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

Refer to NMFS No: WCRO-2019-01675

February 11, 2020

Zachary Simmons
Senior Project Manager
Enforcement/Special Projects Branch
United States Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response, and Fish and Wildlife Coordination Act Recommendations for the 2017 Storm Damage Department of Water Resources Rehabilitation Phase 4, 5, and 6 Repair Sites Programmatic

Dear Mr. Simmons:

Thank you for your letter of June 17, 2019, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the 2017 Storm Damage DWR Rehabilitation (SDDR) Phase 4, 5, and 6 Repair Sites Programmatic. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

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

The enclosed Programmatic biological opinion (BO), analyzes the effects of the SDDR Phase 4, 5, and 6 sites. This BO is based on the final biological assessment for the project, and on the best available scientific and commercial information. The BO concludes that the analyzed project is not likely to jeopardize the continued existence of the federally-listed endangered Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) evolutionarily significant unit (ESU), the threatened Central Valley spring-run Chinook salmon ESU (*O. tshawytscha*), the threatened southern distinct population segment (DPS) of the North American green sturgeon (*Acipenser medirostris*), and the threatened California Central Valley steelhead (*O. mykiss*) DPS, and is not likely to destroy or adversely modify their designated critical habitats. NMFS has included an incidental take statement with reasonable and prudent measures and nondiscretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project.

This letter also transmits NMFS's review of potential effects of the SDDR Project on EFH for Pacific Coast salmon, designated under the MSA. This review was pursuant to section 305(b) of the MSA, implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. The analysis concludes that the project would adversely affect the EFH of Pacific Coast salmon in the Action Area. The EFH consultation concludes with conservation recommendations.

Please contact Ally Lane at the California Central Valley Office of NMFS at (916)930-5617 or via email at Allison.lane@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Maria Rea
Assistant Regional Administrator

Enclosure

cc: To the file 151422-WCR2019-SA00527
Zachary Simmons, Senior Project Manager, Zachary.M.Simmons@usace.army.mil
Kristin Ford, DWR Flood Maintenance Office, Kristin.ford@water.ca.gov

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

2017 Storm Damage DWR Rehabilitation Phase 4, 5, and 6 Repair Sites Programmatic

National Marine Fisheries Service Tracking Number: WCRO-2019-01675

Action Agency: United Stated 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	Yes	No
California Central Valley steelhead DPS (*O. mykiss*)	Threatened	Yes	No	Yes	No
Southern DPS of North American green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	Yes	No
Sacramento River winter-run Chinook salmon ESU (*O. tshawytscha*)	Endangered	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: Maria Rea

Maria Rea
Assistant Regional Administrator

Date: ***February 11, 2020***

LIST OF ACRONYMS

ACID	Anderson-Cottonwood Irrigation District Diversion Dam
BA	biological assessment
BMP	best management practice
°C	degrees Celsius
CCV	California Central Valley
CDEC	California Data Exchange Center
CDFW/CDFG	California Department of Fish and Wildlife
cfs	cubic feet per second
CVP	Central Valley Project
Delta	Sacramento-San Joaquin River Delta
DPS	distinct population segment
DQS	Data Quality Act
EFH	essential fish habitat
EPA	United Stated Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionary significant unit
°F	degrees Fahrenheit
FWCA	Fish and Wildlife Coordination Act
HAPCs	Habitat Areas of Particular Concern
ITS	incidental take statement
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
OHWM	ordinary high water mark
Opinion	biological opinion
PAHs	polyaromatic hydrocarbons
PBFs	physical or biological features
RBDD	Red Bluff Diversion Dam
RPMs	reasonable and prudent measures
sDPS	southern distinct population segment
SJR	San Joaquin River
SJRRP	San Joaquin River Restoration Program
SRA	shaded riverine aquatic
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
UC Davis	University of California at Davis
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
VSP	viable salmonid population
WOUS	Waters of the United States
YOY	young-of-the-year
µg/L	microgram per liter

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1. INTRODUCTION

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

1.1 Background

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

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

Because the proposed action would modify a stream or other body of water, NMFS also provides recommendations and comments for the purpose of conserving fish and wildlife resources, and enabling the Federal agency to give equal consideration with other project purposes, as required under the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661 et seq.).

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 17, 2019, NMFS received a letter and Biological Assessment (BA) from the United States Army Corps of Engineers (USACE) requesting formal consultation of the 2017 Storm Damage Department of Water Resources (DWR) Rehabilitation (SDDR) Phase 4 and 5 Repair Sites**.**

- On July 2, 2019, NMFS requested clarification from USACE on effects determinations, project description, and site impacts.

- On August 19, 2019, NMFS received a final BA with all questions clarified from USACE and initiated formal consultation.

- However, on August 21, 2019, DWR requested changes to the proposed action be incorporated. These included increased mitigation ratios at sites where they could not install Instream Woody Material (IWM) or plant willow poles/other vegetation beyond native grasses, and incorporating soil/rock mix at all sites with salmonid impacts.

- On September 20, 2019, DWR requested the consultation be changed to a programmatic to include Phase 6 sites that will be of a similar repair type at unknown locations – but still within the described action area.

- On November 4, 2019, DWR provided an updated the Proposed Action, and the initiation of consultation was adjusted to this date.

1.3 Proposed Federal Action

Under 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 Part 402.02).

Under EFH, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR Part 600.910).

Under the FWCA, an action occurs "whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, or by any public or private agency under Federal permit or license" (16 USC 662(a)).

The United States Army Corps of Engineers (USACE) proposes to authorize activities proposed by the Department of Water Resources (DWR) described in the Project description. Repair activities at 12 sites in Yolo, Sutter, Colusa, San Joaquin, and Sacramento counties for phase 4 and 17 levee repair sites in Yolo, Tehama, Butte, Glenn, San Joaquin, and Sacramento counties for phase 5 of the 2017 SDDR site repairs. Phase 6 site locations are not final, but are expected to include the same watersheds as sites 4 and 5, with work proposed in Deer Creek as well. The total length to be repaired for phases 4, 5, and 6 will not exceed 15,000 linear feet. A description of the general construction approach for all of the proposed repair sites is provided below. Site-specific construction, site lists, and detailed plans for each of the repair areas for Phases 4 and 5 were provided in the 2019 SDDR BA, and are adopted here by reference. The proposed Federal action conducted by the USACE is to permit proposed activities described in the Project description. Phase 6 sites are expected to be similar repair designs to those described for Phases 4 and 5, and site-specific details will be provided to NMFS prior to construction.

1.3.1 General Construction Approach

Construction activities will take place throughout the summer to fall (July 1 through October 31). Each individual site will be repaired in a single season but completion of all proposed sites for phases 4 and 5 will take up to three years (construction occurring 2020 through 2022). Phase 6 construction timing is uncertain but likely to begin in 2022 or 2023 following the completion of Phases 4 and 5. Construction activities for Phase 6 are expected to be similar as those described below for Phases 4 and 5. Each site will require approximately 2 to 4 weeks of active construction. All work will take place during daylight hours, and no nighttime lighting will be required. The maximum length of the workday will be 5 AM to 8 PM depending on available daylight. At least three sites will be repaired concurrently, with up to nine sites being repaired at the same time.

Heavy equipment and vehicles to be used during construction may include the following:

- Bobcat
- Compactors
- Water truck
- Excavator
- Barges
- Loader
- Dozer
- Dump trucks
- Pick-up trucks
- Barge crane

Typical construction activities at repair sites can be subdivided into the following stages, which are described in detail below:

1. Mobilization—site access and staging areas
2. Site preparation
3. Construction sequencing
4. Demobilization—restoration and cleanup

1.3.2 Mobilization – Site Access and Staging Area

Mobilization will take place at each levee rehabilitation site. Mobilization includes creation of temporary access roads, if needed; securing the site; and transporting equipment and materials to the site for latter repair phases (e.g., clearing and grubbing, and construction of the repair). Access to rehabilitation sites will occur primarily along existing paved public roads, levee crown roads, or unpaved private farm roads. At several sites, a barge crane may be used to transport and stockpile rock and soil to the repair site. Staging areas (approximately 0.25 to 0.5 acres in size) will be located close to the repair area and avoid sensitive habitats. The staging areas will be selected so removal of native trees or shrubs are avoided and previously disturbed areas will be preferred. For waterside repairs, staging areas will be preferentially located along the levee crown or waterside berm, where these areas are of sufficient size and free of woody vegetation. However, landside staging areas are frequently required for stockpiling materials and equipment. For landside and certain waterside repairs, staging areas may require construction easements from the landowners adjacent to the repair area. Activities that will occur within staging areas would include: storing necessary imported materials (e.g., rock, soil); parking, refueling, and servicing of construction equipment; establishing a temporary restroom; and parking construction staff transportation vehicles.

1.3.3 Site Preparation

Clearing and grubbing will be the first step in preparing each site for construction. Vegetation clearing may include the removal of submerged instream woody debris and fallen trees on the levee slope within the repair footprint. A turbidity curtain will be installed when feasible prior to any in-water work being conducted on the waterside of the levee where there is potential for listed fish within range. The repair work limits and staging areas will be fenced (orange

construction fencing) to prevent vehicles and equipment from approaching the waterside edge of the existing bank (where applicable), to protect sensitive habitat, and to identify disturbance area limits.

Where necessary, existing vegetation within the repair area will be removed during project construction except for trees or shrubs identified and marked for protection prior to construction. Box protection or other appropriate methods would be installed to protect any remaining trees from damage (see Attachment A in 2019 SDDR BA). Trees within the repair area identified for protection and outside the work limit may require trimming or removal for equipment clearance, excavation, or due to severely undermined tree health. Removal and trimming of trees will be under the guidance of a certified arborist and would only occur to the extent necessary. All tree and sensitive plant removal will be documented. The construction site will be cleared of grasses, ground cover, trash, or any other undesirable materials, using mechanized equipment (see above).

1.3.4 Construction Process, Staging, Sequencing, and Equipment

Once each site is cleared and grubbed, existing rock and levee soils disturbed by the failure and transition zones (zone between failure and existing grade/surface of levee) will be excavated, then the site will be graded to the slope specified in the design drawings (see Attachment A in 2019 SDDR BA in 2019 SDDR BA). The back slope of the levee will be shaped for stability using clean rock placement (see Attachment A in 2019 SDDR BA for types of rock and fill used at each site). All excavated material will be hauled off site.

Geotextile fabric and rock material will be placed in the excavated areas as specified in the design drawings (see Attachment A in 2019 SDDR BA). Geotextile fabric will to be used as a filter-separator layer between natural ground and rock slope protection (riprap). For example, levee slope revetment or in-water rock revetment, and soil filled rockfill above and below standing or flowing water surfaces. Geotextile fabric will also be used to separate soil filled rockfill from launch rock/rockfill. The repair area slope will be graded to provide a smooth, uniform surface. The slope will be cleared of debris or sharp objects that may tear or damage the fabric during installation. Geotextile fabric will be placed loosely upon the surface to prevent damage to the fabric when placing riprap. Geotextile fabric placed above the water surface will be covered with riprap within 72 hours of placement.

Geotextile fabric was incorporated into all erosion repair designs because it:

- Minimizes excavation into levee since bedding layer cannot be placed on steep slopes greater than 1 horizontal:1 vertical.
- Reduces the total number truck hauls that would be required to bring in sand or gravel to repair site if bedding layer was utilized.
- Placing bedding layer underwater is difficult or infeasible.
- A sand or gravel bedding layer would introduce a pervious layer that is thicker that geotextile which may create a seepage path due to the thickness required.
- Additional course bedding layer would be required as a transition to prevent migration of earthfill or soil-filled rockfill into launch rock/rockfill.

Using a long-arm bucket excavator or barge crane, the clean rock will be placed in the water at the toe of the bank up to the water elevation at time of construction. IWM, usually orchard tree stock, may be installed, if feasible, near the water surface during time of construction at 20-feet interval spacing to replace or enhance riverine aquatic habitat to the repair area (see Attachment A in 2019 SDDR BA). IWM locations were selected if levee slope was greater than a 2 horizontal:1 vertical slope and thickness of riprap was greater than 10-feet to properly embed IWM in the slope without a separate anchoring mechanism. For soil-filled rockfill, rock will be placed in 2-foot lifts, and the voids will be filled with clean soil. Willow poles (if applicable) may be placed after construction to help stabilize soil once they become established. Willows will be staggered at two different elevations at a typical spacing interval of 5-feet if placed in soil-filled rockfill and an interval of 10-feet installed if soil-fill sonotubes buried in launch rock (see Attachment A in 2019 SDDR BA). Willow locations were selected if finished slope grade was no steeper than a 1.5 horizontal: 1 vertical slope (safety concern) and waterside levee profile was wider than 15-feet (slightly overbuilt levee) to be compliant with current USACE vegetation policy. In locations with earthfill, 0.5 feet of clean topsoil will be placed above the fill covered with erosion fabric to stabilize the bank. Once bank construction is completed, all remaining disturbed soil within the repair area will be seeded with a native erosion control seed mix as per the planting specifications (see Attachment B of 2019 SDDR BA [sub attachment B1]).

1.3.5 Demobilization, Restoration, and Clean-up

Following levee rehabilitation construction, all equipment and materials will be removed from the repair area and excess materials will be disposed of at appropriate facilities. Staging areas and temporary access roads, if constructed, will be ripped to loosen the soil surface and then seeded with a native grass mix to promote revegetation and minimize soil erosion. These areas would be restored to pre-project conditions to the extent feasible. Any damage as a result of the construction, including haul route roads and fencing, would be repaired. All areas would be cleaned and cleared of rubbish and left in a safe and suitable condition.

1.3.6 Conservation Measures

In order to avoid and minimize effects of the proposed action and to provide compensation for those impacts that will occur, DWR has incorporated a number of avoidance, minimization, and conservation measures that are in the project description.

DWR proposes to minimize impacts at repair areas by implementing the following measures:

1. Designated Biologist and Biological Monitors.

    a. Designated Biologist(s). DWR proposes to submit in writing to NMFS the name, qualifications, business address, and contact information of a biologist(s) (Designated Biologist) at least 30 days before starting project activities. DWR will ensure that the Designated Biologist is knowledgeable and experienced in the biology and natural history of the covered species. The Designated Biologist will be responsible for monitoring project activities to help minimize and fully mitigate or avoid the incidental take of individual Covered Species and to minimize disturbance of covered species' habitat. DWR will obtain

NMFS, USFWS, and California Department of Fish and Wildlife (CDFW) approval of the Designated Biologist in writing before starting project activities, and will also obtain approval in advance in writing if the Designated Biologist must be changed. NMFS, USFWS, and CDFW will provide written response within 21 days of submittal.

b. Biological Monitors. The Designated Biologist may authorize Biological Monitors to assist in ESA compliance efforts, under the direct supervision of the Designated Biologist. The Designated Biologist is responsible for assuring that any Biological Monitors working under his or her direct supervision is knowledgeable and experienced in the biology and natural history of the covered species, the regulatory documents conditions of approval, the definition of "take" in FESA, and in implementation of standard avoidance and minimization measures used on construction projects in covered species' habitat. DWR proposes to provide a description of the Biological Monitor duties, for CDFW approval, prior to the start of project activities.

2. Prior to initiation of repair activities (72 hours or less), Designated Biologists will conduct a pre-construction survey to identify special status species and associated habitat. Surveys will be conducted within the project footprint, laydown area, and adjacent haul route. If required, species and/or buffers will be marked in the field by a qualified biologist using temporary fencing, high-visibility flagging, or other means that are equally effective.

3. DWR will provide environmental awareness training by a Designated Biologist to DWR construction lead, construction foreman, crew leader, and any contractor personnel working on construction sites. Environmental awareness training will include descriptions of all special-status fish and wildlife species potentially occurring in the repair area for activity-specific training, their habitats, and methods of identification, including visual aids as appropriate. The training will also describe activity-specific measures that will be followed to avoid impacts. Hard copies of environmental permits and training materials will be provided to the DWR construction lead, construction foreman, crew leader, and any contractors participating in repair work.

4. Use existing staging sites, maintenance toe roads, and levee crown roads to the extent practicable for staging and access to avoid affecting previously undisturbed areas.

5. Limit the number of access routes and the size of staging and work areas to the minimum necessary to conduct the activity.

6. Where feasible and practicable (e.g., based on the size of the repair area and repair to be performed), clearly mark work area limits (e.g., with flagging or fencing). These include access roads, staging and equipment storage areas, stockpile areas for spoil disposal, soil, and materials, fueling and concrete washout areas, and equipment exclusion zones. Work will occur only within the marked limits. This measure is intended to apply to repair

activities occurring in discrete areas as opposed to activities occurring over an extensive area where flagging work limits would be infeasible.

7. Inspect under all vehicles and heavy equipment for the presence of wildlife before the start of each workday when equipment is staged overnight. Additionally, look for wildlife in all pipes, culverts, and similar structures that have been stored on-site for one or more nights before being buried, capped, or moved.

8. All excavated, steep-walled holes or trenches will be covered with appropriate covers (thick metal sheets or plywood) at the end of each workday. Covers will be placed to ensure that trench edges are fully sealed. Alternatively, such trenches may be furnished with one or more escape ramps constructed of earth fill or wooden planks to provide escape ramps for wildlife.

9. Ensure that all project related trash items, such as wrappers, cans, bottles, and food scraps, are collected in closed containers, removed from repair sites each day, and disposed of at an appropriate off-site location to minimize attracting wildlife to work areas.
    a. DWR (or its contactor) proposes to initiate a trash abatement program before starting construction activities and will continue the program for the duration of the project activities. DWR (or contractor) will ensure that trash and food items are contained in animal-proof containers and removed at least once a week to avoid attracting opportunistic animals such as ravens, raccoons, coyotes, bears, and feral pigs. DWR (or contractor) will provide trash receptacles that are equipped with latching or locking lids.

10. Keep the clearing of vegetation to the minimum necessary; especially minimize the clearing of native riparian vegetation and native oaks, and grubbing for temporary vehicle access to the extent practicable.

11. Where feasible, avoid removal of native trees with a trunk greater than (>) 4 inches diameter at breast height (4.5 feet above the ground). Work will be done in a manner that ensures, to the extent feasible, that living native riparian vegetation within the vegetation-clearing zones is avoided and left undisturbed, where this can reasonably be accomplished without compromising repair requirements.

12. Trees within the repair area identified for protection and outside the work limit may require trimming or removal for equipment clearance, excavation, or due to severely undermined tree health. Trees that require trimming or removal will be under the guidance of a certified arborist. A qualified biologist will document all tree and sensitive plant trimming or removal.

13. If erosion control fabrics are used, products will not be used with plastic monofilament or cross-joints in the netting that are bound/stitched (such as straw wattles, fiber rolls, or erosion control blankets), which could trap giant garter snakes and other wildlife.

14. DWR will install erosion control materials that minimize soil or sediment from entering waterways and wetlands. DWR will monitor the erosion control materials for effectiveness and maintain them throughout the repairs and monitoring. DWR will immediately repair or replace any erosion control barrier that is not functioning effectively.

15. The amount of revetment and similar materials used for bank protection and other repair activities will be limited to the amount necessary to ensure proper flood protection system integrity and function.

16. Remove temporary fill, construction debris, and refuse, and properly dispose of these materials following completion of any repair activities.

17. Habitats, including sensitive natural communities, will be restored to pre-project conditions wherever feasible. Restoration could include re-contouring by grading and disking, revegetating with native seeds and plants reflective of the target plant community, decompacting soil, and installing appropriate erosion control measures to return the disturbed on-site habitat to pre-activity conditions.
18. For invasive plant species removal, DWR will implement measures to minimize the potential for invasive plants to be introduced or spread during activities. Measures to avoid contamination and spread of invasive species will be created for each site as deemed necessary by a qualified biologist and will be approved by a qualified biologist prior to implementation.

19. DWR will provide USFWS, NMFS, and/or CDFW (natural resource agencies) staff with reasonable access to all repair sites and will otherwise fully cooperate with the natural resource agencies' efforts to verify compliance with, or effectiveness of, conservation measures.

20. The Designated Biologists and Biological Monitors will be authorized to stop repair activities that, in the biologist's opinion, threaten to cause unanticipated and/or unpermitted adverse effects on special-status wildlife. If repair activities are stopped, the qualified biologist will consult with CDFW, USFWS and/or NMFS as appropriate to determine appropriate measures that DWR will implement to avoid adverse effects. Buffers, determined by the Designated Biologists and Biological Monitors in conjunction with USFWS and CDFW, will be maintained until there is no longer a threat of disturbance to the sensitive biological resource, as determined by the Designated Biologists and Biological Monitors.

21. DWR will immediately notify the Designated Biologist if a species is taken or injured by a project-related activity, or if a species is otherwise found dead or injured within the vicinity of the project. The Designated Biologist will provide initial notification to USFWS, NMFS and/or CDFW by contacting the appropriate agencies within 24 hours. The initial notification will include information regarding the location, species, and number of animals taken or injured, and site number. Following initial notification, DWR will send a written report within two calendar days. The report will include the date and

time of the finding or incident, location of the animal or carcass, and if possible provide a photograph, explanation as to cause of take or injury, and any other pertinent information.

22. After repair is completed, any temporary fill and construction debris will be removed, and temporarily disturbed areas will be restored to pre-project conditions or better conditions. Before restoration, all non-biodegradable materials will be removed. Restoration may include re-contouring disturbed areas to their original configurations.

23. No later than 45 days after completion of the repair, DWR will provide NMFS, USFWS, and CDFW with a Final Mitigation Report. The qualified biologist will prepare the Final Mitigation Report which will include, at a minimum: (1) a summary of all Weekly Compliance Reports; (2) notes showing when each of the minimization measures was implemented; (3) all available information about project-related incidental take of species; (4) information about other project impacts on the species; (5) beginning and ending dates of the repair; (6) an assessment of the effectiveness of conservation measures in minimizing and fully mitigating project impacts to species; (7) recommendations on how minimization measures might be changed to more effectively minimize effects and mitigate the impacts of future project on the species; and (8) any other pertinent information.

24. The Biological Monitors will be responsible for maintaining daily records of compliance-related activities, and for communicating to NMFS, USFWS, and CDFW when any aspect of the project is out of compliance.

Special-Status Fish Specific Measures

If conducting repair activities that could impact special-status fish or habitat, DWR will implement the following minimization measures:

1. Areas of suitable habitat should be surveyed, avoided (whenever possible), or mitigated when avoidance is not possible.

2. In-water work should occur during standard in-water work windows:
    a. Delta and Longfin smelt: August through November
    b. Salmon and steelhead: July through October

3. In areas where rock is placed to provide slope protection, place clean soil to fill voids, which could potentially provide favorable habitat for nonnative predatory fish species, as feasible.

4. Install willow pole cuttings beyond vegetation free zone (USACE Engineering Technical Letter, 2014), where possible, to provide aquatic cover and shade, and habitat complexity favorable for native fish species at feasible locations (see Table 3-2 of SDDR 2019 BA).

Sensitive Habitats Measures

See Table 1 below (from the 2019 SDDR BA) for detailed site-specific Sensitive Habitat conservation measures.

1. Prior to initiation of repair activities, a Designated Biologist will identify potential riparian habitat, wetlands, shallow water habitat, SRA cover, and native oak trees. Where feasible, DWR will mark the boundaries of these areas using temporary fencing, high-visibility flagging, or other means that are equally effective in clearly delineating the boundaries. When feasible, repair activities will be excluded from these areas. In many situations, equipment can be operated to avoid disturbing isolated riparian trees or low-height riparian scrub habitat.

2. Trees that are designated to be protected in place will be protected using box or tree wrap protection or other techniques as chosen by the Designated Biologist.

Table 1. Riparian, Shaded Riverine Aquatic Conservation Measures from Revised November 2019 SDDR BA Supplemental Information (provided by Kip Young)

Repair Area Site Number	Listed Fish Presence/ Potential for SRA Effects	Willow Poles Installed	Instream Woody Material Installed	No. of Trees/ Shrubs Protected	Tree/Shrub Species Protected
42	N/A	N/A	N/A	No Trees Impacted	--
44	Yes	30	4	4	valley oak, white alder, black walnut
46	Yes	90	11	17	oaks and sycamores
47	Yes	101	12	30	oaks, sycamores, white alder
48	Yes	127	15	1	cork oak
49	Yes	--	--	3	oaks, walnut, elderberry
50	Yes	--	--	5	valley oak, elderberry, Oregon ash
51	Yes	--	--	4	3 valley oaks, 1 elderberry
52	Yes	--	--	1	elderberry
53	Yes	--	--	0	--
54	N/A	N/A	N/A	No Trees Impacted	--
55	Yes	238	31	0	--
58	Yes	161	--	3	silver maple, live oak, palm
59	N/A	N/A	N/A	No Trees Impacted	--
60	Yes	50	--	No Trees Impacted	--
61	Yes	402	50	55	oaks and sycamores
62	Yes	--	--	0	--
63-67	Yes	136	30	30	oaks and sycamores
69	Yes	--	--	1	1 Oregon ash
70	Yes	--	--	2	2 Oregon ash
71	Yes	--	--	3	2 valley oaks, 1 cottonwood
72	Yes	77	9	1	valley oak
73	Yes	--	--	1	valley oak
74, 75	Yes	--	--	No Trees Impacted	--
76	Yes	--	--	No Trees Impacted	--
77	Yes	--	--	0	--
79	Yes	129	--	6	valley oak and white alder

Water Quality Measures

To reduce the potential release of water quality pollutants to receiving waters, DWR will implement appropriate Best Management Practices (BMPs) and stay in compliance with applicable permits. BMPs may include the following measures:

1. Conduct environmental awareness training to train the contractor on the proper use of BMPs and applicable permit requirements to protect receiving water quality.

2. DWR will install erosion control materials, such as straw bales, silt fences, fiber rolls, or equally effective measures, at repair areas adjacent to stream channels, drainage canals, and wetlands, as needed. Erosion control measures will be monitored during and after each storm event for effectiveness. Modifications, repairs, and improvements to erosion control measures will be made as needed to protect water quality.
    a. No erosion control products will be used with plastic monofilament or cross-joints in the netting that are bound/stitched (such as straw wattles, fiber rolls, or erosion control blankets).

3. Install turbidity curtains or similar methods during in channel work to control silt and sediment, where needed.

4. DWR will minimize ground and vegetation disturbance by establishing designated equipment staging areas, access routes, spoils and soil stockpile areas, and equipment exclusion zones prior to the commencement of activity.

5. DWR will prepare and implement hazardous materials management and spill response plan. DWR will ensure any hazardous materials are stored at the staging areas and with an impermeable membrane between the ground and hazardous material and that it is bermed to prevent the discharge of pollutants to groundwater and runoff water. DWR will immediately stop and, pursuant to pertinent state and Federal statutes and regulations, arrange for repair and clean up by qualified individuals of any fuel or hazardous waste leaks or spills at the time of occurrence, or as soon as it is safe to do so, according to the spill response plan. DWR will notify NMFS, USFWS, and CDFW within 24 hours of any leaks or spills. DWR will properly contain and dispose of any unused or leftover hazardous products off-site. DWR will use and store hazardous materials, such as vehicle fuels and lubricants, in designated staging areas located away from stream channels and wetlands according to local, state, and Federal regulations, as applicable.

6. Construction vehicles and equipment will be checked daily for leaks and will be properly maintained to prevent contamination of soil or water from leaking hydraulic fluid, fuel, oil, and grease.

Mitigation/Compensation for Adverse Effects

See Table 2 below for site-specific mitigation rations. If impacts to riparian habitat (and/or SRA habitat) cannot be feasibly avoided, DWR proposes to implement the following measure:

Secure native riparian (and SRA) habitat credits or acres at a mitigation bank approved by CDFW (and NMFS for SRA) for impacts to native riparian habitat on streams within the project area that support special-status species. The credit purchase will be at a 3:1 ratio of the total acreage of habitat types affected at each site below the ordinary high water mark (OHWM) and a 2:1 ratio for affected habitat above the OHWM. For those Phase 4 and 5 sites where habitat loss below the OHWM will be partially compensated for through the installation of willow poles and instream woody material (see Table 2 below), the credit purchase ratio will be 2:1. Phase 6 mitigation ratios would be consistent with how Phases 4 and 5 were determined, using the

guidance set out in Table 5 and would be presented to NMFS for final approval with the site description prior to construction of any Phase 6 sites.

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

Table 2. Project Effects of Phases 4 and 5, to Listed Fish Species and Proposed Compensatory Mitigation (from email revisions provided by Kip Young November 2019)

Phase	Site	SRA (acres) or Critical Habitat Below OHWM	SRA (acres) or Critical Below OHWM	SRA (acres) or Critical Below OHWM	Riparian/SRA (acres) Above OHWM	Riparian/SRA (acres) Above OHWM	Riparian/SRA (acres) Above OHWM
-	-	Impacts	Mitigation Ratio	Mitigation	Impacts	Mitigation Ratio	Mitigation
4	42	-	-	-	-	-	-
4	44	0.02	2:1	0.04	0.03	2:1	0.06
4	46	0.11	2:1	0.22	0.09	2:1	0.18
4	47	0.2	2:1	0.4	0.16	2:1	0.32
4	48	0.04	2:1	0.08	-	-	-
4	49	0.08	3:1	0.24	0.06	2:1	0.12
4	50	0.1	3:1	0.3	0.07	2:1	0.14
4	51	0.03	3:1	0.09	0.03	2:1	0.06
4	52	0.03	3:1	0.09	0.02	2:1	0.04
4	53	0.01	3:1	0.03	0.01	2:1	0.02
4	54	-	-	-	-	-	-
4	55	0.02	2:1	0.04	0.1	2:1	0.2
5	58	0.02	2:1	0.04	-	-	-
5	59	-	-	-	-	-	-
5	60	0.02	1:1	0.02	-	-	-
5	61	0.3	2:1	0.6	0.75	2:1	1.5
5	62	0.03	1:1	0.03	-	-	-
5	63	0.13	2:1	0.26	0.22	2:1	0.44
5	65	0.09	2:1	0.18	0.15	2:1	0.3
5	67	0.09	2:1	0.18	0.12	2:1	0.24
5	69	0.01	2:1	0.02	-	-	-
5	70	0.01	1:1	0.01	-	-	-
5	71	0.03	1:1	0.03	-	-	-
5	72	0.01	3:1	0.03	0.04	3:1	1.2
5	73	0.06	1:1	0.6	-	-	-
5	74	0.08	1:1	0.8	-	-	-
5	76	0.12	1:1	0.12	-	-	-
5	77	0.002	3:1	0.006	-	-	-
5	79	0.01	2:1	0.02	0.02	2:1	0.04
-	Totals	1.652	-	4.476	1.87	-	4.86

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 provides an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This 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 CFR402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species. The Action Area overlaps with area utilized by the CV spring-run, CCV steelhead, SR winter-run, and sDPS green sturgeon. Many of the factors affecting these species throughout their range are discussed in the Status of the Species section of this opinion and are considered the same in the Action Area.

This 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).

NMFS has evaluated the proposed action for this consultation as a "mixed programmatic" action as defined by 50 CFR 402.02 because it includes some action components for which no additional authorization will be necessary and others that are considered at a framework-level. Components that require no additional authorization are analyzed in this Opinion and exemptions from take prohibitions provided in the incidental take statement of this Opinion. Action components that are considered at a framework-level are also analyzed in this Opinion, but with a broader scale of examination of the components' potential impacts on listed species and critical habitat. Exemption from take prohibitions are not provided for these components in the incidental take statement of this Opinion. Once framework-level action components are further developed and provide sufficient detail for take determination, they will require additional ESA section 7 consultation before implementation; this subsequent consultation will include an incidental take statement for those components.

For components of the proposed action that lacked the specificity in description required to analyze a particular effect in detail, NMFS took a reasonably conservative approach to analyzing the range of effects that could result. This approach, paired with NMFS' identification of

framework-level action components and the inclusion of additional analytical methods not used in the BA, could result in NMFS drawing different conclusions from our analysis than the action agency's conclusions in the biological assessment. We identify the lines of evidence to support NMFS' conclusions in the Effects Analyses and Integration and Synthesis sections of this Opinion.

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 opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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

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

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and

recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that value for the conservation of the species. See Table 3 below for descriptions of species and current ESA listing classifications for species within the Action Area. Table 4 includes updated information regarding the critical habitat of the species listed in Table 3.

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
Sacramento River winter-run Chinook salmon ESU	Endangered, 70 FR 37160; June 28, 2005	According to the NMFS 5-year species status review (NMFS 2016c), the status of the winter-run Chinook salmon ESU, the extinction risk has increased from moderate risk to high risk of extinction since the 2007 and 2010 assessments. Based on the Lindley *et al.* (2007) criteria, the population is at high extinction risk in 2019. High extinction risk for the population was triggered by the hatchery influence criterion, with a mean of 66 percent hatchery origin spawners from 2016 through 2018. Several listing factors have contributed to the recent decline, including drought, poor ocean conditions, and hatchery influence. Thus, large-scale fish passage and habitat restoration actions are necessary for improving the winter-run Chinook salmon ESU viability.
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

Species	Listing Classification and Federal Register Notice	Status Summary
		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 extinction. Most natural-origin CCV populations are very small, are not monitored, and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to natural-origin fish. The life-history diversity of the DPS is mostly unknown, as very few studies have been published on traits such as age structure, size at age, or growth rates in CCV steelhead.
Southern distinct population segment 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 2018b), 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).

Table 4. Description of critical habitat, Listing, and Status Summary.

Critical Habitat	Designation Date and Federal Register Notice	Description
Sacramento River winter-run (SR winter-run) critical habitat	June 16, 1993; 58 FR 33212	Designated critical habitat includes the Sacramento River from Keswick Dam (river mile (RM) 302) to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta (Delta); all waters from Chipps Island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and the Carquinez Strait; all waters of San Pablo Bay westward of the Carquinez Bridge; and all waters of San Francisco Bay north of the San Francisco-Oakland Bay Bridge from San Pablo Bay to the Golden Gate Bridge. The designation includes the river water, river bottom and adjacent riparian zones used by fry and juveniles for rearing. PBFs considered essential to the conservation of the species include: Access from the Pacific Ocean to spawning areas; availability of clean gravel for spawning substrate; adequate river flows for successful spawning, Incubation of eggs, fry development and emergence, and downstream transport of juveniles; water temperatures at 5.8–14.1°C (42.5–57.5°F) for successful spawning, egg incubation, and fry development; riparian and floodplain habitat that provides for successful juvenile development and survival; and access to downstream areas so that juveniles can migrate from spawning grounds to the San Francisco Bay and the Pacific Ocean. Currently, many of the PBFs of SR winter-run critical habitat are degraded and provide limited high quality habitat. Although the current conditions of SR winter-run critical habitat are significantly limited and degraded, the spawning habitat, migratory corridors, and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species.

Critical Habitat	Designation Date and Federal Register Notice	Description
Central Valley spring-run Chinook salmon (CV spring-run) critical habitat	September 2, 2005; 70 FR 52488	Critical habitat for CV spring-run Chinook salmon 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. Currently, many of the PBFs of CV spring-run critical habitat are degraded, and provide limited high quality habitat. Although the current conditions of CV spring-run critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species.

Critical Habitat	Designation Date and Federal Register Notice	Description
California Central Valley steelhead (CCV steelhead) critical habitat	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. Many of the PBFs of CCV steelhead critical habitat are currently degraded and provide limited high quality habitat. Although the current conditions of CCV steelhead critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain in the Sacramento/San Joaquin River watersheds and the Delta are considered to have high intrinsic value for the conservation of the species as they are critical to ongoing recovery effort.

Critical Habitat	Designation Date and Federal Register Notice	Description
Southern distinct population segment of North American green sturgeon (sDPS green sturgeon) critical habitat	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. 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 also 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. Currently, many of the PBFs of sDPS green sturgeon are degraded and provide limited high quality habitat. Although the current conditions of green sturgeon critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain in both the Sacramento/San Joaquin River watersheds, the Delta, and nearshore coastal areas are considered to have high intrinsic value for the conservation of the species.

2.2.1 Recovery Plans

In July 2014, NMFS released a final Recovery Plan for SR winter-run, CV spring-run, and CCV steelhead (NMFS 2014, Recovery Plan). The Recovery Plan outlines actions to restore habitat, access, and improve water quality and quantity conditions in the Sacramento River to promote the recovery of listed salmonids. Key actions for the Recovery Plan include conducting landscape-scale restoration throughout the Delta, incorporating ecosystem restoration into Central Valley flood control plans that includes breaching and setting back levees for juveniles to access floodplains, and restoring flows throughout the Sacramento and San Joaquin River basins and the Delta.

In August 2018, NMFS released a final Recovery Plan for the sDPS green sturgeon (NMFS 2018), which focuses on fish screening and passage projects, floodplain and river restoration, and riparian habitat protection in the Sacramento River Basin, the Delta, San Francisco Estuary, and nearshore coastal marine environment as strategies for recovery.

2.2.2 Global Climate Change

One major factor affecting the rangewide status of the threatened and endangered anadromous fish in the Central Valley (CV) 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, Miller et al. 2000); Central California has shown trends toward warmer winters since the 1940s (Dettinger and Cayan 1995). Projected warming is expected to affect CV 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 CV Chinook salmon populations can persist (Williams 2006).

SR winter-run embryonic and larval life stages that are most vulnerable to warmer water temperatures occur during the summer, which makes the species particularly at risk from climate warming. The only remaining population of SR winter-run depends on the cold-water pool in Shasta Reservoir, which buffers the effects of warm temperatures in most years. The exception occurs during drought years, which are predicted to occur more often with climate change (Yates *et al.* 2008). The long-term projection of how the Central Valley Project (CVP) and State Water Project (SWP) will operate incorporates the effects of climate change in three possible forms: less total precipitation; a shift to more precipitation in the form of rain rather than snow; or, earlier spring snow melt (Reclamation (U.S. Bureau of Reclamation and ESSA Technologies Ltd 2008) 2008). Additionally, air temperature appears to be increasing at a greater rate than what was previously analyzed (Lindley 2008, Beechie *et al.* 2012, Dimacali 2013). These factors will compromise the quantity and/or quality of SR winter-run habitat available downstream of Keswick Dam. It is imperative for additional populations of SR winter-run to be re-established into historical habitat in Battle Creek and above Shasta Dam for long-term viability of the ESU (NMFS 2014).

CV spring-run adults are vulnerable to climate change because they over summer in freshwater streams before spawning in autumn (Thompson *et al.* 2011). CV spring-run spawn primarily in the tributaries to the Sacramento River and those tributaries without cold-water refugia (usually input from springs) will be more susceptible to impacts of climate change.

CCV steelhead will experience similar effects of climate change to Chinook salmon, as they are also blocked from the vast majority of their historic spawning and rearing habitat, the effects may be even greater in some cases, as juvenile CCV steelhead need to rear in the stream for one to two summers prior to emigrating as smolts. In the Central Valley, summer and fall temperatures below the dams in many streams already exceed the recommended temperatures for optimal growth of juvenile CCV steelhead, which range from 14°C to 19°C (57°F to 66°F).

water temperature is warmer than at the ACID Dam during late spring and summer. Thus, if water temperatures increase with climate change, temperatures adjacent to the ACID Dam 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 these listed 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 the uncertainty associated with these projections increases over time, the direction of climate change is relatively certain (McClure 2011).

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). As the proposed action covers a large geographical area, some work sites will have their own discrete discontiguous action areas, while other sites may be shared or combined, depending on proximity and nature of short- and long-term effects. The proposed action for phase 4 includes 12 repair areas in Colusa, Glenn, Sacramento, San Joaquin, Sutter, and Yolo counties (Figure 1). Phase 5 includes a total of 17 repair areas in Butte, Sacramento, San Joaquin, Tehama, and Yolo counties (Figure 2). The Action Area for each site includes the immediate work and surrounding areas, including the downstream portion of waterways for each of the proposed repair areas (see Attachment B of 2019 SDDR Biological Assessment). NMFS includes in the Action Area the portions of the waterways where effects occur from the action including upstream and downstream areas with turbidity increases caused by construction activities. Phase 6 sites are likely going to fall within the same Action Area as Phases 4 and 5 as described above, but will be provided in the final site description provided prior to construction.

Because the proposed action includes the purchase of mitigation credits from a conservation bank, the action area also includes the areas affected by the two mitigation banks that have service areas relevant to the project. These include the Fremont Landing Conservation Bank, which is a 100-acre floodplain site along the Sacramento River (Sacramento River Mile 106) and Bullock Bend Mitigation Bank, a 119.65-acre floodplain site along the Sacramento River at the confluence of the Feather River (Sacramento River Mile 80).

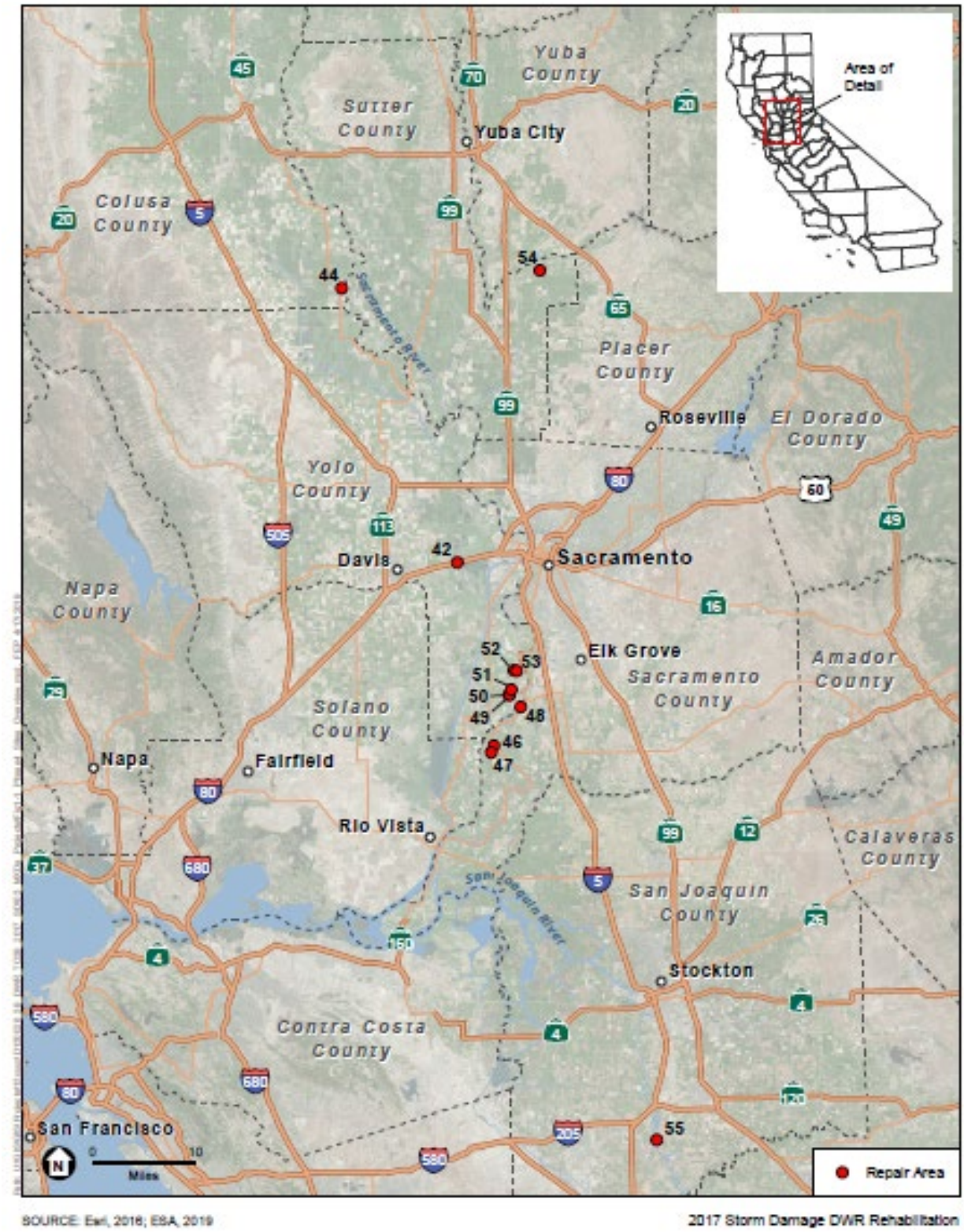

Figure 1. Phase 4 sites (from 2019 SDDR BA).

Figure 2. Phase 5 sites (from 2019 SDDR BA).

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).

The SDDR is occurring in the Sacramento River, San Joaquin River, Butte Creek, and other bypasses and sloughs in the Sacramento-San Joaquin Delta watershed, most of which serve as rearing habitat and migratory corridors for listed SR winter-run Chinook salmon, CV spring-run, CCV steelhead, and sDPS green sturgeon. As mentioned above, much of the Sacramento River and San Joaquin River watersheds has been substantially altered from human activities, and this has dramatically reduced the habitat value of the watershed for listed fish species. However, despite the impaired status of the watersheds in the proposed Action Area, the value of the habitat for the conservation of the listed fish species is high, as it provides PBFs of critical habitat to support several life stages.

2.4.1 Sacramento River and San Joaquin River Watersheds

The segments of the Sacramento River located within the Action Area are heavily channelized and leveed. The river is bordered by agricultural land, the City of Sacramento, and surrounding urban and rural areas. The lower segment of the Sacramento River is characterized primarily by slow-water glides and pools, is depositional in nature, and has lower water clarity and habitat diversity relative to the upper portion of the river. Over 30 fish species are known to occur within the Sacramento River. Many of these are anadromous, including both native and non-native species. Anadromous fish species include Chinook salmon (SR winter-run, CV spring-run, fall-run, and late fall-run Chinook salmon), CCV steelhead, sDPS green sturgeon, white sturgeon, Pacific lamprey, river lamprey, American shad, and striped bass. Downstream from the City of Red Bluff, the Sacramento River provides a migration corridor and rearing habitat for salmonids and green sturgeon as well as spawning and rearing habitat for a variety of other native fish species such as Sacramento splittail and Sacramento pikeminnow. The lower Sacramento River and the associated sloughs are an important migratory corridor for SR winter-run, CV spring-run, CCV steelhead, and sDPS green sturgeon, and contain PBFs that support the rearing and growth of juveniles and the successful upstream migration of adults.

Much like the Sacramento River watershed, the transformation of the San Joaquin River from a meandering waterway lined with a dense riparian corridor, to a highly leveed system under varying degrees of control over riverine erosional processes resulted in homogenization of the river, including effects to the river's sinuosity (USFWS 2000).
Prior to the construction of dams, there were distinct differences in the natural seasonal flow patterns between the northern Sacramento River watershed and the southern San Joaquin River

watershed. Furthermore, the natural unimpaired runoff in the Central Valley watersheds historically showed substantial seasonal and inter-annual variability. Watersheds below 5,000 feet in elevation followed a hydrograph dominated by rainfall events with peak flows occurring in late fall or early winter (northern Sierra Nevada, Cascade Range, and most of the western coastal mountains). Conversely, those watersheds with catchment areas above 5,000 feet, such as the Central and Southern Sierras, had hydrographs dominated by the spring snowmelt runoff period and had their highest flows in the late spring and early summer period. Since the construction of the more than 600 dams in the mountains surrounding the Central Valley, the variability in seasonal and inter-annual runoff has been substantially reduced and the peak flows muted, except in exceptional runoff years. Currently, average winter and spring flows are typically reduced compared to natural conditions, while summer/fall flows have been artificially increased by reservoir releases.

Most of the large structures in the basin-wide flood control system and other human developments were constructed prior to the ESA. The current system evolved from private efforts begun in 1850 into the joint Federal-State Sacramento River Flood Control Project (SRFCP), which was essentially completed in 1960. Because the SRFCP removed large acreages of riparian floodplain and overflow basins from the river system, it had major effect on regeneration of riparian woodland communities, recruitment of large woody debris to the river system, spawning and rearing of fish in floodplain and floodplain functions, and allochthonous inputs of nutrients and food to the aquatic system. It eliminated the possibility of natural channel migration and habitat renewal over a considerable portion of the river system. Reaches throughout the Action Area historically provided both shallow and deeper water habitat. However, channel confining levees and upstream reservoirs that maintain year-round outflow have eliminated much of the adjacent shallow water floodplain habitat. Many native fish species are adapted to rear in flooded, shallow water areas that provide abundant cover from prey. As a consequence of habitat alterations, and introduction of non-native species and pollutants, some native fish species are now extinct while most others are reduced in numbers (Moyle 2002).

2.4.2 Sacramento-San Joaquin Delta

The magnitude and duration of peak flows during the winter and spring, which affects listed salmonids and sturgeon in the Action Area, are reduced by water impoundment in upstream reservoirs. As described in above sections, these actions reduce or eliminate the scouring flows necessary to mobilize sediments and create natural riverine morphological features within the Action Area. The unimpeded river flow is severely reduced by the combined storage capacity of the different reservoirs located throughout the watersheds. Very little of the natural hydrologic input is allowed to flow through the reservoirs to the valley floor sections of the tributaries leading to the Delta. Most is either stored or diverted for anthropogenic uses. Elevated flows on the valley floor are typically only seen in wet years or flood conditions, when the storage capacities of the numerous reservoirs are unable to contain all of the inflow from the watersheds above the reservoirs.

High water temperatures also limit habitat availability for listed fish in the lower portions of the tributaries feeding into the Delta. High summer water temperatures in the lower portions of the

rivers frequently exceed 72ºF (CDEC database), and create a thermal barrier to the migration of adult and juvenile salmonids.

2.4.3 Status of the Species in the Action Area

2.4.3.1 Status of Central Valley Spring-run Chinook salmon in the Action Area

CVP and SWP salvage records and the northern and central Delta fish monitoring data indicate that juvenile spring-run Chinook salmon first begin to appear in the Action Area in December and January (USFWS 2000-2016), but that a significant presence does not occur until March and peaks in April. By May, the salvage of juvenile CV spring-run declines sharply and essentially ends by the end of June. The data from the northern and central Delta fish monitoring programs indicate that a small proportion of the annual juvenile spring-run emigration occurs in January and is considered to be mainly composed of older yearling spring-run juveniles based on their size at date. Adult spring-run Chinook salmon are expected to start entering the Action Area in approximately January. Low levels of adult migration are expected through early March. The peak of adult spring-run Chinook salmon movement through the Action Area is expected to occur between April and June with adults continuing to enter the system through the summer. Currently, all known populations of CV spring-run inhabit the Sacramento River watershed.

Within the Action Area, there are "Core 1," "Core 2," and "Core 3" populations of CV spring-run, as designated by NMFS's Recovery Plan for the species (NMFS 2014). Core 1 watersheds possess the known ability or potential to support a viable population. Core 2 populations meet, or have the potential to meet, the biological recovery standard for moderate risk of extinction set out in the Recovery Plan. Core 3 watersheds have populations that are present on an intermittent basis and require straying from other nearby populations for their existence. These populations likely do not have the potential to meet the abundance criteria for moderate risk of extinction. Core 3 watersheds are important because, like Core 2 watersheds, they support populations that provide increased life history diversity to the ESU and are likely to buffer against local catastrophic occurrences that could affect other nearby populations. Dispersal connectivity between populations and genetic diversity may be enhanced by working to recover smaller Core 3 populations that serve as stepping stones for dispersal.

In the Sacramento River and tributaries, there is juvenile rearing and migration habitat present within the Action Area. All site repairs are downstream of known spawning habitat. The mainstem Sacramento and Delta locations for repairs are all rearing habitat and migratory corridors for spring run juveniles (NMFS 2014). Adults may move through the Action Area on the way to their summer holding habitat in February through July. Juveniles may be present in the Action Area as early as October in the tributaries, with the low potential to be present year-round closer to the Delta.

Historically, CV spring-run spawned in the San Joaquin River from about the present day location of Friant Dam to as far upstream as Mammoth Pool (RM 322) (McBain and Trush 2002). During the late 1930s and early 1940s, as Friant Dam was being constructed, large runs continued to return to the river. After the dam was completed and the reservoir was filling, runs of 30,000 to 50,000 fish continued to return and spawn in the river downstream of Friant Dam.

These runs were completely gone by 1950, as diversions from Friant Dam resulted in the river being dry for extended sections starting at Gravelly Ford and below Sack Dam (McBain and Trush 2002).

The San Joaquin River Restoration Program started releasing juvenile CV spring-run into the San Joaquin River in 2014. Adult spring-run were first discovered returning to the San Joaquin River in 2019. They are not anticipated to be present in the Action Area as they will be transported upstream prior to proposed activities occurring. Juveniles may be traveling through the Action Area and utilizing the area as rearing habitat and a migratory corridor.

Critical habitat for CV spring-run is designated in the Sacramento River and tributaries. The PBFs include freshwater rearing habitat and freshwater migration corridors. Although the current conditions of CV spring-run critical habitat in the Sacramento River and tributaries are limited and degraded, the habitat remaining is considered highly valuable.

2.4.3.2 Status of California Central Valley Steelhead in the Action Area

The CCV steelhead DPS final listing determination was published on January 5, 2006 (71 FR 834) and included all naturally spawned populations of steelhead (and their progeny) downstream of natural and manmade barriers in the Sacramento and San Joaquin rivers and their tributaries. There is no known spawning habitat present within the Action Area. There is rearing and migration habitat present in the Action Area. Juveniles use rearing and migration habitat year-round in the mainstem Sacramento River, San Joaquin River, and tributaries. Juveniles and smolts are most likely to be present in the Action Area during their outmigration, which begins in November, peaks in February and March, and ends in June.

Adult CCV steelhead will have to migrate through the Action Area in order to reach their spawning grounds and to return to the ocean following spawning. Likewise, CCV steelhead smolts and kelts will also have to pass through the Action Area during their emigration to the ocean. The waterways in the Action Area also are expected to provide some rearing benefit to emigrating steelhead smolts. The CCV steelhead DPS occurs in both the Sacramento River and the San Joaquin River watersheds. However, the spawning population of fish is much greater in the Sacramento River watershed and accounts for the majority of the DPS' population.

Within the Action Area, there are "Core 1," "Core 2," and "Core 3" populations of steelhead, as designated by NMFS's Recovery Plan for the species (NMFS 2014).

Historic abundance of CCV steelhead in the Action Areas within the San Joaquin River are difficult to determine, but CCV steelhead were widely distributed, with abundance estimates of 1 to 2 million adults annually, throughout the Central Valley system as a whole (McEwan 2001). Steelhead have been captured in the three main tributaries of the San Joaquin River: the Stanislaus, Tuolumne, and Merced rivers.

Critical habitat for CCV steelhead DPS is designated in the Sacramento River, San Joaquin River, and tributaries. The PBFs in the Action Area include freshwater rearing habitat and freshwater migration corridors. Although the current conditions of CCV steelhead DPS critical

habitat in the Sacramento River and tributaries are limited and degraded, the habitat remaining is considered highly valuable.

2.4.3.3 Status of Sacramento River Winter-run Chinook Salmon

Of the four anadromous fish species addressed in this BO, the Sacramento River winter-run Chinook ESU faces the greatest risk of extinction. This is due to a severe reduction in historical spawning habitat in the Sacramento River watershed. Listed as federally endangered, winter-run Chinook geographical distribution is confined to the mainstem Sacramento River, extending as far north as Keswick Dam. Spawning occurs below Keswick Dam and the mainstem Sacramento River serves as a migratory corridor. The temporal occurrence of SR winter-run Chinook salmon smolts and juveniles within the Action Area are determined by a combination of the salvage records of the CVP and SWP fish collection facilities and the fish monitoring programs conducted throughout the Delta. Based on salvage records at the CVP and SWP fish collection facilities, juvenile SR winter-run are expected in the Action Area November through April (NMFS 2014). Juvenile winter-run utilize rearing habitat year-round and can be present in many non-natal tributaries of the Sacramento River. Adult winter-run Chinook salmon are expected to enter the Action Areas starting in January, with the majority of adults passing through between February and April. The majority of winter-run juveniles will enter the Action Area during February through June. Juveniles are expected to be present in the Delta sites primarily November through April. Presence of SR winter-run is only within the Sacramento River mainstem and Delta Action Areas, with no presence documented within the San Joaquin River areas or Butte Creek.

The Action Areas contain SR winter-run from the Basalt and Porous Lava Diversity group (*i.e.*, mainstem Sacramento River below Keswick Dam). Within the Action Area, the one remaining population of SR winter-run Chinook salmon occur. Any construction activities within their habitat could result in adverse impacts to the species.

Critical habitat for SR winter-run is designated in the Sacramento River. The PBFs include freshwater rearing habitat and freshwater migration corridors. Although the current conditions of SR winter-run critical habitat in the Sacramento River are significantly limited and degraded, the habitat remaining is considered highly valuable.

2.4.3.4 Status of Southern DPS of North American Green Sturgeon

Adult sDPS green sturgeon may occur in the Action Area from February through April, with some adults migrating up the nearby Sacramento River as late as July (Heublein et al. 2009). During flood flows in the Sacramento River system, upstream migrating adult sDPS green sturgeon are attracted by the high flows in the Yolo and Sutter bypasses. Adults that move into the Yolo Bypass can eventually concentrate behind the Fremont weir, where the fish are blocked from further upstream migration. DWR recently completed the Fremont Weir Adult Fish Passage Modification Project which allows some adult sturgeon and salmonids to volitionally enter the Sacramento River from the Yolo Bypass after an over topping event, but because the Fremont Weir is not graded to drain into the new fish passage, some fish will remain stranded behind the weir. Agency biologists will continue to conduct rescues when fish become stranded behind the

weirs (CDFW 2011). Recurring stranding events might have significant population-level impacts on sDPS green sturgeon (Thomas et al. 2013). Adult sDPS green sturgeon have also been observed and rescued in Tule Pond following overtopping events at the Fremont Weir (CDFW 2016). These stranded fish may have attempted to migrate upstream on the tail end of an overtopping event at the Fremont Weir, or they successfully made it to the Fremont Weir but were unable to ascend the weir and retreated to Tule Pond.

Although sDPS green sturgeon have been stranded and rescued in the Yolo Bypass after overtopping events at the Fremont Weir, adult green sturgeon have never been observed in the fyke trap operations in the Toe Drain of the Yolo Bypass (Reclamation and DWR 2017). Juvenile sDPS green sturgeon have been caught in the Sacramento River from May through August (NMFS 2018), and juveniles may also be present in the Yolo Bypass from May through August (CDFG 2002).

The Yolo Bypass and the Sacramento River are designated critical habitat for sDPS green sturgeon. PBFs for sDPS green sturgeon within freshwater riverine systems include food resources, substrate type/size, flow, water quality, migration corridors free of passage impediments, depth (holding pools), and sediment quality. NMFS recognizes that when inundated with Sacramento River flood flows, Yolo Bypass is an important rearing habitat for juvenile sDPS green sturgeon. PBFs for critical habitat in the Action Area have been severely impaired and degraded.

2.4.4 Factors Affecting the Species in the Action Area

As many of the factors affecting these species throughout their range are discussed in the Status of the Species section, this section will focus on the specific factors in the Action Area that are most relevant to the proposed project.

The magnitude and duration of peak flows during the winter and spring are reduced by water impoundment in upstream reservoirs affecting listed salmonids in the Action Area. Instream flows during the summer and early fall months have increased over historic levels for deliveries of municipal and agricultural water supplies. Overall, water management now reduces natural variability by creating more uniform flows year-round. Current flood control practices upstream require peak flood discharges to be held back and released over a period of weeks to avoid overwhelming the flood control structures downstream of the reservoirs (i.e. levees and bypasses). Consequently, managed flows in the mainstem of the rivers often truncate the peak of the flood hydrograph and extend the reservoir releases over a protracted period. These actions reduce or eliminate the scouring flows necessary to mobilize gravel and clean sediment from the spawning reaches of the river channel, and disrupt natural sediment transfer in general. In addition, water diversions at the dams (i.e. Friant, Goodwin, La Grange, Folsom, Nimbus, and other dams) for agricultural and municipal purposes have reduced in-river flows below the dams. These reduced flows frequently result in increased temperatures during the critical summer months, which potentially limit the survival of juvenile salmonids (Reynolds et al. 1993, Brandes and McLain. 2001) in these tail water sections.

Levee construction and bank protection have affected habitat availability and the processes that develop and maintain preferred habitat by reducing floodplain connectivity, changing riverbank substrate size, and decreasing riparian habitat and SRA habitat. Such bank protection generally results in two levels of impacts to the environment: (1) site-level impacts which affect the basic physical habitat structure at individual bank protection sites; and (2) reach-level impacts which are the cumulative impacts to ecosystem functions and processes that accrue from multiple bank protection sites within a given river reach (USFWS 2000). Armored embankments result in loss of sinuosity and braiding and reduce the amount of aquatic habitat. Impacts at the reach level result primarily from halting erosion and controlling riparian vegetation. Reach-level impacts which cause significant impacts to fish are reductions in new habitats of various kinds, changes to sediment and organic material storage and transport, reductions of lower food-chain production, and reduction in IWM.

The use of rock armoring limits recruitment of IWM (i.e., from non-riprapped areas), and greatly reduces, if not eliminates, the retention of IWM once it enters the river channel. Riprapping creates a relatively clean, smooth surface, which diminishes the ability of IWM to become securely snagged and anchored by sediment. IWM tends to become only temporarily snagged along riprap, and generally moves downstream with subsequent high flows. Habitat value and ecological functioning aspects are thus greatly reduced, because wood needs to remain in place for extended periods to generate maximum values to fish and wildlife (USFWS 2000). Recruitment of IWM is limited to any eventual, long-term tree mortality and whatever abrasion and breakage may occur during high flows (USFWS 2000). Juvenile salmonids are likely being impacted by reductions, fragmentation, and general lack of connectedness of remaining near shore refuge areas.

Point and non-point sources of pollution resulting from agricultural discharge and urban and industrial development occur upstream of and within the Action Area. The effects of these impacts are discussed in detail in the Status of the Species section. Environmental stressors as a result of low water quality can lower reproductive success and may account for low productivity rates in fish (e.g. green sturgeon, Klimley 2015). Organic contaminants from agricultural drain water, urban and agricultural runoff from storm events, and high trace element (i.e. heavy metals) concentrations may deleteriously affect early life-stage survival of fish in the San Joaquin River (USFWS 1995b).

2.4.5 Conservation Banks

Conservation banks present a unique factual situation, and this warrants a particular approach as to how they are addressed. Specifically, 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 of the "environmental baseline" might suggest that the overall ecological benefits of the conservation bank actions therefore belong in the baseline. However, under this interpretation, all proposed actions, whether or not they included proposed credit purchases, would benefit from the environmental 'lift' of the entire conservation bank because it would be factored into the environmental baseline. In addition, where proposed actions did include credit purchases, it would not be possible to attribute their benefits to the proposed action, without double counting. These consequences undermine the purposes of

conservation banks and also do not reflect the unique circumstances under which they are established. Specifically, conservation banks are established based on the expectation of future credit purchases. In addition, credit purchases as part of a proposed action will also be the subject of a future Section 7 consultation. It is therefore appropriate to treat the beneficial effects of the bank as accruing incrementally at the time of specific credit purchases, not at the time of bank establishment or at the time of bank restoration work. Thus, for all projects within the service area of a conservation bank, only the benefits attributable to credits sold are relevant to the environmental baseline. Where a proposed action includes credit purchases, the benefits attributable to those credit purchases are considered in the effects of the action.

The proposed construction occurs within the service areas of two conservation or mitigation banks approved by NMFS. Both these banks occur within critical habitat for CCV steelhead. These include:

Fremont Landing Conservation Bank: Established in 2006, the Fremont Landing Conservation Bank is 100-acre floodplain site along the Sacramento River (Sacramento River Mile 106) and is approved by NMFS to provide credits for impacts to SR winter-run Chinook salmon, CV spring-run Chinook salmon and CCV steelhead. There are off-channel shaded aquatic habitat credits, riverine shaded aquatic habitat credits and floodplain credits available. To date, there have been about 60 of 100 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. Additional transactions may be pending but given the uncertainty, associated benefits are not considered part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this opinion.

Bullock Bend Mitigation Bank: Established in 2016, the Bullock Bend Mitigation Bank is a 119.65-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 SR 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 about 85 of 116.15 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. Additional transactions may be pending but given the uncertainty, associated benefits are not considered part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this opinion.

2.4.6 Climate Change

Rangewide climate change information for CCV steelhead, SR winter-run, sDPS green sturgeon, and CV spring-run is presented within the status of the species in Section 2.2 of this opinion.

In the future, the proposed Action Area will likely experience additional changes in environmental conditions due to climate change. These changes may overlap with the direct and indirect effects of long term proposed actions. Thus, for long-term actions, we can no longer assume current environmental variability adequately describes environmental baseline conditions. Instead, we need to project baseline conditions into the future, synchronizing our projections with the duration of the effects of the proposed action we are analyzing.

Within the context of the relatively brief period of time over which the proposed action is scheduled to be constructed and operated, however, the near term effects of global climate change are unlikely to result in any perceptible declines to the overall health or distribution of the listed populations of anadromous fish within the Action Area that are the subject of this consultation.

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 sections describe and analyze phases 4, 5, and 6 of the proposed action. While site-specific details are known for Phases 4 and 5, specific details are not yet known for Phase 6 repairs though they are anticipated to be similar repairs to those evaluated for Phases 4 and 5. Assumptions for phase 6 sites as described in the Analytical Approach section include that sites would be similar in scale, and would incorporate the same BMPs and conservation measures as described in the proposed action. For action components that are considered at a framework-level, effects are also analyzed in this Opinion, but with a broader scale of examination of the components' potential impacts on listed species and critical habitat.

2.5.1 Effects to Listed Fish

The proposed action includes activities that are likely to directly or indirectly impact SR winter-run, CV spring-run, CCV steelhead, sDPS green sturgeon, and their associated critical habitats. The following is an analysis of the potential direct and indirect effects to the species and their critical habitat that may occur because of the implementation of this project. Effects analyzed include physical disturbance, increased mobilization of sediment, noise/vibration/motion disturbance from heavy equipment operation, chemical spills, and long-term effects.

Physical Disturbance

Physical disturbance of aquatic habitat may occur during construction activities and the placement of materials, which has the potential to affect the juvenile and adult life stages of salmonids and green sturgeon through displacement and disruption of normal behaviors.

Instream construction activities may cause mortality and reduced abundance of benthic aquatic macroinvertebrates within the footprint of the repairs, due to the placement of rock over the existing streambed. These effects to aquatic macroinvertebrates are expected to be long-term as permanent bank armoring alters the natural streambed (USFWS, 2004). The amount of food available for adult and juvenile salmonids and sturgeon in the Action Area is therefore expected to be permanently decreased in the areas where submerged riprap is being placed.

During construction activities, both juvenile and adult fish will likely be able to detect areas of active disturbance and will typically avoid those portions of the project footprint where equipment is actively operated or a turbidity plume occurs, especially adults. Juveniles may also stay and hunker down in the activity zone. Occasionally, feeding juvenile salmonids and green sturgeon may be attracted to activity stirring up sediment, but are likely to avoid areas disturbed by active equipment. In addition, the area disturbed by gravel placement or excavation at any given time is expected to be only a portion of the river width; therefore, juveniles will have opportunities to move to other portions of the channel where they can avoid potential injury or mortality. Adult salmonids and green sturgeon are expected to move out of the area to adjacent suitable habitat before, as equipment enters the water, or before gravel or boulders are placed over them due to the disturbance caused by vibrations on land. Direct harm due to disturbance or or death from crushing by construction equipment is possible, though not expected.

Due to the limited number of juveniles likely to be present due to timing of the construction, and implementation of avoidance/minimization measures, it is not expected that juveniles will be injured or killed as a result of the physical disturbance, but will be subject to minor disturbances.

Increased Turbidity and Suspended Sediment

All activity within the Action Area with waterside repairs have the potential to temporarily increase turbidity and suspended sediment levels within the project work site and downstream areas. The re-suspension and deposition of instream sediments is an effect of construction equipment disturbances and rock entering the river. Short-term increases in turbidity and suspended sediment levels associated with construction may negatively impact fish populations temporarily through reduced availability of food, reduced feeding efficiency, and exposure to sediment released into the water column (Barrett et al 1992).

Increased exposure to elevated levels of suspended sediments have the potential to result in physiological and behavioral effects. The severity of these effects depends on the extent of the disturbance, duration of exposure, and sensitivity of the affected life stage. Based on the types and duration of proposed in-water construction methods, short-term increases in turbidity and suspended sediment may disrupt feeding activities or result in avoidance or displacement of fish from preferred habitat (Bash et al 2001), which may lead to increased susceptibility to predation.

Salmonids have been observed avoiding streams that are chronically turbid (Lloyd 1987) or move laterally or downstream to avoid turbidity plumes (Sigler, Bjornn et al. 1984). Chronic exposure to high turbidity and suspended sediment may also affect growth and survival by impairing respiratory function, reducing tolerance to disease and contaminants, and causing physiological stress (Waters 1995).

Any increase in turbidity associated with proposed instream work is likely to be brief and localized, attenuating downstream as suspended sediment settles out of the water column. Temporary spikes in suspended sediment may result in behavioral avoidance of the site by fish. Several studies have documented active avoidance of turbid areas by juvenile and adult salmonids including Sigler et al. (1984), Lloyd (1987), and Servizi and Martens (1992).

Based on similar projects conducted by DWR and the USACE (i.e., levee repair work and placement of rock riprap), construction activities are expected to result in periodic increases in localized turbidity levels up to 75 Nephelometric Turbidity units (NTUs). These levels are capable of affecting normal feeding and sheltering behavior. In the past, levee protection work on the Sacramento River has produced turbidity plumes that hug the shoreline for several hundred feet downstream of the activity. However, once construction stops, water quality is expected to return to background levels within a few hours, depending on how high the percentage of fines in the material are. Adherence to erosion control measures and BMP's will minimize the amount of sediment from construction activities and will minimize the potential for post-construction turbidity changes should precipitation events occur after construction has been completed. NMFS expects that most fish will actively avoid the elevated turbidity plumes if possible. For those fish that do not or cannot avoid the turbid water, exposure is expected to be brief (i.e., minutes to hours) and not likely to cause injury or death from reduced growth or physiological stress. This expectation is based on the general avoidance behaviors of salmonids and the requirement to suspend construction when turbidity exceeds Central Valley Regional Water Quality Control Board standards. However, some juveniles that are exposed to turbidity plumes may be injured or killed by predatory fish that take advantage of disrupted normal behavior. Once fish migrate past the turbid water, normal feeding and migration behaviors are expected to resume. A low proportion of fish that are exposed to the area of increased turbidity are expected to be adversely affected by increased predation due to displacement and the lowered visibility caused by the suspended sediment.

Noise, Motion, and Vibration Disturbance from Heavy Equipment

Noise, motion, and vibration produced by heavy equipment operation are expected at each project site. However, the use of equipment will occur primarily outside the active channel, in addition to the infrequent, short-term use of heavy equipment in the wetted channel. As a result, we anticipate minimal effects to listed fishes. Listed fishes will generally be expected to move away and avoid interaction with instream machinery by temporarily relocating either upstream or downstream into suitable habitat adjacent to the worksite.

The excavation and placement of rock below the waterline will produce noise and physical disturbance, which could displace juvenile and adult fish into adjacent habitats, or crush and injure, or kill, individuals. Similarly, construction activities carried out in close proximity to the river channel have the potential to transfer kinetic energy through the adjoining substrates, disturb the water column, and temporarily generate increased turbulence and turbidity in the river. Migrating juveniles react to this disturbance with a startle response in which they are likely to suddenly disperse in random directions (Carlson *et al.* 2001). While construction is proposed in periods where fish are least likely to be present, some adverse effects are likely due to the wide Action Area of this proposed action. Adverse effects are expected in the form of injury or death due to being crushed by rocks. The number of individuals present is likely to be small during the construction timing, and would constitute a small proportion of the population. These effects could occur to any of the listed species present within the Action Area, but will be limited to the construction footprint.

Disturbance to Riparian Vegetation

Impacts to existing vegetation will be avoided to the extent practicable. The loss of riparian vegetation is an effect of creating and maintaining temporary access points to the river. In the event that streamside riparian vegetation is removed, the loss is expected to be small, due to minimization measures described in the BA, and limited to mostly shrubs and an occasional tree (see also discussion on long-term effects below). The loss of riparian habitat, including that which provides SRA functions, would be avoided and minimized where possible. The proposed project describes that any loss that cannot be avoided would be compensated for through restoration and/or credit purchase. Fish being exposed to the areas losing riparian habitat may be more susceptible to predators due to loss of cover and have changes to their food foraging behavior. As the areas of lost vegetation will be small and vegetation removal will be avoided when possible, these effects are expected to be minimal and unlikely to have any long-term effects on the species.

Chemical Contamination from Equipment Fluids

Equipment refueling, fluid leakage, and maintenance activities within and near the stream channel pose some risk of contamination and potential impacts to listed fish species. However, all projects will include the minimization measures outlined in the BA, which address and minimize pollution risk from equipment operation. Therefore, water quality degradation from toxic chemicals associated with the rehabilitation projects is expected to be improbable.

2.5.2 Effects to Critical Habitat

Critical habitat has been designated in the Action Area for CCV steelhead, SR winter-run, CV spring-run, and sDPS green sturgeon. The general PBFs of critical habitat within the Action Area for salmonids are freshwater rearing sites, freshwater migration corridors, riparian and floodplain habitat that provides for successful juvenile development and survival, and access to downstream areas so that juveniles can migrate from spawning grounds to the San Francisco Bay and the Pacific Ocean. The PBFs for green sturgeon within the Action Area include food resources, substrate type/size, flow, water quality, migration corridors free of passage impediments, depth (holding pools), and sediment quality.

Placement of Rock Revetment

The continual input of riprap into the Sacramento and San Joaquin rivers will permanently alter critical habitat in the system. Garland et al. (2002) found that juvenile salmonids are significantly less likely to be found in riprap habitats versus unaltered habitats. The study found that as substrate size decreased, likelihood of presence increased (until reaching sand substrate). Placement of riprap is expected to adversely affect the value of freshwater migratory and rearing habitat PBFs for juvenile salmonids and reduce the amount of useable rearing habitat. This reduction in habitat quantity and quality will cause harm to individual fish.

Toxic Substance Spills

Operation of power equipment, such as an excavator, in or near aquatic environments increases the potential for toxic substances to enter the aquatic environment and have negative effects on ESA-listed anadromous fish species and designated critical habitat. Spills of toxic substances could negatively affect the freshwater migratory corridor and freshwater rearing habitat PBFs.

Equipment refueling, fluid leakage, and maintenance activities within and near the stream channel pose some risk of contamination and potential impacts to listed fish species. However, all projects will include the minimization measures outlined in the BA, which address and minimize pollution risk from equipment operation. Therefore, water quality degradation from toxic chemicals associated with the rehabilitation projects is not expected to occur.

The proposed action includes the development of a hazardous materials spill prevention and countermeasures plan. The proposed action includes daily inspections of all heavy equipment for leaks. With inclusion of these measures, the potential effects from hazardous materials entering the aquatic environment and adversely affecting ESA-listed anadromous fish and their designated critical habitat are not expected to occur.

Loss of Riparian Habitat Functions

The proposed action will modify designated critical habitat for SR winter-run, CV spring-run, CCV steelhead and sDPS green sturgeon in the Action Area. These permanent modifications to designated critical habitat are expected to reduce the PBFs of rearing habitat (reduced quantity and quality, increased predation, reduced cover, and reduced benthic invertebrate production), and may also adversely affect the PBFs of migratory habitat by decreasing the quality. Potential adverse impacts to PBFs of rearing habitat include disturbed riverbed (resulting in reduced benthic invertebrate production), and/or displacement (resulting in increased predation). Permanent habitat loss is expected to occur at sites where rock is being placed below the OHWM, estimated at 1.652 acres for Phase 4 and 5 repair sites, and potentially at sites where rock is being placed above the OHWM if the site is unable to be revegetated (up to 1.87 acres estimated for Phase 4 and 5 sites). Mitigation credits are being purchased to offset impacts that are both temporary and permanent. Please see Table 2 for the mitigation ratios, which are site dependent. As the repairs being done are in small fragmented portions all throughout the Action Area, the impacts to the habitat are smaller on a local level as opposed to if this repair length was done continuously.

Physical Disturbance

Physical disturbance of aquatic habitat may occur during construction activities and the placement of materials, which has the potential to affect the PBFs of migratory corridors, and rearing habitat. Instream construction activities may cause impacts to rearing habitat quality from reduced abundance of benthic aquatic macroinvertebrates within the footprint of the repairs, due to the placement of rock over the existing streambed. These effects to aquatic macroinvertebrates are expected to be long-term as permanent bank armoring alters the natural streambed (USFWS, 2004). The amount of food available for adult and juvenile salmonids and sturgeon in the Action Area is therefore expected to be permanently decreased in the areas where submerged riprap is being placed, up to 15,000 linear feet. The proposed action includes the purchase of mitigation

bank credits to compensate for the permanent losses caused by the project. The ratio of credits to be purchased is described in Section 2.5.3 below.

Increased Mobilization of Sediment

All project sites with waterside repairs will have temporary increases in turbidity and suspended sediment levels within the project work site and downstream areas. The re-suspension and deposition of instream sediments is expected to occur from construction equipment and rock entering the river. The deposition of sediment is expected to temporarily reduce food availability and feeding efficiency due to the natural substrate being coated with a new layer of sediment. Short-term increases in turbidity and suspended sediment levels associated with construction may negatively impact rearing habitat PBFs temporarily through reduced availability of food, reduced feeding efficiency.

Based on the types and duration of proposed in-water construction methods, short-term increases in turbidity and suspended sediment may disrupt the ability of rearing habitat to support feeding fish resulting in avoidance or displacement from preferred habitat.

Incorporation of BMPs are expected to minimize adverse effects to rearing habitat and migratory corridor PBFs, such that any increase in turbidity associated with proposed instream work is likely to be brief and localized, attenuating downstream as suspended sediment settles out of the water column. Rearing habitat and migratory corridor PBFs would be adversely affected during construction from temporary spikes in suspended sediment.

Although adverse effects to critical habitat PBFs are expected to occur, as construction activities are planned during times when fish presence is low, sediment redistribution and increased turbidity are expected to subside during peak migration times. Incorporation of BMPs are expected to minimize the extent of adverse effects to critical habitat PBFs to a minimal level.

Noise, Motion, and Vibration Disturbance from Heavy Equipment

Noise, motion, and vibration produced by heavy equipment operation are expected at each project site. However, the use of equipment, which will occur primarily outside the active channel, and the infrequent, short-term use of heavy equipment in the wetted channel, is expected to result in minimal and temporary adverse effects to listed fishes. PBFs that may be affected include rearing habitat and migratory corridor. Any excessive noise or vibrations may temporarily reduce usage of the habitat within the Action Area. Suitable habitat adjacent to the worksite either upstream or downstream will likely be less utilized if machinery noise is present. Critical habitat effects from noise, motion, and vibration are expected to be temporary and minimal.

Disturbance to Riparian Vegetation

Impacts to rearing habitat and migratory corridor PBFs are expected to occur through reduced riparian vegetation, though impacts to existing vegetation will be avoided to the extent practicable. The loss of riparian vegetation is expected to result from maintaining temporary

access points to the river, and covering vegetation with gravel/rock. When streamside riparian vegetation removal is needed, the loss is expected to be small, due to minimization measures described in the BA, and limited to mostly shrubs and an occasional tree (see also discussion on long-term effects in section 2.5.7 below). The impacts to rearing habitat and migratory corridor PBFs from loss of riparian habitat, including that which provides SRA functions, is expected to cause short and long term loss in quality habitat. Degraded SRA habitat will affect migrating and rearing fish through loss of food input, cover, and cooling from shade. This is expected to result in reduced feeding/growth, increased predation, and reduced survival. Unavoidable adverse effects will be compensated through the purchase of mitigation credits as described in the proposed action.

Inaccessible Floodplain for Rearing

Bank armoring halts the meander migration and reworking of floodplains, which eventually reduces habitat renewal, diversity, complexity, and heterogeneity. This, in turn, has adverse effects on aquatic ecosystems, ranging from carbon cycling to altering salmonid population structures and fish assemblages (Schmetterling 2001, USFWS 2004). Riprapping decreases river sinuosity, which increases the river channel slope, increasing the bedload transport and possible bed degradation and scour near the toe of the riprapped bank (USFWS 2004, Larson 2002). Although the proposed repairs include compensation for permanent impacts at each repair site (see section below), extending the useful life of levees in the Action Area results in continued degraded quality and quantity of rearing habitat PBFs for juveniles from not being able to access the natural floodplains of the rivers and creeks.

Mitigation/Conservation Bank Credit Purchases

To address permanent impacts to riparian and aquatic habitats, the proposed action includes purchase of mitigation bank credits as outlined in Table 2 above. In summary, impacts due to the proposed action are 1.87 acres above the OHWM and 1.652 acres below the ordinary high water mark for a total of 3.522 acres of impact. Total proposed purchase of credits to mitigate is 9.336 acres. Table 5 below outlines how mitigation credits will be purchased for future projects under the programmatic aspect of this opinion. As described above, riparian and aquatic habitat impacts affect designated critical habitat PBFs as well as listed fish species. The purchase of mitigation credits is expected to compensate for the loss of ecosystem functions due to the modification of the riverbank. These credit purchases are ecologically relevant to the impacts and the species affected because the banks (Bullock Bend and Fremont Landing) include shaded riparian aquatic, riparian forest and floodplain credits with habitat values that are already established and meeting performance standards. Also, the banks are located in areas that will benefit SR winter-run Chinook salmon, CV spring-run, CCV steelhead, and sDPS green sturgeon.

The purchase of credits provides a high level of certainty that the benefits to fish will be realized because both of the NMFS approved banks considered in this 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, and credit transactions and credit availability are tracked on the Regulatory In-lieu fee and Bank Information Tracking System (RIBITS). RIBITS was developed by the USACE with support from the Environmental Protection Agency, the U.S. Fish and Wildlife Service, 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, and 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.

Table 5. DWR SDDR approach matrix for applying salmonid compensatory mitigation ratios for SDDR Impacts (initial table provided from DWR and adjusted for clarity after verbal discussions between DWR and NMFS)

		Habitat Impacts	**Habitat Impacts**	**Minimization and Mitigation Measures**	**Minimization and Mitigation Measures**	**Minimization and Mitigation Measures**	**Minimization and Mitigation Measures**
Proposed Ratios	**Rationale**	***Existing Revetment***	***Riparian Vegetation Removed***	***Soil-Filled Rockfill***	***Revegetation***	***IWM Installation***	***Willow Cutting Installation***
No Compensation	Work occurs above OHWM or in dry channel with existing rock revetment with no riparian vegetation removal. Work not within designated critical habitat	-	-	-	-	-	-
1:1	Erosion site has been existing rock protection that is failing or slumping with little to no riparian vegetation. Additional habitat measures incorporated into design will improve existing site conditions. Ratio applied to above and below OHWM areas of impact. Work considered temporary and will be completed within approve work windows.	Failing or slumping rock; insufficient sized rock, concrete or smaller rip-rap	None to minimal, limited to <4-inches DBH in sparse habitat; non-native riparian trees may be removed	Incorporated into the design above OHWM	Reseeded levee slope with native grass seed mix	If feasible for habitat enhancement purposes	If feasible for habitat enhancement purposes or if scrub-shrub vegetation is removed
2:1	Effort will be made to protect as many larges trees as feasible. Reduced compensation ratio for riparian scrub vegetation removal and placement of rockfill below OHWM with incorporation of IWM and/or pole cuttings into design. Ratio applied to above and below OHWM depending on area of	Majority of existing rock protection still present but absent in erosion pockets	Requires removal of scrub shrub <4-inches DBH; trees and shrubs >4-inches DBH protected in place	Incorporated into the design above OHWM	Reseeded levee slope with native grass seed mix	Likely feasible for mitigation and/or habitat enhancement purposes	Incorporated into the design at OHWM

		Habitat Impacts	Habitat Impacts	Minimization and Mitigation Measures	Minimization and Mitigation Measures	Minimization and Mitigation Measures	Minimization and Mitigation Measures
	impact. Work will be completed within approve work windows.						
3:1	Effort will be made to protect as many larges trees as feasible. Rock protection may have been lacking at site but majority of mature, native trees are protected in place, and fallen trees are allow to remain outside excavation area. Ratio applied to above and below OHWM depending on area of impact. Work will be completed within approve work windows.	Majority of existing rock absent due to extensive erosion	Requires removal of scrub shrub <4-inches DBH; trees protected in place	Incorporated into the design above OHWM	Reseeded levee slope with native grass seed mix	Not feasible to incorporate into design due to site conditions or slope of levee <2:1	Incorporated into the design at OHWM.
4:1	Significant riparian habitat will be affected, effort will be made to protect as many larges trees as feasible. Rock protection may have been lacking at site but majority of mature, native trees are protected in place, and fallen trees are allow to remain outside excavation area. Ratio applied to above and below OHWM depending on area of impact. Work will be completed within approve work windows.	Majority of existing rock absent due to extensive erosion	Scrub shrub required to be removed; mature trees maybe protected but <50-percent may need to be removed	May be included in design depending on slope and existing revetment	Maybe reseeded levee slope with native grass seed mix	Site conditions do not allow incorporating IWM into design	Site conditions do not allow incorporating willow poles into design
5:1	Significant riparian habitat will be affected with trees located in erosional area and likely falling. Rock protection may have been lacking at site and majority of mature, native trees and fallen trees require removal to rebuild levee. Ratio applied to above and below OHWM depending on area of impact. Work will be completed within approve work windows	Non-revetted bank or levee	Scrub shrub required to be removed; >50-percent or native trees need to be removed Majority of mature and scrub-shrub riparian vegetation and IWM required to be removed	Site conditions do not allow placement of soil into voids of rockfill	Site conditions do not allow reseeding due to bare rock levee	Site conditions do not allow incorporating IWM into design	Site conditions do not allow incorporating willow poles into design

2.6 Cumulative Effects

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

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

2.6.1 Agricultural Practices

Agricultural practices in the Action Area may adversely affect riparian and wetland habitats through upland modifications of the watershed that lead to increased siltation or reductions in water flow. 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 then 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 salmonid and sDPS green sturgeon reproductive success and survival rates (Dubrovsky et al. 1998, Daughton 2003).

2.6.2 Increases in 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 will 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 that are situated away from waterbodies, will not require Federal permits, and thus will not undergo review through the ESA section 7 consultation process with NMFS.

Increased urbanization is also 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 will 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 suspending contaminated sediments and degrading areas of submerged vegetation. This in turn will reduce habitat quality for the invertebrate forage base required for the survival of juvenile salmonids and green sturgeon 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

Cumulative effects include non-Federal RSP projects. Depending on the scope of the action, some non-Federal rock revetment projects carried out by state or local agencies do not require Federal permits. These types of actions and illegal placement of RSP occur within the Sacramento River watershed. Most of the levees have roads on top of the levees, which are maintained either by the county, reclamation district, owner, or by the state. Landowners may utilize roads at the top of the levees to access part of their agricultural land. The effects of such actions result in continued fragmentation of existing high-quality habitat, and conversion of complex nearshore aquatic to simplified habitats that affect salmonids in ways similar to the adverse effects associated with this project.

2.7 Integration and Synthesis

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

In our *Rangewide Status of the Species* section, NMFS summarized the current status and likelihood of extinction of each of the listed species. We described the factors that have led to the current listing of each species under the ESA and across their ranges. These factors include past and present human activities and climatological trends and ocean conditions that have been identified as influential to the survival and recovery of the listed species. Beyond the continuation of the human activities affecting the species, we also expect that ocean condition cycles and climatic shifts will continue to have both positive and negative effects on the species' ability to survive and recover. The *Environmental Baseline* section reviewed the status of the species and the factors that are affecting their survival and recovery in the Action Area. The *Effects of the Action* section reviewed the exposure of the species and critical habitat to the proposed action. NMFS then evaluated the likely responses of individuals, populations, and impacts to critical habitat. The *Cumulative Effects* section described future activities within the Action Area that are reasonably certain to have a continued effect on listed fish.

In order to estimate the risk to CCV steelhead, CV spring-run Chinook salmon, SR winter-run, and sDPS green sturgeon as a result of the proposed action, NMFS uses a hierarchical approach. The condition of the ESU or DPS is summarized from the *Status of the Species* section of this opinion. We then consider how the status of populations in the Action Area are affected by the proposed action, as described in the *Environmental Baseline* section. Effects on individuals are summarized, and the consequence of those effects is applied to establish risk to the diversity group, ESU, or DPS.

Status of the Species and Environmental Baseline

There are several criteria that would qualify the SR winter-run population at moderate risk of extinction (continued low abundance, a negative growth rate over two complete generations, significant rate of decline since 2006, increased hatchery influence on the population, and increased risk of catastrophe), and because there is still only one population that spawns below Keswick Dam, SR winter-run are at a high risk of extinction in the long term. Although many of the PBFs of SR winter-run critical habitat are currently degraded and provide limited high quality habitat, the spawning habitat, migratory corridors, and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species.

CV spring-run Chinook salmon remain at moderate risk of extinction based on the evaluation for years 2012 to 2014 (Williams al. 2016). However, based on the severity of the drought and the low escapements, as well as increased pre-spawn mortality in Butte, Mill, and Deer creeks in 2015, and poor returns in 2016, 2017, 2018, there is concern that these CV spring-run Chinook salmon strongholds will deteriorate into high extinction risk based on the population size or rate of decline criteria (NMFS 2016b). Although many of the PBFs of CV spring-run Chinook salmon critical habitat are currently degraded and provide limited high quality habitat, the spawning habitat, migratory corridors, and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species.

The status of the CCV steelhead DPS appears to have remained unchanged since the 2016 status review and the DPS is likely to become endangered within the near future throughout all or a significant portion of its range (NMFS 2016a). Many of the PBFs of CCV steelhead critical habitat are degraded and provide limited high quality habitat. However, the spawning habitat, migratory corridors, and rearing habitat that remain in the Sacramento watershed are considered to have high intrinsic value for the conservation of the species, as they are critical to ongoing recovery efforts.

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate (NMFS 2015). Currently, many of the PBFs of sDPS green sturgeon are degraded and provide limited high quality habitat. Factors that lessen the quality of migratory corridors for juveniles include unscreened or inadequately screened diversions, altered flows in the Delta, and presence of contaminants in sediment. Critical habitat PBFs of spawning habitat, migratory corridors, and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species.

The evidence presented in the *Environmental Baseline* section indicates that past and present activities within the Sacramento River basin have caused significant habitat loss, degradation, and fragmentation. This has significantly reduced the quality and quantity of the remaining PBFs within Action Area of the Sacramento River for the populations of CCV steelhead, SR winter-run and CV spring-run Chinook salmon, and sDPS green sturgeon that utilize this area. Alterations in the flow regimes of the Sacramento River system, removal of riparian vegetation and shallow water habitat, reduced habitat complexity, construction of armored levees for flood

protection, and the influx of contaminants from agricultural and urban discharges have also substantially reduced the functionality of the waterways.

Cumulative Effects
Water diversions, increased urbanization, and rock revetment and levee projects are reasonably expected to continue in the future in the Action Area. The effects of these actions result in the continued degradation, simplification, and fragmentation of the riparian and freshwater habitat. Some of these actions, particularly those that are situated away from waterbodies, will not require Federal permits, and thus will not undergo review through the ESA section 7 consultation process with NMFS.

Summary of the Effects of the Proposed Action

Fish may be harassed, injured, or killed during completion of the proposed action through various pathways. Project activities result in negative effects through altered behavioral responses caused by the proposed action. Fish be directly injured or killed from in water construction activities and placement of rock revetment below the OHWM. Construction-related increases in turbidity and suspended sediment above background level affect fish species reducing survival of juveniles or interfering with feeding, migrating, and rearing activities. While effects will be reduced due to avoidance and minimization measures and BMPs, effects from turbidity and suspended sediments to listed species are still expected to be adverse.

Critical habitat has been designated in the Action Area for SR winter-run, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon. The placement of rock revetment will permanently alter the PBFs of rearing habitat and migratory corridor, including degradation of available food and cover within the Action Area and causing reduced feeding/growth and increased predation. Therefore, the proposed action will have permanent effects to Critical Habitat and its relevant PBFs for all species. Through the purchase of mitigation bank credits and onsite mitigation features, the proposed project is not expected to reduce or appreciably diminish the value of designated critical habitat for the conservation of the species.

Effects to the ESUs/DPSs

According to the most recent status reviews, SR winter-run are at risk of extinction, and CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon are at risk of becoming endangered, due to past and present activities causing habitat loss, degradation and fragmentation. Most proposed project locations are on the Sacramento River within the Delta, which serves as a migratory corridor for all populations of listed salmonids and sturgeon in the Sacramento River Basin as they move between the ocean and riverine habitat. The continuation of structures like levees that cut off access to floodplain rearing habitat and channelize the river appreciably reduce the overall quality of the habitat. This project will be extending the functional life of the levees blocking access to floodplain habitat. The proposed project is expected to impact a small proportion of multiple populations and life stages of listed fish. Although there are long-term and short-term impacts to the listed ESUs/DPSs, the proposed Project, with the implementation of avoidance/minimization measures and the purchase of mitigation credits at a NMFS-approved mitigation bank to offset the acres of permanent impacts, is not expected to reduce appreciably the likelihood of either the survival or recovery of SR winter-run, CV spring-

run Chinook salmon, CCV steelhead, and sDPS green sturgeon 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, any effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' opinion that the proposed action is not likely to jeopardize the continued existence of the SR winter-run Chinook salmon ESU, the CV spring-run Chinook salmon ESU, the CCV steelhead DPS, the sDPS of green sturgeon, or destroy or adversely modify their respective designated critical habitat.

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 anticipates incidental take of SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon in the Action Area through the implementation of the proposed action for Phases 4, 5, and 6. Because of the proposed timing of the in-water work for the construction phase of the project, actual numbers of fish adversely affected by the construction actions are expected to be low. Only small numbers of individual salmonids or sDPS green sturgeon are expected to be present in the Action Area during the in-water construction period of each phase. Greater numbers of individuals from the four listed species are expected to utilize the Action Area over the long term after construction is completed. These fish will be exposed to the adverse effects of permanent levee stabilization, which extends the useful life of the bank, which continues to block access to natural floodplain habitat.

While individual fish are expected to be present in the Action Area at the time of construction, and during seasonal rearing and migration, NMFS cannot, using the best available information, precisely quantify and track the amount or number of individuals that are expected to be incidentally taken (injure, harm, kill, etc.) per species as a result of the proposed action. This is

due to the variability and uncertainty associated with the response of listed species to the effects of the proposed action, the varying population size of each species, annual variations in the timing of spawning and migration, individual habitat use within the Action Area, and difficulty in observing injured or dead fish. However, it is possible to estimate the extent of incidental take by designating as ecological surrogates, those elements of the project that are expected to result in incidental take, that are more predictable and/or measurable, with the ability to monitor those surrogates to determine the extent of take that is occurring.

The most appropriate threshold for incidental take is an ecological surrogate of habitat disturbance, which includes the loss of SRA cover and riparian habitat through the placement of rock revetment and removal of vegetation. This degradation is expected to result in reduction in the growth and survival of individuals from predation, or by causing fish to relocate and rear in other locations and reduction of the carrying capacity of the existing habitat. NMFS will describe (1) the causal link between the surrogate and take of the species; (2) why it is not practical to express the amount of anticipated take or to monitor take related impacts in terms of individuals of the listed species; and (3) sets a clear standard for determining when the amount or extent of the incidental take has been exceeded.

Incidental take, in the form of harm resulting in behavioral modifications or fish responses to habitat disturbance are described as follows. Increased predation is expected to occur during the construction phase due to construction-related disturbance and shoreline activity. Long-term behavioral modifications and increased predation vulnerability resulting from loss and degradation of shoreline riparian habitat and shallow water habitat is also expected to occur throughout the life of the levee. Quantification of the number of fish exposed to noise, shoreline activities, and increases in predation vulnerability are not currently possible with available monitoring data. Observations of individual fish within the river channel are not possible due to water clarity and depth. However, all fish passing through or otherwise present in the Action Area during construction activities or over the long term during their adult and juvenile rearing and migratory life history stages will be exposed to the disturbed shoreline habitat associated with the rehabilitation sites. Thus, the footprint of each rehabilitation site defines the area in which projected incidental take will occur for this project due to the effects of construction actions and the long-term habitat disturbance associated with each site. NMFS anticipates incidental take will be limited to the following:

1. Harm to rearing juvenile SR winter-run, CV spring-run Chinook salmon, and CCV steelhead, and adult and juvenile sDPS green sturgeon from the repairs of a total habitat impact of 3.522 acres of SRA habitat (see Table 6 below). This loss will affect juveniles through displacement, increased predation, and loss of food, resulting in decreased fitness, growth, and survival. The following table describes the anticipated area of disturbed habitat representing the ecological surrogate of incidental take at each levee rehabilitation site location for known project designs within Phases 4 and 5. Incidental take for Phases 4 and 5 will be limited to the anticipated 3.522 acres with a 10% buffer; therefore, incidental take will be exceeded if impacts exceed 3.874 acres combined for Phase 4 and 5 repairs. USACE expects Phase 5 to have the highest impacts of the three Phases, therefore, we assume using the Phase 5 surrogate for describing the extent of incidental take will also be appropriate to describe anticipated Phase 6 incidental take.

Incidental take will be limited to a total impact of 2.312 acres plus a 10% buffer; therefore, incidental take will be exceeded if Phase 6 repair impacts exceed 2.543 acres.

Table 6. Salmonid Habitat Take (acres)

-	-	SRA (acres) or Critical Habitat Below OHWM	SRA (acres) Above OHWM
Phase	**Site**	Impacts	Impacts
4	**42**	-	-
4	**44**	0.02	0.03
4	**46**	0.11	0.09
4	**47**	0.2	0.16
4	**48**	0.04	-
4	**49**	0.08	0.06
4	**50**	0.1	0.07
4	**51**	0.03	0.03
4	**52**	0.03	0.02
4	**53**	0.01	0.01
4	**54**	-	-
4	**55**	0.02	0.1
5	**58**	0.02	-
5	**59**	-	-
5	**60**	0.02	-
5	**61**	0.3	0.75
5	**62**	0.03	-
5	**63**	0.13	0.22
5	**65**	0.09	0.15
5	**67**	0.09	0.12
5	**69**	0.01	-
5	**70**	0.01	-
5	**71**	0.03	-
5	**72**	0.01	0.04
5	**73**	0.06	-
5	**74**	0.08	-
5	**76**	0.12	-
5	**77**	0.002	-
5	**79**	0.01	0.02
-	**Totals**	**1.652**	**1.87**

2. Harm to rearing juvenile SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon from construction activities, resulting in increased turbidity in the footprint of the proposed project at levee rehabilitation repair sites, extending upstream and downstream 400 feet from the footprint and 100 feet from the bank, extending into the river channel. This disturbed habitat will affect the behavior of fish, including displacement, which is reasonably certain to result in fish migration delay, leading to increased predation, decreased feeding, and increased competition. NMFS does not expect to see any direct mortality or morbidity of these fish due to exposure to construction related turbidity. Quantification of the number of fish exposed to turbidity is not currently possible with available monitoring data. Observations of individual fish within the river channel are not possible due to water clarity and depth. However, all fish passing through or otherwise present during construction activities at the rehabilitation sites will be exposed to construction related turbidity events,

particularly when the turbidity curtains are removed. Thus, the waterside footprint of each rehabilitation site plus the additional area of river channel where turbidity effects are expected to be observed defines the area in which projected take will occur for this project due to the effects of construction related turbidity. Take will be exceeded if turbidity impacts extend beyond the 400 feet downstream and upstream and 100 feet from the bank buffer added to the repair lengths as outlined in Table 7 below. Incidental take for Phase 6 will be exceeded if turbidity effects are measured beyond the buffer area of the site length in the final designs given to NMFS prior to construction.

Table 7. Site Specific Repair Lengths from 2019 SDDR BA

Phase	Site	Length of Repair Area (Linear ft.)
4	**42**	75
4	**44**	120
4	**46**	250
4	**47**	270
4	**48**	345
4	**49**	280
4	**50**	410
4	**51**	55
4	**52**	105
4	**53**	60
4	**54**	170
4	**55**	610
5	**58**	430
5	**59**	430
5	**60**	120
5	**61**	1000
5	**62**	125
5	**63**	210
5	**65**	150
5	**67**	180
5	**69**	350
5	**70**	60
5	**71**	130
5	**72**	220
5	**73**	175
5	**74**	250
5	**76**	370
5	**77**	120
5	**79**	400
-	**Total**	**7470**

3. Harm to rearing and migrating juveniles within the project footprint for areas below the OHWM due to rock placement within the channel. For Phases 4 and 5, harm to rearing juvenile SR winter-run, CV spring-run Chinook salmon, and CCV steelhead, and adult and juvenile sDPS green sturgeon from the repair will be limited to a total habitat impact of 1.652 acres of below OHWM (see Table 6 above) plus a 10% buffer. Therefore, incidental take will be exceeded if rock placement below OHWM for Phases 4 and 5 combined exceeds 1.817 acres. Rock placement is expected to result in injury or death to a small number of juvenile fish that are anticipated to be present in the action area where

riprap placement is occurring below OHWM. We use Phase 5 as a reasonable representative for Phase 6, therefore it is assumed the total riprap placement below OHWM for Phase 6will not exceed 1.012 acres below (see Table 6 above) plus a 10% buffer. Incidental take will be exceeded if rock placement below OHWM for Phase 6 exceeds 1.113 acres.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

1. Measures shall be taken to minimize the impacts of bank protection on the growth and survival of listed fish by implementing integrated onsite conservation measures.

2. Measures shall be taken to monitor incidental take of listed fish and the survival of on-site plantings, reporting of annual repair status and purchase of mitigation credits, and submissions of site-specific designs for Phase 6 sites.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the USACE, DWR, or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). USACE and DWR have 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.

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

a. DWR shall minimize the removal of existing riparian vegetation and IWM to the maximum extent practicable, and where appropriate, removed IWM shall be anchored back into place from the location from which it was removed. IWM shall, when practicable be placed to ensure coverage of 80 percent of the shoreline at each erosion repair site and this should persist for at least 50 years (or an alternative duration based on the size of the project and the professional expertise of DWR's staff and knowledge or the duration of expected potential impacts).

b. DWR shall incorporate measures, to the extent practicable, to minimize the placement of rock revetment below the OHWM of freshwater rearing and migratory corridors. DWR shall consider using alternative methods to traditional riprap for levee repairs. For

instance, bioengineered products and strategic plantings of small trees and brush are consistent with project goals to resist erosive forces and wave wash along shorelines and are good alternatives to using riprap.

c. DWR shall avoid the use of filter fabric or geotextile fabrics to the extent practicable, as they often are unnecessary. Erosion can occur behind the filter fabric causing the bank to fail, or the fabric can create a slip-face and cause the riprap to slip, exposing the fabric. Gravel "blankets" shall be considered first, which can accomplish similar goals to geotextile fabrics to minimize adverse effects described.

d. DWR/USACE shall provide to NMFS a detailed re-vegetation plan prior to the initiation of replanting and shall include a list of species and designs depicting the proposed location for each species and their density. The plan shall also include the success criteria for the re-vegetation effort to meet the project's conservation goals. Where appropriate, the vegetation plan shall also include proposed irrigation and vegetation monitoring schedules, which will likely be needed for several years to obtain conservation goals.

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

e. DWR/USACE shall provide NMFS with a final Site Specific project description similar to those provided in the 2019 BA prior to construction of any sites for Phase 6. The project description shall include proposed mitigation ratios for the site using the same justifications as used for Phases 4 and 5. NMFS must provide written approval that the site is consistent with this opinion prior to construction.

f. DWR/USACE shall provide to NMFS (at the address below) a vegetation monitoring report at years 1, 2, and 3 post-construction no later than December 31st of each reporting cycle. This report shall provide information as to the success of the revegetation program and whether the conservation goals are being met at each site. If goals are not being met, then the report shall indicate what actions are being implemented to meet those goals.

g. DWR/USACE shall submit a report to NMFS of any incidental take that occurs as part of the project. This report shall be submitted no later than December 31, of each reporting cycle.

h. All reports for NMFS shall be sent to:

Maria Rea
California Central Valley Office
National Marine Fisheries Service
650 Capitol Mall, Suite 5-100
Sacramento California 95814
FAX: (916) 930-3629
Phone: (916) 930-3600

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. DWR should minimize risk of incidental take whenever possible, and implement practices that avoid or minimize negative impacts to salmon, steelhead, and sturgeon and their designated critical habitat.

2. USACE/DWR should support and promote aquatic and riparian habitat restoration within the Delta and other watersheds, especially those with listed aquatic species. Practices that avoid or minimize adverse effects to listed species should be encouraged.

3. USACE/DWR should continue to work cooperatively with 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.

4. USACE should make setback levees integral components of their authorized bank protection or ecosystem restoration efforts.

5. USACE/DWR should conduct or fund studies to identify setback levee opportunities, at locations where the existing levees are in need of repair or not, where setback levees could be built now. Removal of the existing riprap from the abandoned levee should be investigated in restored sites and anywhere removal does not compromise flood safety.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting 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 2017 Storm Damage DWR Rehabilitation Phase 4, 5, and 6 Repair Sites Programmatic consultation.

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 opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include 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) also requires NMFS to recommend measures that can be taken by the Action Agency to conserve EFH.

For the purposes of interpreting the definition of EFH, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and, "spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle.

This analysis is based, in part, on the EFH assessment provided by the United States Army USACE of Engineers (USACE) and the California Department of Water Resources (DWR) and descriptions of EFH for Pacific coast salmon as described in Amendment 18 to the Pacific Coast Salmon Plan (Pacific Fisheries Management Council [PFMC], 2014) contained in the fishery management plans (FMP) developed by the PFMC and approved by the Secretary of Commerce.

The PFMC has identified and described EFH, Adverse Impacts and Recommended Conservation Measures for salmon in Amendment 18 to the Pacific Coast Salmon FMP (PFMC 2014). Freshwater EFH for Pacific salmon in the California Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem as described in Myers et al. (1998). SR winter-run Chinook salmon (*O.s tshawytscha*), CV spring-run Chinook salmon (*O. tshawytscha*), and Central Valley fall-/late fall-run Chinook salmon (*O. tshawytscha*) are species managed under the FMP that occur in the project areas.

3.1 Essential Fish Habitat Affected by the Project

The geographic extent of freshwater EFH is identified as all water bodies currently or historically occupied by Council-managed salmon as described in Amendment 18 of the Pacific Coast Salmon Plan (PFMC 2014). In the estuarine and marine areas, salmon EFH extends from the extreme high tide line in nearshore and tidal submerged environments within state territorial waters out to the full extent of the Exclusive Economic Zone (EEZ) (200 nautical miles or 370.4 km) offshore of Washington, Oregon, and California north of Point Conception. The proposed project occurs in the area identified as "freshwater EFH", as it is above the tidal influence where the salinity is below 0.5 parts per thousand.

The implementing regulations for the EFH provisions of the MSA (50 CFR part 600) recommend that the FMPs include specific types or areas of habitat within EFH as "habitat areas of particular concern" (HAPC) based on one or more of the following considerations: (1) the importance of the ecological function provided by the habitat; (2) the extent to which the habitat is sensitive to human-induced environmental degradation; (3) whether, and to what extent, development activities are, or will be, stressing the habitat type; and (4) the rarity of the habitat type. Based on these considerations, the Council designated five HAPCs: (1) complex channels and floodplain habitats; (2) thermal refugia; (3) spawning habitat; (4) estuaries; and (5) marine and estuarine SAV. HAPCs that occur within the proposed project area are (1) complex channels and floodplains, and (2) thermal refugia.

3.2 Adverse Effects on Essential Fish Habitat

The proposed action is considered to have multiple non-fishing activities that affect EFH for Pacific salmon as described in Amendment 18 to the Pacific Coast Salmon FMP (PFMC 2014). The following aspects of the proposed action are expected to have adverse effects on the freshwater EFH in the Action Area of the project:

1) Bank Stabilization and Protection – The proposed project has components that will entail bank stabilization and protection activities in the Action Area which includes freshwater EFH. These activities include placement of rock armoring and removal of riparian vegetation. The alteration of riverine and estuarine habitat from bank and shoreline stabilization, and protection from flooding events can result in varying degrees of change in the physical, chemical, and biological characteristics of existing shoreline and riparian habitat. Human activities removing riparian vegetation, armoring, relocating, straightening and confining stream channels and along tidal and estuarine shorelines influences the extent and magnitude of stream bank erosion and down cutting in the channel. In addition, these actions have reduced hydrological connectivity and availability of off-channel habitat and floodplain interaction. Armoring of shorelines to prevent erosion and maintain or create shoreline real estate simplifies habitats, reduces the amount of intertidal habitat, and affects nearshore processes and the ecology of a myriad of species (Williams and Thom 2001). As described in Amendment 18 in PFMC 2014, a river confined by adjacent development and/or flood control and erosion control structures, can no longer move across the floodplain and support the natural processes that, 1) maintain floodplain connectivity and fish access that provide velocity refugia for juvenile salmon during high flows; 2) reduce flow velocities that reduce streambed erosion, channel incision, and spawning redd scour; 3) create side channels and off-channel areas that shelter rearing juvenile salmon; 4) allow fine sediment deposition on the floodplain and sediment sorting in the channel that enhance the substrate suitability for spawning salmon; 5) maintain riparian vegetation patterns that provide shade, large wood, and prey items to the channel; 6) provide the recruitment of large wood and spawning gravels to the channel; 7) create conditions that support hyporheic flow pathways that provide thermal refugia during low water periods; and 8) contribute to the nutrient regime and food web that support rearing and migrating juvenile salmon in the associated mainstem river channels. These activities are expected to adversely affect HAPCs for (1) complex channels and floodplains, and (2) thermal refugia.

2) Flood Control Maintenance – The proposed project will continue to prevent access to historic floodplain habitat by maintaining the levees constructed for flood protection. The protection of housing communities from flooding events can result in varying degrees of change in the physical, chemical, and biological characteristics of existing shoreline and riparian habitats. Maintaining the flood control levees results in the addition of rock armoring after any erosion event, regular (sometimes yearly) herbicide application, removal of riparian vegetation from the shoreline (also sometimes yearly), and other potentially harmful maintenance activities. Managing flood flows with flood control structures such as levees can disconnect a river from its floodplain eliminating off-channel habitat important for salmonids. Floodplains serve as a natural buffer to changes in water flow: retaining water during periods of higher flow and releasing it from the water table during reduced flows. These areas are typically well vegetated, lowering water temperatures, regulating nutrient flow and removing toxins. Juvenile salmon use these off channel areas because their reduced flows, greater habitat complexity, increased food availability, and shelter from predators may increase growth rates and their chance of survival. Artificial flood control structures have similar effects on aquatic habitat as does the efforts to stabilize banks and remove woody debris. The function of natural stream channels and associated riparian areas and the effects of flood control structures such as levees has been discussed in section 2.4.1 of this opinion. The HAPCs adversely affected include (1) complex channels and floodplains, and (2) thermal refugia.

3.3 Essential Fish Habitat Conservation Recommendations

DWR/USACE should implement the following conservation measures to minimize the adverse effects described in section 3.2 above. In order to avoid or minimize the effects to HAPCs (1) and (2) described above, NMFS recommends the following conservation measures described in Amendment 18 to the Pacific Coast Salmon FMP:

1) *Bank Stabilization and Protection*

- Minimize the loss of riparian habitats as much as possible.
- Bank erosion control should use vegetation methods or “soft” approaches (such as beach nourishment, vegetative plantings, and placement of IWM) to shoreline modifications whenever feasible. Hard bank protection should be a last resort and the following options should be explored (tree revetments, stream flow deflectors, and vegetative riprap).
- Re-vegetate sites to resemble the natural ecosystem community.
- Replace in-stream fish habitat by providing root wads, deflector logs, boulders, rock weirs and by planting shaded riverine aquatic cover vegetation.
- Use an adaptive management plan with ecological indicators to oversee monitoring and ensure mitigation objectives are met. Take corrective action as needed.
- Implement term and conditions 1(a-d), from the section 7 Opinion for this project.
- Minimize alteration of floodplains and wetlands in areas of salmon EFH.

- Determine cumulative effects of all past and current floodplain and wetland alterations before planning activities that further alter wetlands and floodplains.
- Promote awareness and use of the United States Department of Agriculture (USDA)'s wetland and conservation reserve programs to conserve and restore wetland and floodplain habitat.
- Promote restoration of degraded floodplains and wetlands, including in part reconnecting rivers with their associated floodplains and wetlands and invasive species management.

2) *Flood Control Maintenance*
Include the conservation measures from the *Bank Stabilization and Protection* section above and:

- Retain trees and other shaded vegetation along earthen levees and outside levee toe.
- Ensure adequate inundation time for floodplain habitat that activates and enhances near-shore habitat for juvenile salmon.
- Reconnect wetlands and floodplains to channel/tides.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 3.522 acres (1.652 acres below the OHWM, and 1.87 acres above the OHWM) of designated EFH for Pacific coast salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, DWR/USACE 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 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

USACE 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. FISH AND WILDLIFE COORDINATION ACT

The purpose of the Fish and Wildlife Coordination Act (FWCA) is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development (16 USC 661). The FWCA establishes a consultation requirement for Federal agencies that undertake any action to modify any stream or other body of water for any purpose, including navigation and drainage (16 USC 662(a)), regarding the impacts of their actions on fish and wildlife, and measures to mitigate those impacts. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources, and providing equal consideration for these resources. NMFS' recommendations are provided to conserve wildlife resources by preventing loss of and damage to such resources. The FWCA allows the opportunity to provide recommendations for the conservation of all species and habitats within NMFS' authority, not just those currently managed under the ESA and MSA.

The following recommendations apply to the proposed action:

- DWR should recommend that contractors use biodegradable lubricants and hydraulic fluid in construction machinery. The use of petroleum alternatives can greatly reduce the risk of contaminants such as polycyclic aromatic hydrocarbons (PAHs) or heavy metals directly or indirectly entering the aquatic ecosystem.

DWR must give these recommendations equal consideration with the other aspects of the proposed action so as to meet the purpose of the FWCA.

This concludes the FWCA portion of this consultation.

5. 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.

5.1 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 USACE. Other interested users could include DWR and CDFW. Individual copies of this opinion were provided to USACE. The format and naming adheres to conventional standards for style. 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.

5.2 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.

5.3 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, if applicable 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.

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