulative injury, as well as a third threshold criteria for behavioral changes to fish. Impact pile driving is expected to produce underwater pressure waves at all three threshold levels. Even at large distances from the pile driving location, underwater pressure changes/noises from pile driving is likely to cause flight, hiding, feeding interruption, area avoidance, and movement blockage when pile driving is ongoing.

For a single strike, the peak exposure level (peak) above which injury is expected to occur is 206 decibels (dB) (reference to 1 micro-pascal [1µpa] squared per second). However, cumulative acoustic effects are expected for any situation in which multiple strikes are made to an object with a single strike peak dB level above the effective quiet threshold of 150 dB. Therefore, the accumulated SEL level above which injury to fish is expected to occur is 187 dB for fish greater than 2 grams in weight, and 183 dB for fish less than 2 grams. If either the peak SEL or the accumulated SEL threshold is exceeded, then physical injury is expected to occur to fish within the estimated distance thresholds. Underwater sound levels below injurious thresholds are expected to produce behavioral changes. NMFS uses a 150 dB root-mean-square (RMS) threshold for behavioral responses in salmonids and green sturgeon. Though the dB value is the same, the 150 dB RMS threshold for behavioral effects is unrelated to the 150 dB effective quiet threshold.

According to the Caltrans pile driving compendium of field data (Caltrans 2012), in-water impact pile driving of the 36-inch diameter steel pipe piles for this project could generate unattenuated underwater sound waves of up to 210 dB peak, 190 dB SEL, and 190 dB RMS, as measured at 10 meters from the strikes, in approximately 5 meters of water depth or less (Table 10). These estimates are calculated from field data gathered from pile driving activities at other locations and are considered informative only, not the definite levels that would be generated by impact pile driving in the San Joaquin River/Smith Canal/Atherton Cove during the course of this project. This is because each pile driving situation is unique and variations in the substrate, channel shape, depth, salinity, and water temperature can alter how the underwater pressure waves propagate and the amount of transmission loss that will dampen the underwater sounds as they travel. -

Table 10. Expected maximum unattenuated hydroacoustic on 36-inch piles from impact pile driving, empirical data from the 2012 FHWG pile driving compendium Caltrans (Caltrans 2012).

Pile Type	Driver Type	Pile Location	Reference Distance	Peak (dB)	SEL (dB)	RMS (dB)
+-	Impact	In water, <5 meters depth	10 meters	208	180	190
36-inch diameter steel pipe piles	Impact	On land	10 meters	201	174	186
36-inch diameter steel pipe piles	Impact	On land	20 meters	198	171	183
36-inch diameter steel pipe pile	Vibratory	In water, ~ 5 meters	10 meters	180-185	170-175	170
24-inch AZ steel sheet pile	Vibratory	In water, ~15 meters	10 meters	175-182	160-165	160-165

Considering the scenario which will be most acutely harmful during construction installation (36-inch diameter steel pipe piles in less than 5 meters water depth, impact pile driving in water, 5,000 strikes a day, no attenuation) with the production of 208-210 dB peak/180-190 dB SEL/177-190 dB RMS underwater sounds, the NMFS Pile Driving Calculator (NMFS 2008) indicates that the distance threshold within which instantaneous mortality would be expected to occur is 18 meters or less from the driven pile. For fish weighing more than 2 grams, the distance at which injury is expected to occur due to cumulative SEL exposure above 187 dB is within 1,585 meters from the driven pile (Table 11). The distance within which behavioral changes are expected is 4,642 meters from the driven pile, where the RMS sound will be above 150 dB RMS. SELs below 150 dB are assumed to not accumulate and cause fish injury, or be significantly different from ambient conditions, (i.e., effective quiet). At 5,000 strikes per day injurious cumulative SELs covers almost the entirety of the affected area, approximately 4,634 meters from the driven pile.

Pressure levels in excess of 150 dB RMS are expected to cause temporary behavioral changes (startle and stress) that could decrease a fish's ability to avoid predators or delay normal migration past the work site. The background RMS sound pressure levels, or effective quiet, is assumed to be 150 dB RMS and the acoustic impact area is the area where the predicted RMS sound pressure level generated by pile driving exceeds this threshold. Once the pressure waves attenuate below this level, fish are assumed to no longer be adversely affected by pile driving sounds. With effective quiet being equal to 150 dB RMS, the distance fish are expected to be adversely affected during pile driving is out to 4,642 meters from the location of the pile being driven, assuming a transmission loss constant of 15 (NMFS 2008). This distance effectively covered the width of the San Joaquin River bank to bank, the San Joaquin River being

approximately 250 meters in width in this section, and would be expected to propagate 2.88 miles both up and downstream from the pile driving location.

Table 11. Threshold distances to in-water adverse effects using unattenuated maximum expected underwater sound (210 dB peak, 190 dB SEL, 190 dB RMS) modulated by strikes per day, when fish weight >2 grams, calculated by the NMFS pile driving calculator (NMFS 2008).

Strikes per Day	Peak (dB) ≥ 206	Cumulative SEL (dB) ≥187	RMS (dB) ≥150
5,000	18 meters	4,634 meters	4,642 meters

The underwater sound conditions in Table 11 would be expected to occur on days when in-water impact pile driving of 36-inch diameter piles occur (i.e., during the installation of the dolphins and fender piles), and represent unattenuated underwater sound monitoring data.

The total number of days over which fish are expected to be exposed to underwater sounds above effective quiet is expected to be approximately 93 days in Year 4 and 93 days in Year 5 (186 days total). The proposed in-water work window is effective in avoiding most interactions with CV spring-run Chinook salmon, because their upstream adult migration concludes by the end of June (summer water temperatures often exceed their lethality threshold at this location). However, CCV steelhead adults can begin their upstream migration in the fall through spring, and sDPS green sturgeon may remain in freshwater systems feeding and rearing throughout the year. It is possible that adult CCV steelhead may use the action area as a migration corridor, while sDPS green sturgeon adults and juveniles may use the action area as foraging and rearing habitat during the in-water work window, whenever water temperatures are suitable (at least below 75°F). According to in-river monitoring data available on the California Data Exchange Center for the San Joaquin River at Garwood Bridge station, water temperatures upstream of the action area in the San Joaquin River are likely to exceed anadromous fish (CCV steelhead, CV spring-run Chinook, and sDPS green sturgeon) thermal limits regularly during the work window. Water temperatures are likely to drop in September, with atmospheric temperature drops and increased cloud cover and rainfall. In some years, water temperatures may be tolerable to anadromous fish use throughout the summer, as seen in 2011 and 2017. Therefore, CCV steelhead and sDPS green sturgeon are assumed to be present when local water temperatures are below 75°F, though the total number of individual fish using the area during the work window is expected to be low.

Impact pile driving is expected to immediately injure or kill fishes within certain distance thresholds, depending on the size of pile being driven, the number of strikes used in a day, and whether attenuation measures are being employed. Using the greatest numbers of strikes estimated to drive the largest piles (up to 5,000), it is expected that fish ≥2 grams may be killed within nine meters (with underwater sound control) to 18 meters (without underwater sound control) of the driven pile due to in-water impact pile driving. In the same scenario, it is expected that fish ≥ 2 grams may be injured within 736 meters (with underwater sound control) to 4,634 meters (without underwater sound control, Table 11) of the driven pile due to the cumulative SELs produced by in-water impact pile driving. Because in-water impact pile driving is limited

to the July through October in-water work window, CCV steelhead and sDPS green sturgeon are expected to be affected. CV spring-run Chinook salmon are not expected to be present in the action area July through October.

Vibratory Pile Driving July 1- July 14 and October 16 - November 30

Both flat sheet and pipe piles will be subject to vibratory driving, throughout a proposed extended in-water construction period. Vibratory pile driving is generally not immediately injurious to fishes even when performed in water without attenuation, it is likely that the underwater pressure waves and sounds will disturb the normal behaviors of fish using this area (Table 12), including potentially interrupting migration patterns and foraging activities, even while using underwater sound control measures.

Table 12. Expected maximum unattenuated hydroacoustic on 36-inch pipe piles and 24-inch sheet piles from vibratory pile driving, empirical data from the 2012 FHWG pile driving compendium Caltrans (Caltrans 2012).

Pile Type	Driver Type	Pile Location	Reference Distance	Peak (dB)	SEL (dB)	RMS (dB)
36-inch diameter steel pipe pile	Vibratory	In water, ~ 5 meters	10 meters	180-185	170-175	170
24-inch AZ steel sheet pile	Vibratory	In water, ~15 meters	10 meters	175-182	160-165	160-165

Flat Sheet Piles

Based on underwater noise levels measured during the TPP (ECORP 2019) and Year 1 (ECORP 2020), underwater noise levels are not anticipated to exceed NMFS criteria or impacts to listed anadromous fish. Unattenuated vibratory driving of two sheet piles during the TPP resulted in instantaneous peak underwater noise levels ranging from 174.3 to 193.9 dB (at 10m from the source) (Table 13), which was substantially lower than the 206 dB (at 18m from the source) peak threshold specified in NMFS' 2019 biological opinion. RMS values for unattenuated vibratory driving of the two sheets during the TPP ranged from 167.7 to 182.3 dB (at 10m from the source). RMS values did not exceed 150 dB beyond 1,423 m from the pile-driving activity.

Table 13. (Table 1 from BA 2021). Underwater peak and RMS noise levels for unattenuated pile-driving events and distance to NMFS 2019 BO thresholds under the 2019 TPP and Year 1 of construction.

Table 1. Underwater peak and RMS noise levels for unattenuated pile-driving events and distance to NMFS 2019 BO thresholds under the 2019 TPP and Year One (2020) of construction.

Year	Count	Pile Types	Noise Level (dB re: 1µPa)[1]				Distance to Threshold (m)			
			Peak		RMS		Peak		RMS	
			Range	Average	Range	Average	Range	Average	Range	Average
2019 TPP	2	Flat	174.3 to 193.9	184.1	167.7 to 182.3	179.2	0 to 2	1	151 to 1,423	787
2020 Year One	193	Z- and H-piles	139.6 to 190.2	164.0	110.3 to 179.1	149.9	0.0 to 1.6	0.3	0.0 to 1,574	36.5

[1] Values calculated for 10 m from the pile.

Additional information was collected on underwater noise levels in Year 2 (2021) at the project. The highest instantaneous peak values measured during vibratory driving in 2021 was 190.2 dB. The calculated maximum distance to compliance associated with the maximum peak value was 1.8 m. During the first two weeks of July 2021 and October 16-November 30, 2021, maximum instantaneous peak values did not exceed 176 dB and all measurements were in compliance with the 206 dB threshold within 0.2 m of the installed piles. According to these project-specific data, peak underwater noise levels did not exceed 206 dB beyond 1.8 m and below the 18 m threshold. As such, no ESA-listed fish were likely exposed to potentially injurious or lethal underwater noise levels from vibratory pile driving during the in-water work window, unless within ≤ 2 m of the piles.

Extended exposure to elevated RMS values above 150 dB may cause behavioral effects in fish, including avoidance and potential delays in migration. Data recorded in Year 2 indicated that vibratory pile driving of flat sheets did not exceed 113.4 dB (at 10 m from the pile) as an overall daily average for July 1-November 30 and were always below 150 dB RMS within less than 1 m from the pile being driven and typically did not exceed 150 dB RMS at any distance from the source. As such, vibratory pile driving of flat sheet piles is not anticipated to exceed the 150 dB RMS behavioral threshold beyond 1 m from the pile being driven during the in-water work period window.

Pipe Piles

For vibratory driving of the 36-inch round pipe piles, the peak and RMS values are anticipated to be higher than those measured for flat sheets. However, because vibratory driving propagates lower peak and RMS values than impact driving, vibratory driving of the pipe piles is anticipated to be within compliance with the peak (i.e., 206 dB at 18 m) and RMS (i.e., 150 dB at 2,154) at all times and likely within compliance with the peak and RMS thresholds within 10 m. Moreover, given the 175 m to 300 m width of the San Joaquin River at the south and north ends, respectively, of the floodwall, and the short distance to compliance with peak and RMS thresholds (i.e., typically less than 10 m), ESA-listed fish migrating through or foraging in the

action area have an adequate zone of passage in which underwater noise levels are below the peak and RMS thresholds.

Based on these values, vibratory pile-driving noise is not anticipated to reach peak levels that would injure or kill ESA-listed anadromous fishes during the July 1-14 and October 16-November 30 extended construction windows in Year 4 (2023) or Year 5 (2024). While instantaneous peak underwater levels may be exceeded within less than 10 m from the source, anadromous fish are not anticipated likely to come within that close to an active pile-driving site due to the presence of equipment, personnel, and the turbidity curtain. RMS values that could cause behavioral effects (e.g., avoidance) would typically occur within 10 m of the vibratory pile-driver and is not anticipated to exceed 150 dB at 2,154 m from the source at any time. Historical temperature data indicates San Joaquin River temperatures in the action area are generally above 75°F during this period, above the preferred temperatures for anadromous fishes. Based on these considerations, extending the proposed period for vibratory pile driving in the Year 4 (2023) and Year 5 (2024) in-water work windows is unlikely to increase impacts on ESA-listed anadromous fishes. The primary impact from extending the in-water work window for vibratory pile driving would result in behavioral changes to an unknown number (likely a small number) of migrating adult ESA-listed salmonids and foraging green sturgeon.

Acoustic Effects of Barge and Boat Traffic

Barge and tugboat traffic will create additional sources of noise in the aquatic environment. This would be an acoustic-related stressor that could result in negative impacts to listed species present. Ships under power produce a substantial amount of mechanical- and flow-induced noise from motor, propeller, and hull turbulence. Measurements of sound intensity from commercial shipping have shown sound levels up to approximately 180 dB (ref. 1 µPa) at the point source (1 meter from ship) (Kipple and Gabriele 2007). This level of noise will drop off by 40 dB at 100 yards away and approximately 53 dB lower at one quarter mile (Kipple and Gabriele 2007). The narrow confines of channels in the action area indicate elevated noise levels generated by the passage of vessels, such as tugboats, would extend from bank to bank in the San Joaquin River. This noise would subject all fish within the confines of the channel to anthropogenic-produced noise conditions. The relatively rapid passage of the barge and tugboat past a given point will somewhat attenuate these effects by decreasing the duration of the elevated sound levels, but some temporary effects can be anticipated to occur, depending on the proximity of the exposed fish to the sound source. The presence of underwater noise, such as that originating with shipping, may adversely affect a fish's ability to detect predators, locate prey, or sense their surrounding acoustic environment (Slabbekoorn et al. 2010, Radford et al. 2014). Other species of fish have been shown to respond to recorded ambient shipping noise by either reacting more slowly to predators, thus increasing their susceptibility to predation (Simpson et al. 2015, Simpson et al. 2016), or becoming hyper-alert and reacting more quickly to a visual predator stimulus, causing them to cease feeding and hide (Voellmy et al. 2014b). Voellmy et al. (2014a) states that elevated sound levels could affect foraging behavior in three main ways: noise acting as a stressor, decreasing feeding behavior in the short-term through reduced appetite, or in the long-term through a reduction in activity and locomotion and alterations to the cognitive processes involved in food detection, classification, and decision making; noise acting as a distracting stimulus, diverting an individual's limited amount of attention from their primary task

to the noise stimuli that have been added to the environment; noise masking crucial acoustic cues such as those made by both prey and predators.

Fish also may exhibit noise-induced avoidance behavior that causes them to move into less suitable habitat for foraging or will wait to feed when the noise has abated. Voellmy et al. (2014a) surmised that sustained decreases in food consumption could have long-term energetic impacts that result in reductions in growth, survival, and breeding success. Moreover, compensatory feeding activities could increase predation risks by increasing time exposed to predators or by forcing animals to feed in less favorable conditions, such as in times or areas of higher predation pressure.

Increased noise, produced by barge and tugboat traffic may result in salmonids and green sturgeon fleeing the area of those noises and moving into the channel's shallowest margins or adjacent habitat. The channel margins of many Delta waterways have submerged and emergent vegetation (e.g., Egeria) and rock rip-rapped levees where predatory species are likely to occur in greater numbers than in the open waters of the channel. This scenario therefore could increase the predation risk of salmonids, particularly smolts. Likewise, elevated noise exposure can reduce the ability of fish to detect piscine predators, either by reducing the sensitivity of the auditory response in the exposed fish or masking the noise of an approaching predator. Such would be the case if open water predators such as striped bass (*Morone saxatilis*) encounter the juvenile fish in the open channel while a barge and tug are present.

The following assessment further evaluates the proposed project-related incremental increase in boat traffic during the year-round in-water work window, including the June 15-30 staging period, and December 1-15 demobilization period.

Boat and barge traffic is anticipated to include two relatively short periods of daily barge movements (i.e., approximately 15 minutes per trip totaling 30 minutes per day) to travel 1.26 nautical miles each way to and from the staging area. This daily period of boat and barge traffic amounts to 3 hours per week (i.e., less than 1.8% of a 7-day period) during daylight hours. Based on these data, noise and disturbance associated with the Project-related boat and barge traffic is not expected to reach levels that would cause measurable behavioral effects, injury, or lethality to ESA-listed anadromous fishes during Year 4 (2023) and Year 5 (2024).

The small boats would be used for short durations (i.e., typically 10 minutes or less at time), primarily for shuttling personnel and equipment over short distances from the boat launch to the barge, relocating the underwater noise monitoring equipment, or for water quality and biological monitoring (i.e., typically 3-4 times per day). These boats would be used primarily within the mouth of the canal and, most often, in the 1,800-foot channel between the boat ramp and the active construction area and within approximately 300 feet of the active construction area. Trips into the San Joaquin River (e.g., to inspect for the presence of marine mammals, when necessary) would be infrequent, of short duration (i.e., typically ≤ 15 minutes), and usually limited to within a few hundred feet of the mouth of Smith Canal.

The larger tugboat used to move the barge would be used less frequently and primarily for repositioning or deploying the barge during different phases of construction. After deployment of the barge on or around June 15, this would be done on a semi-daily basis (i.e., typically a few

times per week at most) and the duration of each movement would be relatively short (i.e., typically <30 minutes per barge movement). Movement of the barge would be primarily confined to within the mouth of Smith Canal, although there may be infrequent occasions that the tugboat would use the San Joaquin River mainstem to move or deploy a barge.

A tugboat will be used to move the construction barge(s) into position at the mouth of Smith Canal and, occasionally, to reposition the barge to complete work within the cofferdam and along the alignment of the gate. Upon deployment, the frequency and duration of the tugboat and barge movements will vary and will occur on an as-needed basis to position the barge and construction equipment at the appropriate location and orientation to complete the necessary tasks for different phases of the Project. As discussed above, this will typically be a semi-daily basis (e.g., several times per week) and each movement is anticipated to be relatively short (e.g., less than 30 minutes each). The tugboat motor will be turned off (i.e., silent) when not in use.

There are few reported values of underwater noise levels associated with tugboats in the scientific literature, as the majority of reported values for marine vessels pertain to large, commercial ships. However, Richardson et al. (1995) reported tugboat values of 172 dB RMS and 175 dB peak values for tugboats at 1 m from the source. The Xodus Group (2015) calculated a 16 m radius of potential fish disturbance (i.e., noise levels above 150 dB RMS) associated with tugboats. In a study comparing the noise levels associated with different marine ship classes, Veirs et al. (2016) reported source levels (SL) of 166-170 dB and received signal levels (RL) of just 108 dB for tugboats traveling at approximately 8 knots (9.2 mph). In all cases, these underwater noise values are associated with tugboats in transit (i.e., travelling at speeds greater than 5 mph) and thus are considered conservative for assessing the Project's use of the tugboat (i.e., to move a relatively small construction barge a short distance within the mouth of Smith Canal).

From data recorded during tugboat movements and underwater sound levels generated by tugboats in the available literature, the use of a tugboat outside the construction window is not anticipated to create underwater noise levels above 180 dB. Rather, the noise levels associated with the tugboat for the Project are anticipated to be below threshold values for injury to fish within a short distance (i.e., 16m) of the tugboat. To further minimize the potential for any impacts, the tugboat will obey the posted speed limit of 5 mph within the canal, use of the tugboat will be limited to the minimum amount necessary to complete the Project work, and the tugboat motor will be turned off when not in use. A fisheries biologist will be on-site during barge movements to monitor for erratically behaving fish in the Project area.

Boating activity will occur year-round but the primary boating activity that will occur during the extended in-water work window, (June 15-30 staging period, and December 1-15 demobilization period) will consist of the use of small (i.e., <30 feet) boats with outboard motors. These boats will be used primarily to shuttle construction personnel, supplies, and small equipment to and from the barge and active construction area for observation of construction activities and to conduct biological and water quality monitoring required in the Project's permits. Other uses of small boats may include monitoring of underwater noise, biological monitoring (e.g., presence of marine mammals), and water quality monitoring. These boats will primarily be running only during short periods throughout the work day, while transporting personnel and supplies to and from the dock (i.e., approximately 1,800 feet from the construction site) and movements will

primarily be confined to within the mouth of Smith Canal and the boat ramp. This area of the lower San Joaquin River is a popular recreation boating and angling area. As such, the incremental increase in Project-related boat traffic to the overall boating activity in the Action Area will be minor and localized to within a channel that primarily serves as recreational boating access to the San Joaquin River.

Underwater noise levels generated from water vessels are affected by, and generally increase, with increasing boat size, speed, and revolutions per minute (RPM) of the boat propeller (Kipple and Gabriele 2007; Matzner et al. 2010). Kipple and Gabriele (2007) reported that small (i.e., up to 20 feet in length) recreational boats traveling at 10 knots (11.5 mph) had peak SPL values ranging from 157-172 dB re 1 µPa at 1 yard. This range of values equates to peak SPL values of 136-151 dB re 1 µPa at 10 m. RMS values associated with these SPLs would be considerably lower and would be less than, the "effective quiet" value of 150 dB. In a study of underwater noise associated with coastal boat traffic in North Carolina, Haviland- Howell et al. (2007) reported that small outboard motorboats comprised the highest percentage of boat traffic and had a maximum RMS value of approximately 71 dB re 1 µPa. Matzner et al. (2010) evaluated the underwater noise levels generated by small vessels equipped with one and two outboard motors, each with 3-blade and 4-blade propellers, at RPMs ranging from 2,000 to 6,000. The highest observed broadband noise level was 45 dB over background noise with the dual-engine boat at 6,000 RPMs, whereas the broadband noise was increased by only 15 dB for the single-engine boat at 2,000 RPMs. Notably, the SPL values for the single-engine boat at 2,000 RPMs were between 90-100 dB (Matzner et al. (2010). Barlett and Wilson (2002) reported that small boats operating at 2,600-6,000 RPMs had peak underwater noise levels of 150-165 dB. The SPL and peak values reported in these studies were below the thresholds for protection of fish. Furthermore, the boats used for the Project will typically be operating at well below 2,000 RPMs and, therefore, are anticipated to have even lower underwater noise levels.

According to these considerations, the use of small boats, tugboats, and barges during the in-water work window and outside the in-water work window is not anticipated to reach underwater noise levels that would exceed NMFS criteria. While the incremental increase in the use of small boats outside the construction window is not anticipated to increase underwater noise levels by an amount that would exceed the thresholds for injury to fish, any potential impacts will be further minimized by limiting all project boats to the posted 5 mph speed limit in the canal at all times, limiting boat traffic to the minimum amount necessary to complete the project work, and turning boat motors off when not in use. Furthermore, adverse impacts to ESA-listed fish from barge and boat traffic is not expected to occur.

2.5.1.3. RSP Placement

There will be placement of 0.386-acre of 18-inch RSP around the gate structure. The RSP would prevent scour of the gate foundation. Gate RSP placement is expected to occur in the later portion of the Year 5 (2024) in-water work window.

ESA-listed fish that have the potential to be present during the placement of Gate RSP include adult CCV steelhead and adult and juvenile sDPS green sturgeon. However, the timing of the placement of Gate RSP during the in-water work window (during July-September) coincides with the period when CCV steelhead are least likely to be present due to their migration timing

and generally unsuitable habitat conditions. Adult and juvenile sDPS green sturgeon have the potential to be present, however background water quality in the action area is poor (low dissolved oxygen, low flow, high water temperatures), therefore the likelihood of green sturgeon being present during the placement of Gate RSP is very low.

ESA-listed fish have potential exposure to injury and mortality during the placement of Gate RSP through coming in contact with RSP during placement or with heavy machinery during placement. Gate RSP would be placed around the gate foundation by being lowered by excavators or clamshell buckets, which fish could come in contact with and potentially be injured or killed. However, the presence of equipment and personnel and associated disturbances are likely to cause most fish to avoid the immediate work area. RSP will be lowered slowly by the excavators/crane, allowing for fish to avoid/leave the work area. Furthermore, the presence of turbidity curtains around the active work area will further minimize the likelihood of fish entering the active work area. Gate RSP placement is expected to take no more than two weeks and is scheduled to occur during July-September of the extended in-water work window. Therefore, the exposure will be limited to this two-week period. A qualified fisheries biologist with work-stop authority will be present during the placement of Gate RSP and will halt construction if ESA-listed fishes are observed within or near the work area. Gate RSP placement would only occur during the daylight hours.

2.5.1.4. Cone Penetration Tests (CPTs)

SJAFCA proposes to complete approximately 13 Cone Penetration Tests (CPTs) (twelve in-water and one on land) near the floodwall and seepage cutoff wall alignments (on Dad's Point) to characterize the geological composition of the Project area. No impact or vibratory hammer would be used. Six CPTs will be performed on the San Joaquin River side of the floodwall, another six will be performed on the Atherton Cove/Smith Canal side of the floodwall, and one CPT on land on Dad's Point. Following CPTs, the work area is anticipated return to pre-Project conditions. CPTs are proposed for completion at the first part of the extended 2023 in-water work window (i.e., within the first two weeks of July).

Potential adverse effects of the CPTs to ESA-listed fish would be limited to the temporary voids resulting from boring into the substrate with hollow tubes. Each bore hole would create an approximately 3-inch diameter hole in the substrate at each location that would be filled with a grout material. Due to the fine, uncompacted sediments in the project area, the bore holes are anticipated to fill within one or two days. Water quality monitoring, including turbidity and pH monitoring associated with the five CPTs in 2019 did not detected changes in baseline conditions for either parameter.

CPT work would be conducted under the supervision of one or more qualified fisheries biologists with work-stop authority to ensure that no fish are injured, killed, or exhibiting signs of distress in response to the CPT work. The CPTs would be performed in the first two weeks of the requested in-water work window extension in Year 4 (2023) at a time when ESA-listed anadromous fish presence is anticipated to be very low due to their migration timing and elevated water temperatures. Therefore, the potential for ESA-listed anadromous fish to be directly injured or killed during the CPT work is also very low. Water quality measurements for CPTs in 2019 failed to detect changes in water quality parameters over baseline conditions.

Because similar methods would be used for the proposed 12 in-water CPTs, it is likely that these tests will also have minimal impacts to water quality. Adverse impacts from the CPTs to CV spring-run Chinook salmon, CCV steelhead, sDPS green sturgeon are not expected to occur.

2.5.1.5. Effects of Structures

Placement of riprap in the San Joaquin River can result in adverse effects to ESA-listed fish. The action area is a major migratory corridor for juvenile and adult listed fish. The finalization of the permanent floodwall gate would not impede fish passage, but it would occupy a portion of the area adjacent to the San Joaquin River. The action area currently does not provide suitable aquatic riparian habitat, but the modification and placement of riprap would preclude, in its footprint, any potential for future riparian vegetation to grow that would provide shelter and resting areas for migrating juveniles. The intent of riprap is to stabilize stream channels and limit natural fluvial processes. The reduction of the erosion and consequent deposition cycle, naturally inherent to all alluvial channels, eliminates a channel's ability to maintain bedforms for salmonid habitat and impairs the ability for a stream to be maintained in a dynamic steady state. This alteration of the aquatic ecosystem has diverse deleterious effects on aquatic communities, ranging from carbon cycling to altering salmonid population structures and fish assemblages (Schmetterling et al. 2001). Riprap does not provide the intricate habitat requirements for multiple age classes or species similar to natural banks, or banks that include instream woody material (Peters et al. 1998).

Therefore, adverse effects resulting from permanent habitat loss/modification to listed fish are expected to occur. Since it is not possible with the currently available information to determine how many individual fish will be taken through the loss or modification of the habitat, NMFS will use the values for lineal feet of aquatic habitat impacted and lost on waters bearing NMFS' listed species as ecological surrogates for the detrimental effects upon listed fish. This loss is expected to result in reduced fitness and survival of listed fish in the action area.

The proposed project would result in permanent impacts to approximately 0.820 acres of tidal perennial drainage and 0.83 acres of riparian habitat. Additionally, 0.386-acre of 18-inch RSP material would be placed around the gate foundation. Once the fixed wall is constructed, approximately 3,400 tons of riprap (approximately 200 linear feet) would be placed along the banks at the Stockton Golf and Country Club (approximately 100 linear feet on each side of the fixed wall), as well as 230 linear feet around the tip of Dad's Point. The fixed gate wall would extend approximately 800 feet from the north tip of Dad's Point Levee to the right bank of the San Joaquin River, at the Stockton Golf and Country Club. The walls would be constructed to be between approximately 29 feet apart at the connection between cells and 34 feet apart at the widest part of each cell, and would have a top elevation of 15.0 feet, extending 10 feet above the mean water level at the entrance to Smith Canal.

2.5.1.6. Long-term Operations and Maintenance

The now existing gate is a 50-feet wide mitered double-door metal structure that when open extends outward into the San Joaquin River. The purpose of the gate when closed is to provide a tool for flood control when the San Joaquin River reaches a water surface elevation of 8.0 feet, North American Vertical Datum of 1988 [NAVD88]. Isolating Smith Canal and the 15,000

residents identified in a designated FEMA 100-year floodplain, will meet the Central Valley Flood Protection Act of 2008 which requires a 200-year flood protection by 2025 for urban and urbanizing areas.

Typically, the gates would be operated (closed) under specific conditions during the rainy season and during times when high tides occur in the area. Generally, extreme high tides and floods associated with the rainy season occur between November 1 and April 30. The gate will typically be operated only during extreme high tides and flood events when the water elevation exceeds + 8.0 feet (NAVD 88) in the channels containing the gates, or when operated for maintenance purposes. When operated for forecasted high tides above +8.0 feet, the gates would be closed on the lowest tide prior to the predicted high tide, typically within a 24-hour period. The gates would not be opened until the high tide elevation drops below +8.0 feet, allowing any accumulated water behind the gate to flow out. The Corps predicts that the duration of the gate closures for extreme high tides should not last more than 6 to 12 hours per a high tide event. Rarely will two extreme tides occur within a 24-hour period. On these infrequent occasions, the gates may remain closed for more than 24 hours.

The gate is controlled by programmable preset operating controls housed in a fixed building on Dad's Point adjacent to the fixed wall tie-in. A second set of controls may be installed at the end of the sheet pile wall near the shore and a portable generator will be used in the event of a power outage. During the long-term period of gate operations, the narrow gate opening (~50 feet) will create higher velocity flow through the structure than currently exists through the undeveloped channel during each tidal cycle. NMFS expects that elevated turbidities will occur in association with this higher velocity until the surrounding channel substrate has come to an equilibrium between heavier and coarser sediments lining the scour hole and the redistribution of the lighter material more prone to resuspension into other areas of the channel. It is unknown how long this process will take, and what level of turbidity is likely to occur as a result.

Additionally, NMFS expects that the presence of the flood gate structures would create altered flow conditions related to the narrow width of the flood control structure gates. This could increase predation upon listed fish species. These conditions would be present throughout the year and are created by daily tidal flows. A portion of all listed species identified above would be exposed to the operations of the Smith Canal flood control structure. Listed fish would have an elevated vulnerability to predation due to the hydrodynamic conditions created by the open gate structures and the vertical sheet pile wall structure placed into the open water environment, both of which are expected to attract predators. Higher velocities create more turbulence, eddies, and disorientation to the fish caught in the high velocity jet, allowing them to become easier targets for predators.

Effects of turbidity on fish

Resuspension of contaminated sediments may have adverse effects upon salmonids or sDPS green sturgeon that encounter the sediment plume, even at low turbidity levels. Lipophilic compounds in the fine organic sediment, such as toxic PAHs, can be preferentially absorbed through the lipid membranes of the gill tissue, providing an avenue of exposure to salmonids or sDPS green sturgeon experiencing the sediment plume (Newcombe and Jensen 1996). Such exposures to PAHs have been linked with declines in the immune systems of exposed fish as

well as damage to genetic material through formation of breaks or adducts on the DNA strands. Similarly, charged particles such as metals (*e.g.*, copper), may interfere with ion exchange channels on sensitive membrane structures like gills or olfactory rosettes. This reduces the sensitivity of fish to detect smells or chemical cues in their environment and may interfere with ion exchange metabolism across cellular membranes necessary for osmoregulation. Increases in ammonia from the sediment may create acutely toxic conditions for salmonids or sDPS green sturgeon present in the channel's margins.

An increase in flow velocity due to gate operations between November 1 and April 30 overlaps with species run timing and adds to the probability of potential exposure of listed salmonids and green sturgeon to effects of higher levels of turbidity. Therefore, we expect a small number of each species to be adversely affected each year, resulting in decreased fitness and survival.

Effects Related to Long Term Maintenance of RSP

The potential of injury/mortality to juvenile ESA-listed fish could also come from increased predation from bass and other predators who might use the interstitial spaces in the Gate RSP. These interstitial spaces would be filled with ≤ 6-inch rock to avoid creating potential fish predatory habitat in the RSP voids. The voids will further be filled in with fine sediments dominating the benthos in the mouth of the canal, further reducing the potential for predator refugia. This interstitial RSP will be placed in the same manner as the larger RSP. As a result of timing, avoidance behavior of ESA-listed fish, and measures to fill in voids, adverse impacts to ESA-listed fish from placement of RSP around the gate structure is not expected to occur.

Effects Related to Long Term Operations of the Flood Control Gates

Episodes of extreme tides create larger than normal movement of waters in the Delta and may stimulate adult fish holding in the Delta to move upstream to spawn. When the gates are operated, any fish moving with the increased tidal activity may enter the waterways behind the gates on prior tides and become trapped by the closed gates. However, fish trapped behind the closed gate would typically be detained for less than 24 hours, and usually only for 6 to 12 hours. Fish trapped behind the gate will have typically short-term exposures to the waters behind the gates, and any deleterious water quality issues or predator populations that may exist there. Any fish caught behind the gates cannot leave the area of degraded water quality until the gates are reopened, and thus are exposed to any negative conditions existing for the duration of the closure. The short duration of exposure is probably not sufficient to cause mortality from any contaminants that might be present, but sublethal effects may start to manifest even with exposures of only a few hours. Smith Canal, as well as several waterways draining to the eastern Delta in the action area, are listed under the EPA's 303(d) listing of impaired water bodies in California (State Water Resources Control Board 2010) containing elevated levels of organic materials, pesticides, heavy metals, and pathogens, as well as many other constituents that impair water quality. Furthermore, it is unclear how the physical barriers will affect the level of contaminants in the impacted waterways, but it is likely to degrade water quality over the long-term by preventing dilution and muting tidal exchange with the larger Delta. Finally, when fish are trapped behind the gates, they become susceptible to predators that may reside in the waterways behind the gate. Trapped fish will be exposed to these predators for the duration of the gate closure with a reduced avenue of escape through the narrow gate opening. Fish such as

CCV steelhead smolts and juvenile CV spring run Chinook salmon are highly vulnerable to predation by predators such as striped bass (*M. saxatilis*) or largemouth bass (*Micropterus salmoides*) that may also occupy the waters behind the gates.

Adult CV spring-run Chinook salmon and CCV steelhead are less likely to be preyed upon, unless marine mammals such as California sea lions (*Zalophys californianus*) also are present in the waterways when they are closed off. Sea lions are known to occur within the Stockton DWSC leading to the Port of Stockton and are likely to be present near the Smith Canal gates.

SJAFCA has indicated that if necessary the gates will be closed for an extended period during flood conditions particularly when they are coupled with high tides. If flood conditions, either by themselves or in combination with high tide events, raise the water elevation to greater than +8.0 feet NAVD 88, the gates will be closed until the water elevation recedes below +8.0 feet. Records show that the high water conditions may last several days. As indicated above, there is the potential for listed fish to be trapped behind the flood control gates when closed. Under flood conditions, the longer duration of gate closures will expose fish to longer periods of degraded water quality or predation within the enclosed water bodies. Furthermore, flood conditions usually coincide with increased precipitation events that create surface runoff from upland areas. This results in increased stormwater flows into waterbodies such as Smith Canal and the sloughs feeding into other waterways. Stormwater runoff has the potential to be heavily contaminated with organic materials (which decrease DO content in the water), petroleum products and heavy metals from roadways, pathogens, and pesticides. Stormwater is cited as a source for these contaminants in Smith Canal (State Water Resources Control Board 2010).

Elevated contaminant loads coupled with longer exposure periods will increase the likelihood of sublethal and lethal effects on exposed fish. Furthermore, increased durations of gate closure will expose any listed fish trapped behind the gates to longer periods of predation risk in those waters. Periods of high runoff that could trigger longer gate closures usually occur in the winter and spring seasons. This period overlaps with the migrations of adult and juvenile CCV steelhead in the San Joaquin River basin. Additionally, adult and juvenile CV spring-run Chinook salmon from the SJRRP nonessential experimental population and their future progeny would be migrating through the San Joaquin River adjacent to the Smith Canal flood control gates during the late winter and spring periods. There is also an increased potential for adult sDPS green sturgeon to begin movements upstream into the San Joaquin River in response to increased flows in the mainstem of the river and its tributaries. Movements of juvenile sDPS green sturgeon in the Delta may also be enhanced by increases in river flows and increased turbidity.

Any individual fish that is trapped behind the closed gates will be vulnerable to increased mortality with prolonged closures. In contrast, more frequent gate operations expose more individual fish to the effects of the flood control structure, but the duration of their captivity is shorter, and lethal effects are less likely to occur due to exposure to contaminants and predation. Although there is significant risk to any individual fish trapped behind the gates, the numbers at risk depends on the proportion of the population moving past the gates at the time the gates are closed and what fraction of that number is actually behind the gates when they are operated. This level of detail is hard to predict and is likely variable.

Risks to fish are not limited to being trapped behind the gates when they are closed. The construction of the flood control gates and the accompanying flood wall create a barrier to the free exchange of water into the Smith Canal waterway during the daily tidal cycle. The relatively narrow opening of the gates (50 feet) compared to the width of the unobstructed channel will create a region of high velocity flows through the gate openings with each tidal change in water surface elevation. This zone will be bi-directional as a result of the changes in tidal elevation; flow will move from the area of higher water elevation to the area of lower water elevation depending on the stage of the tide. On the flood tide, water elevations will be increasing on the outside of the gate structures relative to the inside of the gate structures and water will flow up-channel through the narrow gate opening into the area behind the gates at increasing velocity due to head differentials between the two sides of the gate structure. Flow through the gates will diminish as the two water elevations reach equilibrium at high tide. When the tide changes to ebb, the water inside the flood structure will be higher than the water elevation outside and remain so for a longer period of time due to the gate constriction and the flow will reverse direction.

Creation of a high velocity water flow through the gate opening will create a field of velocity shear causing eddies and turbulence on the down current side of the gate. This region of shear and turbulence provides favorable habitat for predators to hold and feed, as prey moves through the high velocity water flow. This is particularly true when the flood structure creates vertical structure for predators to orient to immediately adjacent to the higher velocity flow, and hold station outside the higher velocity flows without physically exerting themselves to remain in the favorable feeding locations. The structure also creates shade and obscures the presence of the predators holding against the vertical sheet pile wall, creating an increased risk of predation for smaller sized fish such as juvenile CV spring-run Chinook salmon and CCV steelhead smolts that are entrained in the fast moving stream of water going through the gate opening. This condition will occur typically four times a day with each change of the tide while the gates are open.

In addition to the creation of the high velocity flows through the gate openings and increased predation risks, the flood-gate structures also are likely to degrade water quality conditions inside the waterways when the gates are closed. Closed gates will reduce the free exchange of water within the waterways they block with the larger Delta system. This will reduce the volume of water exchanged on each tidal cycle with the larger Delta water volume and increase the residence time of the water behind the gate structures and flood wall. This situation is likely to allow contaminants behind the flood structure to increase in concentration since they are not being flushed out of the system as fast as the pre-gate conditions allowed.

In summary, the long-term operations of the flood control gates on Smith Canal will create barriers to the free movement of individual fish moving within close proximity to the gates and may cause fish to become entrained behind the closed gates. Listed fish that enter through the gate opening will be subject to increased predation risk and exposure to degraded water quality conditions. The gate structures will also create physical conditions that decrease the value of the habitat adjacent to these structures. Diminished circulation will decrease flushing flows through these waterbodies, potentially allowing any contaminants discharged into the waterbody behind the structures to increase in concentration and not be transported away from the confined waterbodies. The narrow gate opening will create hydraulic conditions that will favor predatory

fish, which would be attracted to the open water structure created by the flood barrier. Both of these physical conditions would increase adverse effects to listed fish exposed to them. These conditions will be present at all water elevations to some extent as described above. Based on the best available information, we expect a small number of each species to be adversely affected each year, resulting in decreased fitness and survival.

2.5.1.7. Gate Warranty Testing and Repair

During the gate warranty period, SJAFCA will inspect the facilities for damage and/or deficiencies, and the contractor will remedy the damage and/or deficiencies. Warranty period inspections are planned to occur in 2024 and 2025, and repairs would occur in 2025 and, if needed, 2026. During testing and repair, the gate would remain open, stop logs would not be installed, and the gate structure would not be dewatered during inspection and repairs. Warranty testing would occur during the migration periods of adult CCV steelhead, and the Delta residence period of adult and juvenile sDPS green sturgeon. In-water construction activities not completed by the end of the 2024 in-water work window would be completed during the 2025 and 2026 in-water work windows. Because the activities to be implemented would be limited to visual observation by divers or camera-equipped ROVs, replacement of minor parts in-water and coating repairs above water, Gate Warranty Period activities are not anticipated to result to adverse impacts to ESA-listed fish species.

2.5.2. Project Effects on CCV steelhead and sDPS green sturgeon Critical Habitat

The project is expected to adversely impact several PBFs of critical habitat for CCV steelhead (freshwater rearing habitat and freshwater migration corridors) and sDPS green sturgeon (food resources, water quality, water depth, and migratory corridors). The proposed project is expected to cause short- and long-term, and permanent effects on critical habitat for CCV steelhead and sDPS green sturgeon. Potential project effects include temporary water quality degradation from localized increases in turbidity and suspended sediment from construction and gate operation, permanent habitat loss/modification of critical habitat from RSP placement and presence of the floodwall, and in-channel disturbance from pile driving. Long-term effects on designated critical habitat PBFs are expected to result in a decrease in survival of fish due to increased predation in the action area and impacts from the operations of the tidal gate, resulting in impacts to migratory corridor PBFs.

Poor water quality and elevated contaminant concentrations due to low water exchange rates can impact salmonid rearing habitat PBFs, particularly juveniles that rear in these waters year-round and consume prey exposed to the contaminants such as sDPS green sturgeon. Alternatively, PBFs for food resources may be diminished due to mortality related to the contaminants present or perhaps a combination of diminished prey populations with the remaining prey populations bearing contaminant loads that are then transferred to the green sturgeon that consume them. Green sturgeon that consume contaminated prey may incur sublethal or lethal effects depending on the load and type of contaminates consumed, thus resulting in degraded food resource PBFs.

Placement of the tidal gate will extend 800 linear feet from the tip of Dad's Point levee to the right bank of the San Joaquin River. In addition, 200 linear feet of riprap will be placed on the banks of Stockton Golf and Country Club. Therefore, the project would result in permanent

impacts to approximately 0.820 acres of tidal perennial drainage and 0.83 acres of riparian habitat, resulting in degradation of rearing habitat PBFs.

Habitat in this portion of the San Joaquin River is characterized as a relatively deep, medium velocity channel, with silt and sand substrate. The action area does not include salmonid spawning habitat; however, migration and rearing habitat PBFs are utilized. Low numbers of adult and juvenile sDPS green sturgeon may also utilize food resources PBFs.

While the sandy substrate in the vicinity of the proposed project provides some submerged aquatic and emergent vegetation, it does not currently provide favorable rearing habitat PBFs for salmonids due to the lack of shaded aquatic habitat and habitat complexity. However, placement of permanent infrastructure would prevent improvements to provide more suitable habitat for listed species in the future. In addition, the placement of riprap for scour protection is expected to decrease habitat quality PBFs for salmonids, as warm-water predatory species (such as bass) would be likely to occupy this habitat post-construction.

Because the proposed project will occupy CCV steelhead and sDPS green sturgeon critical habitat, a purchase of compensatory mitigation credits is included as part of the proposed action associated with the rip rapping of the tide gate to partially offset this impact to PBFs. Placement of 0.386-acres of RSP around the tide gate was not included or analyzed in the two prior biological opinions. SJAFCA will purchase salmonid credits at a 3:1 ratio from a NMFS approved mitigation bank. SJAFCA will purchase 1.16 credits for the loss of 0.386 acres of tidal perennial habitat.

Purchase of compensatory mitigation credits will restore and preserve, in perpetuity, shaded riverine aquatic habitat or similar types of riverine habitat that will be beneficial to salmonids. The mitigation banks that serve the action area offer floodplain or other habitat that can support migrating juvenile and adult CCV steelhead and sDPS green sturgeon in the same way that river margin habitat otherwise would have, had the project not occurred. Shaded riverine habitat types of conservation credits can benefit both adult and juvenile CCV steelhead and sDPS green sturgeon, even if such banks are located far from the action area and individuals affected by the project would be unlikely to benefit from the compensation purchase.

The purchase of credits provides a high level of certainty that the benefits of a credit purchase will be realized because each of the NMFS-approved banks considered in this biological opinion have mechanisms in place to ensure credit values are met over time. Such mechanisms include legally-binding conservation easements, long-term management plans, detailed performance standards, credit release schedules that are based on meeting performance standards, monitoring plans and annual monitoring reporting to NMFS, non-wasting endowment funds that are used to manage and maintain the bank and habitat values in perpetuity, performance security requirements, a remedial action plan, and site inspections by NMFS. In addition, each bank has a detailed credit schedule, credit transactions, and credit availability that are tracked on the Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS). RIBITS was developed by the Corps, with support from the Environmental Protection Agency, the USFWS, the Federal Highway Administration, and NMFS to provide better information on mitigation and conservation banking and in-lieu fee programs across the country. RIBITS allows users to access information on the types and numbers of mitigation and conservation bank and in-lieu fee

program sites, associated documents, mitigation credit availability, service areas, as well as information on national and local policies and procedures that affect mitigation and conservation bank and in-lieu fee program development and operation. RIBITS also contains links to bank establishment documents. The Bullock Bend Mitigation Bank was established on June 23, 2016; the Cosumnes Floodplain Mitigation Bank was established on August 4, 2008; the Fremont Landing Conservation Bank was established on October 19, 2006; and the Liberty Island Conservation Bank was established on July 21, 2010.

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).

The private and state activities described below are likely to adversely affect CV spring-run Chinook salmon, CCV steelhead, sDPS green sturgeon, and designated critical habitats for CCV steelhead and sDPS green sturgeon. These potential factors are ongoing and expected to continue into the future. However, the extent of the adverse effects from these activities is uncertain, and it is not possible to accurately predict the extent of the effects from these future non-Federal activities.

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 (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 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 occur within the watershed. The effects of such actions result in continued degradation, simplification, and fragmentation of riparian and freshwater habitat.

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 biological 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; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1. Summary Status of the CCV Steelhead DPS

The 2016 status review (NMFS 2016a) concluded that overall, the status of CCV steelhead appears to have changed little since the 2011 status review. Therefore, we concluded that 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 wild steelhead populations. There are some encouraging signs, as several hatcheries in the Central Valley (such as Mokelumne River), have experienced increased returns of steelhead over the last few years. There has also been a slight increase in the percentage of wild 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 (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, downstream of Friant Dam, as a candidate to reach viable population status. The action area serves as a migratory corridor to these eastside tributaries.

2.7.2. Summary Status of the CV spring-run Chinook salmon

The CV spring-run Chinook salmon ESU is also listed as threatened under the ESA but, until recently were considered extirpated from the San Joaquin River Basin. 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 2016a). Through recovery plan implementation and SJRRP reintroduction efforts (SJRRP, 2018), reintroduced CV spring-run Chinook salmon are expected to use the action area. One of the primary reasons this species is listed under the ESA is the ubiquitous artificial modifications to, and destruction of, crucial freshwater habitat and the services it provides in the Central Valley (NMFS 2016a). This threat currently persists and is expected to grow as human populations, land development and freshwater demands increase in California. Such trends are likely to suppress the recovery potential of these populations, despite recovery efforts, based on the effective scale of adverse habitat changes compared to recovery actions. 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. The action area is a migratory corridor to the upper reaches of the San Joaquin River and its tributaries, downstream of Friant Dam.

2.7.3. Summary Status of the sDPS green sturgeon

The federally listed sDPS green sturgeon and its designated critical habitat occur in the action area and may be affected by the proposed action. It was listed as threatened in 2006 and its designated critical habitat in 2009. Adult sDPS green sturgeon potentially migrate through the action area to reach upstream riverine habitat based on catches of sDPS green sturgeon in the San Joaquin River mainstem, upstream of the Delta (CDFW sturgeon report card data). Juvenile sDPS green sturgeon migrate toward seawater portions of natal estuaries as early as one and a half years old (Allen and Cech 2007). Juvenile and subadult sDPS green sturgeon may rear in freshwater and brackish water for up to three years in the Delta. During laboratory experiments, juvenile sDPS green sturgeon select low light habitats and are primarily inactive during daylight hours, while they seemed to forage actively during night (Kynard et al. 2005). Juvenile sDPS green sturgeon were captured over summer in shallow shoals (1-3 meters deep) in the lower San Joaquin River (Radtke 1966), and are assumed to occupy similar habitats in other Delta region waterways. There is a need for additional information regarding sDPS green sturgeon, especially with regards to a robust abundance estimate, a greater understanding of their biology, and further information about their micro- and macro-habitat ecology. The upstream portion of the San Joaquin River is not known to currently host sDPS green sturgeon spawning; therefore, the San Joaquin River Basin is not a main focus of their recovery plan. Though the sDPS does use the

lower San Joaquin River and the discovery of an individual adult in the Stanislaus River October 2017 highlights that passage for adults is possible during certain river conditions, the recovery plan and efforts are not likely to be modified unless adult spawning or juvenile reproduction occurs (NMFS, 2018).

2.7.4. Summary of the Environmental Baseline and Cumulative Effects

Listed salmonids currently use the action area as a migratory corridor. For CCV steelhead and CV spring-run Chinook, the San Joaquin migratory corridor is an essential component of the recovery strategy because it provides access to the tributaries of the southern Sierra-Nevada Diversity Group (NMFS 2014). The San Joaquin River Basin is not the main focus for sDPS green sturgeon recovery plan. Currently, the San Joaquin River, although degraded due to levees and lack of floodplain habitat, is an important migratory corridor for the recovery of these species.

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

2.7.5. Summary of Project Effects on ESA-listed species

1) Construction-related Effects

During construction, behavioral effects as well as injury or death to individual fish is expected to result from completion of the floodwall and gate structure which includes noise exposure from pile driving and boat/barge activities. Construction activities would occur during the summer and fall months, when the abundance of individual fish is low and outside of most of the migrating adult and juvenile timing period, which would result in correspondingly lower levels of injury or death, and behavioral effects. In addition, during construction activities, water quality impacts, including increased sediment and turbidity are expected to occur, but with the implementation of minimization measures, impacts would be minor to listed species, resulting in behavioral modifications such as displacement and reduced feeding.

2) Long-term Operations and Maintenance Effects

All species considered in this consultation would be present at some point in time when the Corps anticipates the gate would be operated to protect against high water events (November 1 through April 30). All species entrapped would be affected by degraded water quality behind the flood control gates in Smith Canal. As a result of operations and maintenance, NMFS expects that water quality would degrade overtime due to a decrease in tidal flushing of the Smith Canal waterway and an increase in the residence time of water behind the sheet pile walls due to the obstruction of the channel. Salmonids and sturgeon tend to be sensitive fish species to in response to impaired water quality conditions compared to other fish species, particularly non-native species (Waters 1995, Barret et al. 1992). It is uncertain what fraction of the listed fish populations would be present when the gates are operated, and of that fraction present, how many would be entrapped behind the gates. It is certain that those fish trapped behind the gates

would be exposed to more highly degraded water quality conditions than those fish remaining outside the gates, and would likely have a higher risk of predation while remaining behind the gates. NMFS assumes that fish trapped behind the gates are likely to die in the enclosed area. The gate structure increases the risk to passing salmonids and green sturgeon above the current conditions and therefore should be considered as adversely affecting the populations of CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon in the action area.

Gates will be operated for approximately 17 percent of the time in January and February when adults may be moving upriver to spawning grounds, leaving the gates open for 83 percent of the time. The majority of adults are expected to migrate upriver in December and January with the run tapering off quickly in February and March. The gate operations for tides overlaps with a significant proportion of the adult spawning run, however, there is low probability of CCV steelhead being attracted into Smith Canal due to a lack of any tributary inflow, although some false attraction may be created by the high velocity currents described above as a result of tidal elevation differentials. The duration of any entrapment for adults in response to tidal operations will typically be brief (usually lasting no more than 6 to 12 hours per a high tide event), and exposure to contaminants should not result in mortality. CCV steelhead smolts are not likely to be emigrating downriver at the time that gates are being operated for the high tides. Therefore, there is a low risk of smolts being entrapped behind the gates. Gate closures for high water events due to high inflows will result in an average of three closures per year, meaning that there are only that many gate closures to entrap adults or juveniles. While the fish trapped behind the gates for flood closures are likely to be lost to the population, there are no new fish being entrapped by gate operations on additional days while the gates remain closed.

Few CV spring-run Chinook salmon juveniles or smolts would be expected to be moving downstream at this time past the Smith Canal flood gate location, thus exposure to the tidal operations are limited. Some individuals may be present and subsequently entrapped by the operations of the gates and lost. The gates may be closed for approximately 12 percent of the operating season (3 weeks out of 25 weeks; November through April) but will only amount to three gate closures per year on average. Thus, there are only three events per year that will trap fish behind the gates. It is unlikely that these three closure events will overlap with a substantial proportion of the population being present at the gate when it is closed. While the gates are closed during high water events, juvenile and adult fish in the DWSC are unaffected by the presence of the gate structure.

The gates will be operated when both juvenile and adult sDPS green sturgeon may be present in the vicinity of the gate structure. Individual fish may be present in the DWSC and potentially on the flats in front of the gates and thus may become vulnerable to entrapment behind the gates when they are closed. Some of these individuals may be lost to the population. However, available information indicates that sDPS green sturgeon are present in low densities and numbers in this area of the Delta based on the low numbers of fish catches on the CDFW sturgeon report cards, compared to other areas of the Delta. The majority of reported sDPS green sturgeon catches in monitoring efforts and sport fishing catches indicate that sDPS green sturgeon utilize other areas of the Delta and Sacramento River watershed for their life history needs, rather than the DWSC in the Port of Stockton. Using the same reasoning as given for CV spring-run Chinook salmon and CCV steelhead, there is a low likelihood of trapping green

sturgeon behind the gates due to the low frequency of gate closures overall, compared to the time they are open, and the low numbers of fish present.

2.7.6. Summary of Project Effects on CCV steelhead and sDPS green sturgeon critical habitat

Within the action area, the relevant PBFs of the designated critical habitats for listed CCV steelhead are migratory corridors and rearing habitat, and for sDPS green sturgeon the six PBFs include food resources, water flow, water quality, migratory corridors, water depth, and sediment quality. Several components of the proposed project are expected to result in adverse effects to the designated critical habitat in the action area for both CCV steelhead and sDPS green sturgeon. The temporary construction impacts to designated critical habitat would negatively affect the ability of CCV steelhead and sDPS green sturgeon to use the action area as rearing habitat and as migratory corridors during the overlap of migration periods and construction as discussed in the effects to species section. Construction effects would last for a period of weeks, but would not permanently modify critical habitat function as noise and turbidity would end after construction ends.

The impacts of the Smith Canal flood control gate operation would permanently create unsafe migration conditions when fish become trapped behind the gate. However, the flood control structure is not expected to substantially impede migration, as the periods of potential entrapment would only occur during closure of the gate for short-term operations (due to tidal fluctuations). Estimated closure would occur approximately two times per year during November through April, lasting between 6 to 12 hours. Taking the maximum closure time of 12 hours and a closure frequency of two times per year between November through April, the gates will be closed approximately 17 percent of the time during these periods. For flood events, the SJAFCA has estimated that the gates will be closed on average two times a year from a few days to a few weeks based on the past 20 years of hydrology records. If the gates are closed for three weeks every year for high water elevations due to tides and inflow, then the gates are closed approximately 12 percent of the time out of 25 weeks (November through April).

The project is expected to adversely impact several PBFs of critical habitat for CCV steelhead (freshwater rearing habitat and freshwater migration corridors) and sDPS green sturgeon (food resources, water quality, water depth, and migratory corridors). The placement of the tidal gate will extend 800 linear feet from the tip of Dad's Point levee to the right bank of the San Joaquin River. In addition, 200 linear feet of riprap will be placed on the banks of Stockton Golf and Country Club. Therefore, the project would result in permanent impacts to approximately 0.820 acres of tidal perennial drainage and 0.83 acres of riparian habitat. Additionally, 0.386-acre of RSP will be placed around the gate structure. The Gate RSP would include loss of physical habitat. Placement of permanent infrastructure and additional RPS around the gate would prevent improvements to provide more suitable habitat for ESA-listed species. In addition, the placement of riprap for scour protection is expected to decrease habitat quality for salmonids, as warm-water predatory species (such as bass) would be likely to occupy this habitat post-construction.

2.7.7. Mitigation Bank Credits

SJAFCA's mitigation credit purchase is expected to mitigate a portion of the impacts from the Smith Canal Gate project, by providing some benefits to the CCV steelhead DPS by improving riverine or floodplain habitat conditions elsewhere through restoration and ensuring their preservation into the future. The benefits offered to these populations are expected to exist in perpetuity. Although some of the banks that cover the action area in their service area may not technically offer sDPS green sturgeon credits, we expect that some sDPS green sturgeon individuals should benefit from the purchase of credits from these banks since individuals should be able to access the purchased riverine habitat areas created and maintained by the banks/programs.

2.7.8. Synthesis of Effects at the ESU/DPS and Critical Habitat Designation Levels

The flood control structure is not expected to substantially impede migration, as the periods of potential entrapment would only occur, on average, two times per year (usually lasting no more than 6 to 12 hours per a high tide event). The flood control structure is located along the opening of Smith Canal and set back from the San Joaquin River. The presence of the gate structure will continue into the foreseeable future, creating a perpetual source of poor water quality (when the gates are closed) and predation impacts to the action area, and a permanent adverse effect of the structure itself to rearing and migratory corridor habitat, and to the San Joaquin River populations of the listed species. However, the long-term effect of the structure itself is not expected to affect the other populations of the ESU or DPSs within the Sacramento River of CV spring-run Chinook salmon ESU, CCV steelhead DPS, and green sturgeon DPS populations and will not negatively affect their viability.

The number of fish present when the gates are closed, and subsequently trapped behind the gate, is unlikely to represent a substantial proportion of the population present in the system, thus impacts to the DPS/ESU are minimal. The low impact of the Smith Canal Gate to the CCV steelhead population in the San Joaquin River basin over the foreseeable future will not substantially affect the CCV steelhead DPS and will not negatively affect its viability. It is not expected that the operations of the Smith Canal flood control gates will have any demonstrable effect on other populations of CV spring-run Chinook salmon in the ESU. The low impact to the CV spring-run experimental population and its progeny over the foreseeable future will not substantially affect the CV spring-run Chinook salmon ESU and will not negatively affect its viability. The loss of the few individual fish trapped behind the gate when it is closed will not substantially affect the green sturgeon DPS in the Central Valley and is not expected to impair its viability.

Combining the adverse and beneficial effects (compensatory mitigation) associated with the proposed action described above, environmental baseline, cumulative effects, and status of the species and critical habitat, the 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 the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon, and is not likely to destroy or adversely modify designated critical habitat for CCV steelhead and sDPS green sturgeon.

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

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows: increases in turbidity, pile driving, barge and boat traffic noise, operations and maintenance, and permanent loss of habitat.

2.9.1.1. Incidental take associated with water quality (elevated in-river turbidity plumes and disturbance)

- ***Construction-related increased turbidity*** – The ecological surrogate for turbidity increase (in NTU) is equal to or less than 50 NTUs higher within 1000-feet of the disturbance activity when compared to the NTU background levels measured upstream of the project.

NMFS expects that during the in-water work window of July 15 through November 30 (for 2023 and 2024 season) and mid-July through mid-October (for 2025 and 2026 season), there would be adverse effects from increased turbidity as a result of the project to listed species present. NMFS expects the following species and life stages to be present during the in-water work window:

- Adult CCV steelhead
- Adult and juvenile sDPS green sturgeon

The most appropriate threshold for incidental take consisting of fish disturbance and sub-lethal effects associated with elevated in-river turbidity plumes is an ecological surrogate of the amount of increase in downstream in-river turbidity generated by dredging, riprap, or pile driving related activities. In-river pile driving, dredging, and riprap placement are expected to mobilize sediment and increase water turbidity beyond natural levels to some degree. Increased turbidity is expected to cause harm to listed species present through elevated stress levels and disruption of normal habitat use. These temporary responses are linked to decreased growth, survivorship, and overall reduced fitness as described in the effects section for underwater noise avoidance.

The ecological surrogate for turbidity increase is based on salmonids sensitivity to raised turbidity levels. Typical background turbidity in the San Joaquin River during the in-water work season is approximately 25 to 80 NTU (CDEC 2018). Fifty NTUs is above the range at which salmonids experience reduced growth rates but below the range, salmonids would be expected to actively avoid the area. Therefore, the surrogate for incidental take associated with turbidity increase is 50 NTUs higher than NTU background levels measured upstream of the project. Turbidity would be measured immediately downstream of the boundary already established for the action area and construction noise/pile driving disturbance surrogate (1000 feet in the San Joaquin River waterway from the northernmost boundary of the construction footprint) (SJAFCA 2018). Within 1000-foot, the San Joaquin River water is expected to increase up to 50 NTUs above the turbidity level in upstream measurements. Exceeding 50 NTUs will be considered as exceeding the expected incidental take levels.

2.9.1.2. Incidental take associated with pile driving

- ***Pile Driving*** – The ecological surrogate for piling driving is 150dB RMS behavioral threshold up to 2,154 meters from the pile, 187 dB cumulative SEL threshold up to 1597 meters from the pile, and peak 206 dB threshold up to 18 meters from the pile.

During pile driving, NMFS expects the following species and life stages to be present during the pile driving portion of the construction in-water work window from July 15 through November 30 for 2023 and 2024 season:

- adult CCV steelhead
- adult and juvenile sDPS green sturgeon

Quantification of the number of fish exposed to the pile driving associated noise and turbidity is not currently possible with readily available technology. All fish passing through or otherwise present during construction activities will be exposed to noise from pile driving. Only the level

of acoustic noise generated during the construction phases can be accurately and consistently measured and provide a quantifiable metric for determining incidental take of listed fish. The measurement of acoustic noise generated during the construction phase, and in particular the vibratory and impact pile driving described in the proposed project, will serve as physically measurable surrogates for the incidental take of listed fish species.

The most appropriate threshold for incidental take in the form of harm (resulting in fish displacement, behavior modification), injury, and death associated with elevated underwater noise is an ecological surrogate of the amount of habitat affected by elevated underwater noise and vibration within a certain distance from the construction site. Elevated noise disturbance is also expected to elevate fish stress levels even when no observable behavior changes are made, and are expected to decrease individual's overall fitness and survival through compounding sub-lethal effects.

As described and analyzed in the effects section, vibratory pile driving is expected to produce underwater pressure levels over 150 dB RMS out to 2,154 meters from the location of the pile driving sites. Beyond 2,154 meters, underwater sound is expected to attenuate down to effective quiet, or 150 dB RMS or less. Therefore 2,154 meters from the pile being driven is considered the limit of this ecological surrogate. The behavioral surrogate will be limited in general to 2,154 meters from the boundary of the construction footprint and cofferdam placement, and exceeding 150 dB RMS beyond 2,154 meters from the construction site boundary will be considered exceeding expected incidental take levels for this surrogate.

As described and analyzed in the effects section, impact pile driving is also expected to produce underwater pressure waves that are expected to injure or kill CCV steelhead and sDPS green sturgeon within 18 meters of the pile being driven. The lethal distance surrogate will be limited to an 18-meter radius from each pile driven with an impact hammer. The injurious distance surrogate will be limited 1,597 meters from the construction site boundary, and exceeding 206 dB peak or 187 dB cumulative SEL, respectively, beyond these distances will be considered exceeding expected incidental take levels for these surrogates.

2.9.1.3. Incidental take associated with barge and boat traffic noise

- ***Barge and boat traffic noise*** – The ecological surrogate for underwater noise from barge and boat traffic is observation of erratically behaving fish within 500 feet of construction activity in adjacent waterways during any 24-hour period.

During construction of the tidal gate, barges and boats (including tug boats) would be needed to transport materials and machinery. NMFS expects the following species and life stages to be present during the year-round barge and boat traffic:

- adult and juvenile CCV steelhead
- adult and juvenile CV spring-run Chinook salmon
- adult and juvenile sDPS green sturgeon

Quantification of the number of fish exposed to the underwater noise from barge and boat traffic is not currently possible with readily available technology. All fish passing through or otherwise present during construction activities will be exposed to construction noise. Based on the project description and effects analysis, elevated noise disturbance is expected to elevate fish stress levels even when no observable behavior changes are made, and are expected to decrease individual's overall fitness and survival through compounding sub-lethal effects.

The most appropriate threshold for incidental take in the form of harm, resulting in fish displacement, behavior modification, due to elevated underwater noise is an ecological surrogate of the amount of habitat affected by elevated underwater noise within 500 feet distance from the construction site. This would result in reduced survival and fitness to ESA-listed fish. Any observations of erratically behaving fish within 500 feet of construction activity in adjacent waterways during any 24hour period will be considered to have exceeded anticipated take levels, triggering the need to reinitiate consultation on the Project.

2.9.1.4. Incidental take associated with operations and maintenance of the flood gate

- ***Operations and Maintenance of the flood gate*** – The ecological surrogate for fish exposure to entrapment behind the flood gates is operation of the gates at water elevations greater than +8 feet NAVD88 only occurring during the period from November 1 through April 30.

NMFS expects that during the operations of the flood gate structures, closures for water elevations greater than +8.0 feet NAVD88 will occur only during the period from November 1 through April 30. NMFS expects the following species and life stages to be present during this portion of the proposed project operations:

- adult and juvenile CCV steelhead
- adult and juvenile sDPS green sturgeon
- adult and juvenile CV spring-run Chinook salmon

All listed species identified above would be exposed to the operations of the Smith Canal flood control structure. NMFS expects that incidental take would occur in the form of mortality or morbidity resulting from entrapment of listed fish behind the closed gate. Trapped fish would have an elevated vulnerability to predation and exposure to degraded water quality in the waterbodies upstream of the closed gate structures. Gate closures would occur during high tides or water elevations exceeding +8.0 feet NAVD88 or when in operation for maintenance purposes. Therefore, the frequency of gate operations is defined by the water elevation and is used as the ecological surrogate for the exposure of fish to entrapment behind the gates. Operations of the gates at water elevations below +8 feet NAVD would result in more frequent operations of the flood gate structure which would result in more occurrences of entrapped fish. These conditions would indicate incidental take has been exceeded, triggering the need to reinitiate consultation on the proposed project.

The level of incidental take is associated with the creation of a high velocity flow through the narrow gate opening, designed to be approximately 50 feet wide. The width of the gate is an

integral factor in determining the velocity of the water flowing through the open gate, as well as the water elevation differential between the two sides of the flood structure. If the gate opening is made narrower, the velocity increases, thereby creating more adverse conditions for listed fish passing through it. Higher velocities create more turbulence, eddies, and disorientation to the fish caught in the high velocity jet, allowing them to become easier targets for predators. A wider gate opening would have the opposite effect, reducing the velocity of the flow. NMFS considers any changes to the gate opening that would make it narrower and thus increases the velocity of water moving through the open gate as exceeding anticipated incidental take as analyzed in this biological opinion. The level of take associated with placing a vertical structure in the channel (*i.e.*, the sheet pile wall) is related to the linear length of the wall, and the holding and hiding habitat that it can provide to predators residing in the area. Increasing the length of the wall would increase the potential predator holding habitat. Conversely, shortening the length of the wall would reduce the predator holding habitat. NMFS considers any changes to the length of the wall that demonstrably increases its linear length (currently designed to be approximately 800 feet for Smith Canal) would exceed the anticipated incidental take of listed fish as assessed in this biological opinion.

2.9.1.5 Incidental Take Associated with the Permanent Loss of Habitat

- ***Square footage of area impact for permanent structure and riprap placement*** - The proposed project would result in permanent impacts to approximately 0.820 acres of tidal perennial drainage and 0.83 acres of riparian habitat. In addition, 0.386-acre of 18-inch RSP will be placed around the gate structure. This square footage will serve as the ecological surrogate.

NMFS expects that there will be permanent loss of habitat associated with the placement of the tidal gate structure and RSP. NMFS expects the following species and life stages to be present during this portion of the proposed project operations:

- adult and juvenile CCV steelhead
- adult and juvenile sDPS green sturgeon
- adult and juvenile CV spring-run Chinook salmon

The finalization of the flood control project will result in a tidal gate and floodwall that will extend 800 linear feet from the tip of Dad's Point levee to the right bank of the San Joaquin River. In addition, 200 linear feet of riprap will be placed on the banks of Stockton Golf and Country Club and 0.386-acre of RSP material around the gate foundation. Therefore, the project would result in permanent impacts to approximately 1.206 acres of tidal perennial drainage and 0.83 acres of riparian habitat.

The placement of the tidal gate and riprap is expected to harm juvenile and adult ESA-listed fish. It will reduce the amount of feeding and sheltering/escapement areas locally for juveniles. A reduction in the amount of feeding and resting areas is expected to reduce the fitness of fishes that would have otherwise used this area, in perpetuity. The occupation of the permanent structure and rip rap will reduce the amount of feeding and resting areas locally, and create

ambush habitat for predators of juvenile steelhead, in perpetuity. In addition, the permanent structure could change migration behavior for adult and juveniles due to the operations (changes in flow) and permanent placement of structure in the migratory corridor. NMFS considers any changes to the length of the wall that demonstrably increases its linear length (currently designed to be approximately 800 feet for Smith Canal) or increased rip rap placement would exceed the anticipated incidental take of listed fish as assessed in this biological opinion.

2.9.2. Effect of the Take

In the biological 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 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 sediment events and turbidity plumes in the action area and related effects, as discussed in this biological opinion.

2) Measures shall be taken by the Corps, or its applicant, to reduce underwater sound impacts and other disturbances related to pile driving and barge and boat traffic, as discussed in this biological opinion.

3) Measures shall be taken by the Corps, or its applicant, to reduce the extent of degradation and alteration to the habitats in the action area as a result of the tidal gate and riprap placement, related to effects of this project, as discussed in this biological opinion.

4) 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 action on listed species and critical habitat. In the report, the Corps or SJAFCA shall demonstrate how the conservation measures were incorporated.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. 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. Since in-river turbidity values change daily, the upstream comparison value must therefore be taken daily, in association with the downstream readings. A qualified biologist shall use a held-hand turbidity monitor to conduct water quality monitoring during all in-water activities to ensure the turbidity control measures are functioning as intended. If an in-river turbidity plume is created and conditions within the plume exceed take limits (50 NTUs above ambient) for listed species, the Corps, or its applicant, shall coordinate with NMFS within 24 hours after an event that exceeds the given water turbidity surrogate, to discuss ways to reduce turbidity back down to acceptable levels.

b. The following BMPs shall be incorporated into the Project to reduce, minimize or avoid turbidity associated with construction activities:

i. Implement appropriate measures, such as straw wattles and silt fencing, to prevent debris, soil, rock, or other material from entering the water from land.

ii. Use a water truck or other appropriate measures to control dust on haul roads, construction areas, and stockpiles. Application of water would not be excessive or result in runoff into storm drains or waterways.

iii. Schedule construction to avoid the rainy season as much as possible. If rains are forecasted during construction, additional erosion and sedimentation control measures would be implemented.

iv. Maintain sediment and erosion control measures during construction. Inspect the control measures before, during, and after a rain event.

v. Instruct construction workers in stormwater pollution prevention practices.

vi. Revegetate disturbed areas with native seeds or plantings in a timely manner to control erosion.

vii. If vegetation is not growing sufficiently it shall be replanted or provided with irrigation, if necessary.

viii. Erosion control BMPs will be monitored for effectiveness during the active construction window and during periods of inactivity following the active construction window for effectiveness, particularly during the rainy season.

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

a. During the seasonal in-water work windows, at least one day per week, the project activities shall not include pile-driving of any kind so that CCV steelhead and sDPS green sturgeon using the habitat may migrate or forage undisturbed.

b. When local water temperatures are below 75°F, attenuation measures shall be used during impact pile driving to control and dampen underwater pressure wave propagation. Effective attenuation measures include:

i. Pile driving within a dewatered cofferdam or caisson.

ii. Use of a bubble curtain.

iii. Use of a cushion block.

c. Underwater sound monitoring shall be conducted during impact pile driving when water temperatures are below 75°F, to ensure incidental take limits are not exceeded according to the ecological surrogates designated.

i. No more than 150 dB RMS beyond 2,154 meters from the boundary of the construction footprint/cofferdam placement.

ii. No more than 187 dB SEL cumulative beyond 1,597 meters from the construction site boundary per day.

iii. No more than 206 dB peak beyond an 18-meter radius from each pile driven with an impact hammer.

3. The following terms and conditions implement reasonable and prudent measure 3:

Following the placement of riprap on the river bank and gate structure at the extent described in the project Biological Assessment, voids created by the riprap boulders would be filled by smaller diameter rocks/gravel when below the OHWM to avoid supporting piscivorous predator ambush habitat. After the first storm and snowmelt season following placement of this smaller gravel, the area shall be examined to ensure the smaller gravel was not scoured out and effectively removed. If it is found to be removed, the Corps or its applicant shall develop a plan for maintenance of this BMP over time so that this adverse effect can be reduced and controlled.

a. The Corps or applicant shall provide NMFS with a draft of the plan for review, and implement the plan after receiving NMFS' concurrence.

b. The Corps or the applicant shall minimize the removal of existing riparian vegetation and instream woody material (IWM) to the maximum extent practicable, and where appropriate, removed IWM will be anchored back into place or if not feasible, new IWM will be anchored in place.

c. The Corps shall continue to coordinate with NMFS during all phases of construction, implementation, and monitoring by hosting annual meetings and issuing annual reports throughout the construction period.

4. The following terms and conditions implement reasonable and prudent measure 4:

a. The Corps, or its applicant, shall provide a report of project activities to NMFS by December 31 of each year construction takes place. The report shall include a summary description of in-water construction activities, incidental take avoidance and minimization measures taken, and any observed incidents of take.

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 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 projects.

3) The Corps should use all of their authorities, to the maximum extent feasible to implement high priority actions in the NMFS Central Valley Salmon and Steelhead Recovery Plan. High priority actions related to flood management include setting levees back from river banks, increasing the amount and extent of riparian vegetation along reaches of the Lower San Joaquin River Feasibility Study Project.

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 Smith Canal Gate 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. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed

species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect 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) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

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 either directly or indirectly 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 this EFH HAPC 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 pile driving, and permanent habitat loss/modification.

Sediment and turbidity

- Degraded water quality (temporary sedimentation and turbidity)

In-channel disturbance from pile driving

- Channel disturbance and noise pollution from pile driving activity and associated piles

Permanent habitat loss/modification

- Permanent habitat loss due to placement of riprap
- Reduced shelter from predators
- Reduction/change in aquatic macroinvertebrate production
- Reduced habitat complexity
- Reduced water quality (flow and contaminants) due to the operations of the tidal gate
- Permanent loss of habitat due to placement of tidal gate

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

The following are EFH conservation recommendations for the proposed project:

To address the adverse effects of sediment and turbidity:

Implement BO Section 2.9.4 Terms and Condition 1.

To address the adverse effects of in-channel disturbance from pile driving:

Implement BO Section 2.9.4 Terms and Condition 2.

To address the adverse effects of permanent habitat loss/modification:

Implement BO Section 2.9.4 Terms and Condition 3 and 4.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 2.03 acres of designated EFH for Pacific Coast salmon.

3.4. Statutory Response Requirements

As required by section 305(b)(4)(B) of the MSA, Corps must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification

for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5. 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 SJAFCA and the Central Valley Flood Protection Board. 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 implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

5. REFERENCES

Allen, P. J. and J. J. Cech (2007). "Age/size effects on juvenile green sturgeon, Acipenser medirostris, oxygen consumption, growth, and osmoregulation in saline environments." Environmental Biology of Fishes. 79(3-4): 211-229.

Barrett, J.C., G.D. Grossman, J. Rosenfeld. 1992. Turbidity-induced changes in reactive distance of rainbow trout. Transactions of the American Fisheries Society 121:437-443.

Busby, P. J., et al. (1996). Status Review of West Coast Steelhead from Washington, Idaho, Oregon and California. National Marine Fisheries Service. Seattle, Washington**:** 275.

Breitler, A. (2017, 10/30/17). Fish out of (normal) water. Rare sturgeon seen in Stanislaus River. Recordnet.com. Retreived from http://www.recordnet.com/news/20171030/fish-out-of normal-water-rare-sturgeon-seen-in-stanislaus-river

California Department of Fish and Game (1998). A Status Review of the Spring-run Chinook Salmon (*Oncorhynchus tshawytscha*) in the Sacramento River Drainage**:** 1-394.

California Department of Fish and Game (2007). California Steelhead Fishing Report Restoration Card. California Department of Fish and Game**:** 91.

California Department of Fish and Wildlife (2017). GrandTab Spreadsheet of Chinook Salmon Escapement in the Central Valley. Fisheries Branch**:** 1-21.

California Department of Fish and Wildlife (2017). Salmonid Populations of the Upper Sacramento River Basin In 2016. California Department of Fish and Wildlife--Northern Region**:** 126.

California Department of Fish and Wildlife (2018). "Fish Salvage Database." Retrieved 6/23/2019, from ftp://ftp.wildlife.ca.gov/salvage/.

California Department of Fish and Wildlife (2018). GrandTab Spreadsheet Chinook Salmon Escapement in the Central Valley**:** 1-21.

California Department of Transportation (2015). Compendium of Pile Driving Sound Data, Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish**:** 1-215.

Caltrans (2012). Appendix I: Compendium of Pile Driving Sound Data, in Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish**:** 215p.

Caltrans (2015). Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Sacramento, California, Division of Environmental Analysis, California Department of Transportation.

Caltrans (2019). "Hydroacoustics." Retrieved March 25, 2019, from http://www.dot.ca.gov/env/bio/hydroacoustics.html.

CDEC. (2018). River Sensor Data for San Joaquin River at Mossdale Bridge (MSD). State of California, Department of Water Resources, California Data Exchange Center. Retrieved from https://cdec.water.ca.gov/cgiprogs/selectQuery?station_id=msd&sensor_num=&dur_code=D&start_date=&end_date=

Chase, R. (2010). Lower American River steelhead (Oncorhynchus mykiss) spawning surveys – 2010, Department of the Interior, US Bureau of Reclamation**:** 17.

Cohen, S. J., et al. (2000). "Climate change and resource management in the Columbia River basin." Water International 25(2): 253-272.

Daughton, C.G. 2003. Cradle-to-cradle stewardship of drugs for minimizing their environmental disposition while promoting human health. I. Rationale for and avenue toward a green pharmacy. Environmental Health Perspectives 111:757-774.

Dettinger, M. D. and D. R. Cayan (1995). "Large-Scale Atmospheric Forcing of Recent Trends toward Early Snowmelt Runoff in California." Journal of Climate **8**(3): 606-623.

DiVittorio, J., M. Grodowitz, and J. Snow. 2012. Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species. U.S. Department of the Interior, Bureau of Reclamation. Technical Memorandum No. 86-68220-07-05.

Dubrovsky, N. M., D.L. Knifong, P.D. Dileanis, L.R. Brown, J.T. May, V. Connor, and C.N. Alpers (1998). Water quality in the Sacramento River basin. U.S. Geological Survey Circular 1215. United States Geological Survey.

ECORP Consulting, Inc. 2023. National Marine Fisheries Service Biological Assessment Supplement #2 for the Smith Canal Gate Project. Prepared for San Joaquin Area Flood Control Agency. March. 56 pages.

Garza, J. C. and D. E. Pearse (2008). Population genetic structure of Oncorhynchus mykiss in the California Central Valley: Final report for California Department of Fish and Game. Santa Cruz, California, University of California, Santa Cruz, and National Marine Fisheries Service.

Gisiner, R. C. (1998). Proceedings: Workshop on the Effects of Anthropogenic Noise in the Marine Environment. Office of Naval Research Marine Mammal Science Program**:** 1-141.

Gisiner, R. C. (1998). Workshop on the effects of anthropogenic noise in the marine environment proceedings 10 - 12 February 1998, Office of Naval Research.

Gleason, E., et al. (2008). 2007 sturgeon fishing report card:preliminary data report. Stockton, CA, California Department of Fish and Game Bay Delta Region**:** 13.

Good, T. P., et al. (2005). Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead. National Marine Fisheries Service**:** 1-598. Gruber, J. J., et al. (2012). 2011 San Joaquin River Sturgeon Spawning Survey. Lodi Fish and

Hallock, R. J., et al. (1957). The Use of Wire Fyke Traps to Estimate the Runs of Adult Salmon and Steelhead in the Sacramento River. 43**:**19.

Hallock, R. J., et al. (1957). "The Use of Wire Fyke Traps to Estimate the Runs of Adult Salmon and Steelhead in the Sacramento River." California Fish and Game 43(4): 271-298.

Hallock, R. J., et al. (1961). "An Evaluation of Stocking Hatchery-reared Steelhead Rainbow Trout (*Salmo gairdnerii gairdnerii*) in the Sacramento River System." Fish Bulletin 114: 3-74.

Hannon, J. and B. Deason (2001). American River Steelhead (Oncorhynchus mykiss) Spawning 2001 – 2007. U.S. Department of the Interior**:** 53.

Harvey, C. D. (1995). Adult Steelhead Counts in Mill and Deer Creeks, Tehama County, October 1993-June 1994. California Department of Fish and Game**:** 1-10.

Hastings, M. C. and A. N. Popper (2005). Effects of Sound on Fish, California Department of Transportation**:** 1-82.

Hastings, M. C. and A. N. Popper (2005). Effects of Sound on Fish. For the California Department of Transportation, Contract No. 43A0139 Task Order 1**:** 82.

Heublein, J. C., et al. (2009). "Migration of green sturgeon, *Acipenser medirostris*, in the Sacramento River." Environmental Biology of Fishes. 84(3): 245-258.

Jackson, Z. J., et al. (2016). "White Sturgeon Spawning in the San Joaquin River, California, and Effects of Water Management." Journal of Fish and Wildlife Management **7**(1): 171-180.

Johnson, M. R. and K. Merrick (2012). Juvenile Salmonid Monitoring Using Rotary Screw Traps in Deer Creek and Mill Creek, Tehama County, California Summary Report: 1994-2010. California Department of Fish and Wildlife**:** 1-105.

Kipple, B. and C. Gabriele. 2007. Underwater Noise from Skiffs to Ships. Pages 172-175 in J. F. Piatt and S. M. Gende, editors. Proceedings of the Fourth Glacier Bay Science Symposium, October 26-28, 2004: U.S. Geological Survey Scientific Investigations Report 2007-5047.

Kjelson, M. A. and P. L. Brandes (1989). The Use of Smolt Survival Estimates to Quantify the Effects of Habitat Changes on Salmonid Stocks in the Sacramento-San Joaquin Rivers, California. Proceedings of the National Workshop on Effects of Habitat Alteration on Salmonid Stocks. C. D. Levings, L. B. Holtby and M. A. Henderson. Canada, Fisheries and Oceans**:** 100-115.

Kynard, B. and E. Parker (2005). "Ontogenetic Behavior and Dispersal of Sacramento River White Sturgeon, *Acipenser transmontanus*, With a Note on Body Color." Environmental Biology of Fishes **7**4(1): 19-30.

Lindley, S. T., et al. (2004). Population Structure of Threatened and Endangered Chinook Salmon ESUs in California's Central Valley Basin. U.S. Department of Commerce**:** 1-56.

Lindley, S. T., et al. (2006). "Historic Population structure of the Central Valley Steelhead and its Alternation by Dams." 19.

Lindley, S. T., et al. (2008). "Marine migration of North American green sturgeon." Transactions of the American Fisheries Society 137(1): 182-194.

Lloyd, D. S. (1987). "Turbidity as a Water Quality Standard for Salmonid Habitats in Alaska." North American Journal of Fisheries Management 7(1): 34-45.

McEwan, D. (2001). "Contributions to the Biology of Central Valley Salmonids." Fish Bulletin 179: 44.

McEwan, D. and T. A. Jackson (1996). Steelhead Restoration and Management Plan for California. California Department of Fish and Game**:** 1-234.

McReynolds, T. R., et al. (2007). Butte and Big Chico Creeks Spring-Run Chinook Salmon, *Oncorhynchus tshawytscha*, Life History Investigation 2005-2006. California Department of Fish and Game**:** 1-37.

Moyle, P.B., P.J. Foley, and R.M. Yoshiyama. 1992. Status of green sturgeon, *Acipenser medirostris*, in California. Final report sent to NMFS, Terminal Island, California by UC Davis Department of Wildlife and Fisheries Biology. 12 pages.

Moyle, P. B. (1995). "Conservation of Native Freshwater Fishes in the Mediterranean-type Climate of California, USA: A Review." Biological Conservation **72**: 271-279.

Moyle, P. B., et al. (1995). Fish species of special concern in California, Second Edition Final Report for Contract No. 2128IF. California Department of Fish and Game. Davis, California.

Moyle, P. B. (2002). Inland Fishes of California. Berkeley and Los Angeles, University of California Press.

Myers, J. M., et al. (1998). Status Review of Chinook Salmon From Washington, Idaho, Oregon, and California, NOAA Technical Memorandum NMFS-NWFSC-35**:** 467.

Nakamoto, R. J., et al. (1995). Age and Growth of Klamath River Green Sturgeon (*Acipenser medirostris*) U.S. Forest Service and U.S. Fish and Wildlife Service**:** 1-27.

National Marine Fisheries Service (2008). "NMFS Pile Driving Calculations Excel." Retrieved March 25, 2019, from http://www.dot.ca.gov/env/bio/docs/bio-nmfs-pile-driving-calculations.xls.

National Marine Fisheries Service (2009). Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project. U.S. Department of Commerce.

National Marine Fisheries Service (2009). Long-Term Operations of the Central Valley Project and State Water Project Biological Opinion. U.S. Department of Commerce**:** 844.

National Marine Fisheries Service (2014). Final Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead. Sacramento, California, NMFS**:** 427.

National Marine Fisheries Service (2015). 5-Year Summary and Evaluation: Southern Distinct Population Segment of the North American Green Sturgeon. U.S. Department of Commerce. Long Beach, California, U.S. Department of Commerce,**:** 42.

National Marine Fisheries Service (2016a). 2016 5-Year Review: Summary & Evaluation of Central California Coast Steelhead. National Marine Fisheries Service. West Coast Region**:** 55.

National Marine Fisheries Service (2016b). 5-year review: Summary and evaluation of Central Valley spring-run Chinook salmon Evolutionarily Significant Unit. National Marine Fisheries Service. West Coast Region. Central Valley Office, Sacramento, CA.

National Marine Fisheries Service (2018). Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon (Acipenser medirostris). National Marine Fisheries Service**:** 95.

Newcombe, C. P. and J. O. T. Jensen (1996). "Channel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact." North American Journal of Fisheries Management **16**(4): 693-727.

Nielsen, J. L., et al. (2003). Genetic Analyses of Central Valley Trout Populations 1999-2003. U.S.G.S. Alaska Science Center - Final Technical Report submitted December 8, 2003, California Department of Fish and Game, Sacramento, California and US Fish and Wildlife Service, Red Bluff Fish, California.

Nobriga, M. and P. Cadrett (2001). "Differences Among Hatchery and Wild Steelhead: Evidence from Delta Fish Monitoring Programs." IEP Newsletter 14(3): 30-38.

Peters, R. J., B. R. Missildine, and D. L. Low. 1998. Seasonal fish densities near river banks stabilized with various stabilization methods. First year report of the Flood Technical Assistance Project. USDI, FWS, Lacey, WA. 34 pp.

Popper, A. N., et al. (2006). Interim Criteria for Injury of Fish Exposed to Pile Driving Operations: A White Paper**:** 15p.

Popper, A. N., et al. (2006). Interim criteria for injury of fish exposed to pile driving operations: A white paper. Report to the Fisheries Hydroacoustic Working Group, California Department of Transportation, USA**:** 15.

Popper, A. N. and M. C. Hastings (2009). "The effects of human-generated sound on fish." Integr Zool 4(1): 43-52.

Poytress, W. R., et al. (2011). 2010 Upper Sacramento River Green Sturgeon Spawning Habitat and Larval Migration Surveys U.S. Fish and Wildlife Service and University of California Davis**:** 1-48.

Poytress, W. R., et al. (2012). 2011 Upper Sacramento River Green Sturgeon Spawning Habitat and Larval Migration Surveys U.S. Fish and Wildlife Service and University of California Davis**:** 1-46.

PFMC (Pacific Fishery Management Council). 1998. Description and identification of essential fish habitat for the Coastal Pelagic Species Fishery Management Plan. Appendix D to Amendment 8 to the Coastal Pelagic Species Fishery Management Plan. Pacific Fishery Management Council, Portland, Oregon. December.

PFMC. 2005. Amendment 18 (bycatch mitigation program), Amendment 19 (essential fish habitat) to the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington groundfish fishery. Pacific Fishery Management Council, Portland, Oregon. November.

PFMC. 2007. U.S. West Coast highly migratory species: Life history accounts and essential fish habitat descriptions. Appendix F to the Fishery Management Plan for the U.S. West Coast Fisheries for Highly Migratory Species. Pacific Fishery Management Council, Portland, Oregon. January.

PFMC. 2008. Management of krill as an essential component of the California Current ecosystem. Amendment 12 to the Coastal Pelagic Species Fishery Management Plan. Environmental assessment, regulatory impact review & regulatory flexibility analysis. Pacific Fishery Management Council, Portland, Oregon. February.

PFMC. 2014. Appendix A to the Pacific Coast Salmon Fishery Management Plan, as modified by Amendment 18. Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon.

Radford, A. N., E. Kerridge, and S. D. Simpson. 2014. Acoustic Communication in a Noisy World: Can Fish Compete with Anthropogenic Noise? Behavioral Ecology 25(5): 1022-1030.

Radtke, L. D. (1966). "Ecological Studies of the Sacramento-San Joaquin Delta. Part II: Fishes of the Delta: Distribution of Smelt, Juvenile Sturgeon, and Starry Flounder in the

Sacramento-San Joaquin Delta with Observations on Food of Sturgeon." Fish Bulletin 136: 115-129.

Schaffter, R. (1980). Fish Occurrence, Size, and Distribution in the Sacramento River Near Hood, California During 1973 and 1974. California Department of Fish and Game Anadromous Fisheries Branch**:** 1-78.

Schmetterling, D.A., C.G. Clancy, and T.M. Brandt. 2001. Effects of riprap bank reinforcement on stream salmonids in the Western United States. Fisheries 26:8-13.

Seesholtz, A. M., et al. (2014). "First Documented Spawning and Associated Habitat Conditions for Green Sturgeon in the Feather River, California." Environmental Biology of Fishes **98**(3): 905-912.

Simpson, S. D., J. Purser, and A. N. Radford. 2015. Anthropogenic Noise Compromises Anti-Predator Behaviour in European Eels. Global change biology 21(2): 586-593.

SJRRP. (2018). Background and History: San Joaquin River Restoration Settlement. San Joaquin River Restoration Program. Retrieved from http://www.restoresjr.net/about/background-and-history/

Slabbekoorn, H., N. Bouton, I. van Opzeeland, A. Coers, C. ten Cate, and A. N. Popper. 2010. A Noisy Spring: The Impact of Globally Rising Underwater Sound Levels on Fish. Trends Ecology and Evolution 25(7): 419-427.

Snider, B. and R. G. Titus (2000). Timing, Composition, and Abundance of Juvenile Anadromous Salmonid Emigration in the Sacramento River Near Knights Landing October 1996 - September 1997. California Department of Fish and Game**:** 74.

State Water Resources Control Board (2010). Draft technical report on the scientific basis for alternative San Joaquin River flow and delta salinity objectives. State Water Resources Control Board and California Environmental Protection Agency**:** 114.

U.S. Army Corps of Engineers (Corps), 2015. Final Biological Assessment: Terrestrial and Aquatic Species, San Joaquin River Basin, Lower San Joaquin River, CA, Interim Feasibility Study. November 2015. 127 pages plus appendices.

U.S. Bureau of Reclamation (2016). Secure Water Act Section 9503(c) Reclamation Climate Change and Water 2016. U.S. Department of the Interior and Bureau of Reclamation**:** 307.

U.S. Bureau of Reclamation (2016). SECURE Water Act Section 9503(c) Reclamation Climate Change and Water. Prepared for United States Conress. U.S. Department of the Interior**:** 307.

U.S. Fish and Wildlife Service (2002). Spawning Areas of Green Sturgeon *(Acipenser medirostris)* in the Upper Sacramento River, California Red Bluff, CA, U.S. Fish and Wildlife Service,**:** 62.

U.S. Fish and Wildlife Service (2015). Clear Creek Habitat Synthesis Report. The Anadromous Fish Restoration Program. Sacramento, California 1-24.

Voellmy, I. K., J. Purser, D. Flynn, P. Kennedy, S. D. Simpson, and A. N. Radford. 2014a. Acoustic Noise Reduces Foraging Success in Two Sympatric Fish Species Via Different Mechanisms. Animal Behaviour 89: 191-198.

Voellmy, I. K., J. Purser, S. D. Simpson, and A. N. Radford. 2014b. Increased Noise Levels Have Different Impacts on the Anti-Predator Behaviour of Two Sympatric Fish Species. PLoS ONE 9(7): e102946.

Ward, P. D., et al. (2003). Butte and Big Chico Creeks Spring-run Chinook Salmon, Oncoryhnchus tshawytscha Life History Investigation: 2001-2002. California Department of Fish and Game**:** 59.

Waters, T. F. (1995). "Sediment in Streams: Sources, Biological Effects, and Control." American Fisheries Society Monograph 7.

Williams, J. G. (2006). "Central Valley Salmon: A Perspective on Chinook and Steelhead in the Central Valley of California." San Francisco Estuary and Watershed Science **4**(3): 1-398.

Williams, J. G. (2006). "Central Valley Salmon: A Perspective on Chinook and Steelhead in the Central Valley of California." San Francisco Estuary and Watershed Science **4**(3): 1-398.

Williams, T. H., et al. (2016). Viability Assessment For Pacific Salmon And Steelhead Listed Under The Endangered Species Act: Southwest, Memorandum from Steve Lindley to Will Stelle.

Williams, T. H., et al. (2016). Viability Assessment for Pacific Salmon and Steelhead listed under the Endangered Species Act: Southwest. National Marine Fisheries Service**:** 1-53.

Yoshiyama, R. M., et al. (1998). "Historical Abundance and Decline of Chinook Salmon in the Central Valley Region of California." North American Journal of Fisheries Management **18**: 487-521.

Zimmerman, C. E., et al. (2008). Maternal origin and migratory history of Oncorhynchus mykiss captured in rivers of the Central Valley, California. California Department of Fish and Game**:** 54.

Federal Register Notices

50 CFR 402.02 (2007). Status of the Species. National Marine Fisheries Service, Office of Federal Register. 50 CFR chapter. IV (10-1-07 Edition): 815-817.

63 FR 13347 (1998). Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington, Oregon, and California. National Marine Fisheries Service, Office of the Federal Register,. 63: 13347-13371.

64 FR 50394 (1999). Endangered and Threatened Species; Threatened Status for Two Chinook Salmon Evolutionarily Significant Units (ESUs) in California. National Marine Fisheries Service, Office of the Federal Register. 64: 50394-50415.

70 FR 37160 (2005). Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs. National Marine Fisheries Service, Office of the Federal Register. **70:** 37160-37204.

70 FR 37160 (2005). Endangered and Threatened Species; Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs. National Marine Fisheries Service, Office of the Federal Register. **70:** 37160-37204.

70 FR 52488 (2005). Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California. National Marine Fisheries Service, Office of the Federal Register. **70:** 52488-52627.

71 FR 834 (2006). Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead. National Marine Fisheries Service, Office of the Federal Register. **71:** 834-862.

71 FR 17757 (2006). Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon. Bulletin of Environmental Contamination and Toxicology. National Marine Fisheries Service, Office of the Federal Register. **71:** 67.

74 FR 52300 (2009). Final Rulemaking to Designate Critical Habitat for the Threatened Southern Distinct Population Segment of North American Green Sturgeon. National Marine Fisheries Service, Office of the Federal Register. **74:** 52300-52351.

76 FR 50447 (2011). Endangered and Threatened Species. 5-Year Reviews for 5 Evolutionarily Significant Units of Pacific Salmon and 1 Distinct Population Segment of Steelhead in California. National Marine Fisheries Service, Office of the Federal Register. **76:** 50447-50448.

78 FR 79622 (2013). Endangered and Threatened Species: Designation of a Nonessential Experimental Population of Central Valley Spring-Run Chinook Salmon Below Friant Dam in the San Joaquin River, CA. National Marine Fisheries Service, Office of the Federal Register. 78: 79622-79633.

81 FR 33468 (2016). Endangered and Threatened Species; 5-Year Reviews for 28 Listed Species of Pacific Salmon, Steelhead, and Eulachon. Bulletin of Environmental Contamination and Toxicology. National Marine Fisheries Service, Office of the Federal Register. 81: 33468-33469.

APPENDIX A. CONSERVATION MEASURES AND WATER QUALITY ACTIONS FROM THE 2019 AND 2021 NMFS BIOLOGICAL OPINION THAT ARE PART OF THE ONGOING PROPOSED ACTION.

- Prior to any construction activities onsite, a review of all required permits and notifications will be performed to ensure requirements for environmental compliance are fully understood, specific limits of activities and work are defined and understood, and all environmental clearances and access, encroachment agreements, and permissions have been obtained from the appropriate agencies and parties.

- An approved biological monitor will be onsite during all construction activities that occur within the channel (i.e., cofferdam dewatering, pile driving). Biological monitors will be notified in advance of all work activities and locations, and scheduled to be onsite as required during vegetation clearing activities.

- To clearly demarcate the project boundary and protect sensitive natural communities, SJAFCA or its contractor will install temporary exclusion fencing (i.e., minimum 4-foot tall high-visibility orange construction fencing) around sensitive biological resource areas 1 week prior to the start of construction activities.

- Before any work occurs in the project site, a qualified biologist will conduct mandatory contractor/worker environmental awareness training to brief construction personnel on the need to avoid impacts on sensitive biological resources and the penalties for not complying with permit requirements.

- Prior to construction activities, environmentally sensitive areas will be flagged or fenced in order to clearly delineate the extent of the construction. All crews will also have a set of environmental drawings showing the locations of the known environmental areas. The plans will also define the fencing installation procedure. The project's special provisions package will provide clear language regarding acceptable fencing material and prohibited construction- related activities, vehicle operation, material and equipment storage, and other surface- disturbing activities within sensitive areas.

- Access routes and work areas will be limited to the minimum amount necessary to achieve the project goals. Unpaved routes and boundaries will be clearly marked prior to initiating construction.

- All equipment will be maintained such that there will be no leaks of machine fluids such as gasoline, diesel, or oils. Containment pans will be placed under stationary equipment in the event of leaks.

- Hazardous materials such as fuels and oils will be stored in sealable containers in a designated location that is at least 200 feet from any aquatic habitat.

- The number of access routes, size of staging areas, and the total area of the activity will be limited to the minimum necessary to achieve the project goal. Project limits will be established and defined with physical markers to define access routes and maintenance areas to the minimum area necessary to complete the project; this includes locating access routes and maintenance areas outside of any drainages or creeks.

- Construction access, staging, storage, and parking areas shall be located on ruderal or developed lands to the extent possible. Vehicle travel adjacent to wetlands and riparian areas shall be limited to existing roads and designated access paths. Sensitive natural communities (e.g., wetlands, water, riparian zones) shall be conspicuously marked in the field to minimize impacts on those communities, and work shall be limited to outside the marked areas.

- Only tightly woven fiber netting or similar material may be used for erosion control. No plastic monofilament matting will be used for erosion control, as this material may ensnare wildlife or disperse into the environment, increasing the amount of plastic pollution.

- SJAFCA or its contractor will inspect and clean all equipment being used for brush clearing to minimize the spread of invasive plant species into upland refugia and tidal marsh habitat.

- Upon completion of the proposed action, all temporarily disturbed natural areas, including stream banks, will be returned to original contours to the extent feasible. Affected wetlands, stream banks or stream channels will be stabilized prior to the rainy season and/or prior to reestablishing flow. Native wetland vegetation will be reestablished as appropriate.

- SJAFCA or its contractor will implement one or more of the following actions to avoid and minimize the spread or introduction of terrestrial invasive plant species. In addition, SJAFCA will coordinate with the San Joaquin County Agricultural Commissioner to ensure that the appropriate Best Management Practices (BMPs) are implemented for the duration of the construction of the proposed action.

    a. Educate construction supervisors and managers about the importance of controlling and preventing the spread of invasive plant infestations.
    b. Use eradication methods that have been approved by or developed in conjunction with the San Joaquin County Agricultural Commissioner during terrestrial invasive species removal to prevent dispersal of the species and/or destroy viable plant parts or seeds. Methods may include use of herbicides approved for use in and near waterways and seasonal removal (i.e., prior to flower and fruit production).
    c. Minimize surface disturbance to the greatest extent feasible to complete the work.
    d. Use native, noninvasive species or nonpersistent hybrids in erosion-control plantings to stabilize site conditions and prevent invasive plant species from colonizing.
    e. Use erosion-control materials that are weed-free or contain less than 1% weed seed.

- Vegetation will be cleared only where necessary and will be cut approximately 4 inches above soil level. This will allow plants to regrow after construction. All clearing and grubbing of woody vegetation will be done using hand tools, small mechanical tools, or backhoes and excavators.

- Prior to use of the proposed staging area adjacent to the San Joaquin River, or any other potential staging area that is not graded or paved, SJAFCA will retain a qualified wetland delineator to assess the staging area for the presence of any potential waters of the United States. This assessment does not need to be a complete delineation according to all USACE requirements, but will be adequate for the purposes of determining the approximate boundaries of any potential wetlands or other waters of the United States so that they can be avoided. If potential wetlands or other waters are found within the staging area, they will be shown on a map, fenced, and avoided during all construction activity, including a suitable buffer to avoid any long-term impacts.

- All slopes or unpaved upland areas temporarily disturbed by construction activities will be revegetated at least 3 days prior to a forecasted rain event with an erosion control seed mix that consists of grasses and herbaceous species that are native or naturalized to the region. The temporarily disturbed areas will be restored to pre-project topography and hydrology to the greatest extent possible.

- To prevent introduction and/or transport of aquatic invasive species into or from creeks, sloughs or other wetted channels in the Action Area, any equipment that comes into contact with the channel will be inspected and cleaned before and after contact, according to the most current Inspection Standards and Cleaning and Decontamination Procedures (DiVittorio et al. 2012).

Water Quality Measures

Subject to requirements of Section 402 of the Federal Clean Water Act, and the National Pollutant Discharge Elimination System (NPDES) permitting process, all construction projects that disturb more than one acre of land are required to prepare and implement a stormwater pollution prevention plan (SWPPP). The consulting firm selected to prepare detailed construction plans and will also be required to prepare a SWPPP for the project and include it in project plans and specifications. The construction contractor(s) will then be required to post a copy of the SWPPP at the project site, file a notice of intent to discharge stormwater with the Central Valley Regional Water Quality Control Board (Regional Water Board), and implement all measures required by the SWPPP. SJAFCA will be responsible for monitoring to ensure that the provisions of the SWPPP are effectively enforced. In the event of noncompliance, the Regional Water Board will have the authority to shut down the construction site or fine the responsible party or parties.

The SWPPP will include the following information and stipulations:

- A description of site characteristics, including runoff and drainage characteristics and soil erosion hazard.
- A description of proposed construction procedures and construction-site housekeeping practices, including prohibitions on discharging or washing potentially harmful materials into streets, shoulder areas, inlets, catch basins, gutters, or agricultural fields, associated drainage, or irrigation features.
- A description of measures that will be implemented for erosion and sediment control, including requirements for the following:

- Conduct major construction activities involving excavation and spoils haulage during the dry season, to the extent possible;
- Conduct all construction work in accordance with site-specific construction plans that minimize the potential for increased sediment inputs to storm drains and surface waters.
- Grade and stabilize spoils sites to minimize erosion and sediment input to surface waters.
- Implement erosion control measures as appropriate to prevent sediment from entering surface waters, agricultural water features, and storm drains to the extent feasible, including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets on exposed slopes.
- A Spill Prevention and Response Plan (SPRP) that identifies any hazardous materials to be used during construction; describes measures to prevent, control, and minimize the spillage of hazardous substances; describes transport, storage and disposal procedures for these substances; and outlines procedures to be followed in case of a spill of a hazardous material. The SPRP will require that hazardous and potentially hazardous substances stored onsite be kept in securely closed containers located away from drainage courses, agricultural areas, storm drains, and areas where stormwater is allowed to infiltrate. It will also stipulate procedures, such as the use of spill containment pans, to minimize hazards during onsite fueling and servicing of construction equipment. Finally, the SPRP will require that SJAFCA be notified immediately of any substantial spill or release.
- A stipulation that construction will be monitored by SJAFCA personnel to ensure that contractors are adhering to all provisions relevant to state and Federal stormwater discharge requirements, and that SJAFCA will shut down the construction site in the event of noncompliance.

Application of herbicides would be limited to the dry season to avoid potential runoff into adjacent waterways. Herbicides will not be applied during rain events or when winds exceed 10 miles per hour to prevent transport of the herbicide to off-target areas, such as surface waters. Sprayer nozzles will be calibrated to a spray density that avoids drift during application, or a surfactant will be used with the herbicide. Herbicides will be applied at a height no more than approximately four feet above plant canopy. Contractors will follow all herbicide label and requirements.

Turbidity curtains will be used around the cofferdam, and water from the dewatering process would be pumped over the top of the cofferdam and discharged in the area surrounded by the turbidity curtain to allow any silt or suspended sediments to settle back to the channel bottom.

In-Channel Work

In-channel work, including all channel and bank modifications, will be restricted to the dry season (July 15 to October 15). In-channel work will be restricted to low-flow periods between mid-July and mid-October unless otherwise approved by appropriate agencies. This window can be extended based on river conditions, if approved in writing by NMFS. Work from the banks can occur year-round. Work requiring stream dewatering, stream crossings, or work within the

live stream will not begin before July 15. To the extent feasible, all in-channel work will be done by equipment operating from dry areas outside the channel.

Special Status Fish Conservation Measures

To avoid or minimize potential injury and mortality of special-status fish species, SJAFCA proposes to implement the following fish protection measures during cofferdam construction and dewatering.

- Silt fences, fiber rolls, silt curtains, and other appropriate sediment control measures will be used to minimize sediment input to the active channel, consistent with the project.
- Lighting at the gate and along the floodwalls will be directed away from the water surface as much as possible in order to decrease the attraction of juvenile salmonids and predatory fish to the area.
- SJAFCA and/or its contractor will ensure that a qualified fish biologist is on site during cofferdam construction and dewatering to supervise fish rescue activities and document any occurrences of stressed, injured, or dead fish. The biologist will be responsible for:

  (1) identifying the appropriate capture or exclusion measures;

  (2) overseeing the monitoring, handling, and release of all captured salmonids; and

  (3) maintaining detailed records of fish rescue activities, including species, numbers, life stages, and size classes of listed species observed, collected, relocated, injured, and killed, and environmental conditions (e.g., water temperature) under which fish rescue activities are conducted.

- Potential capture methods during fish salvage will include seines, dip nets, electrofishing, or other methods that minimize the risk of injury. If electrofishing is used, all techniques will be consistent with NMFS Electrofishing Guidelines (National Marine Fisheries Service 2000).
- SJAFCA will require the contractor to implement the following measures, developed in coordination with project design engineers, to minimize the exposure of listed fish species to potentially harmful underwater sounds.
  - If feasible, the contractor will vibrate all piles to the maximum depth possible before using an impact hammer.
  - The smallest pile driver and minimum force necessary will be used to complete the work.
  - During impact driving, SJAFCA will require the contractor to use a bubble ring or similar device to minimize the extent of the interim peak and cumulative SEL to below the noise thresholds (reference the Caltrans impact pile driving handbook: http://www.dot.ca.gov/hq/env/bio/files/bio_tech_guidance_hydroacoustic_effects_110215.pdf).
  - Pile driving of gate structure piles will occur inside a dewatered cofferdam.
  - No pile-driving activity will occur at night.
  - A sound attenuation device (pile cap cushion) will be used between the drive hammer strike face and the steel piling to avoid direct steel on steel impacts.

- Construction activities will avoid submerged and emergent aquatic vegetation to the greatest extent possible.
- SJAFCA and/or its contractor will develop and implement a hydroacoustic monitoring plan prior to pile driving commencement for resource agency approval. The monitoring plan will be submitted to the resource agencies (CDFW, NMFS, USFWS) for approval at least 60 days before the start of project activities. The plan will include the following requirements:
    - SJAFCA and/or its contractor will monitor underwater noise levels during all impact pile driving activities on land and in water to ensure that that peak and cumulative SELs do not exceed fish injury or mortality thresholds.
    - If the levels are exceeded, pile driving will cease and SJAFCA and/or its contractor will contact NMFS to determine whether work can resume.
    - The monitoring plan will describe the methods and equipment that will be used to document the extent of underwater sounds produced by pile driving, including the number, location, distances, and depths of the hydrophones and associated monitoring equipment.
    - A reporting schedule that includes provision of daily summaries of the hydroacoustic monitoring results to the resource agencies and more comprehensive reports on a monthly basis during the pile driving season.
    - The final report will include the number of piles installed per day, the number of strikes per pile, the interval between strikes, the peak sound pressure level (Peak), SEL, RMS per strike, accumulated SEL per day at each monitoring station, and when these levels are exceeded, if ever.

- A fisheries biologist will be on-site during all barge movements to monitor for erratically behaving fish within 500 feet of the tugboat; if any erratically behaving fish are observed, the biologist will temporarily halt the barge movement and contact NMFS to identify the appropriate corrective actions (e.g., reduce the tugboat motor RPMs, monitor underwater noise levels to ensure RMS values do not exceed 150 dB RMS beyond 100 m of the tugboat).
- All Project boats will obey the posted speed limit of 5 mph (4.3 knots) within Smith Canal;
- All Project boats will avoid rapid acceleration within the action area;
- All Project boat motors will be turned off when not in use; and
- Movement of the barge and use of the tugboat will be restricted to the minimum amount necessary to complete the intended work.