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-2019-00290

July 22, 2019

Mr. Mark Ziminske
Environmental Resources Branch Chief
Department of the Army
U.S. Army Corps of Engineers
Sacramento District
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 2018/2019 Public Law 84-99 Reclamation Districts 70, 1660, and Maintenance Area 09 Emergency Levee Repair Sites

Dear Mr. Ziminske:

Thank you for your letter of March 25, 2019, requesting initiation of consultation with the 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 2018/2019 Public Law 84-99 Reclamation Districts 70, 1660, and Maintenance Area 09 Emergency Levee Repair Sites.

The enclosed biological opinion is based on our review of the proposed action as detailed in the provided biological assessment, and project effects on the federally listed threatened California Central Valley steelhead (*Oncorhynchus mykiss*) distinct population segment and their designated critical habitat, southern Distinct Population of North America green sturgeon (*Acipenser medirostris*) and their critical habitat, Central Valley spring-run Chinook salmon (*O. tshawytscha*), and Sacramento River winter-run Chinook salmon (*O. tshawytscha*), in accordance with Section 7 of the ESA. Using the best available scientific and commercial information, NMFS concludes that the project is not likely to jeopardize the continued existence of these federally listed species, nor adversely modify or destroy their critical habitat. NMFS has included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor the incidental take of federally listed fish that will occur with project implementation.

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. This biological opinion also includes NMFS's review of the potential effects of the proposed action on EFH for Pacific Coast Salmon, as designated under the MSA. The document concludes that the project will adversely affect the

EFH of Pacific Coast Salmon in the action area and has included EFH Conservation Recommendations.

As required by section 305(b)(4)(B) of the MSA, the action agency 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 your response to the EFH portion of this consultation, we ask that you clearly identify the number of Conservation Recommendations accepted.

Please contact Abbie Moyer in the California Central Valley Office at (916) 930-3703 or abbie.moyer@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Maria Rea

Maria Rea
Assistant Regional Administrator
California Central Valley Office

Enclosure

cc: To the file 151422-WCR2018-SA00468
Ms. Robin M. Rosenau, U.S. Army Corps of Engineers, Robin.M.Rosnau@usace.army.mil

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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

2018/2019 Public Law 84-99 Reclamation Districts 70, 1660, and Maintenance Area 09 Emergency Levee Repair Sites

National Marine Fisheries Service (NMFS) Environmental Consultation Organizer Number: WCRO-2019-00290

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Central Valley spring-run Chinook Salmon ESU (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
California Central Valley steelhead Distinct Population Segment (DPS (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No
Southern DPS of North American green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	Yes	No
Central Valley 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
Assistant Regional Administrator
California Central Valley Office

Date: July 22, 2019

LIST OF ACRONYMS

ACID	Anderson-Cottonwood Irrigation District Diversion Dam
AMM	avoidance and minimization measure
BMP	best management practice
BO	biological opinion
°C	degrees Celsius
CCV	California Central Valley
CV	Central Valley
CDFW/CDFG	California Department of Fish and Wildlife
cfs	cubic feet per second
CRs	Conservation Recommendations
Delta	Sacramento-San Joaquin River Delta
DPS	distinct population segment
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
IWM	instream woody material
m	meter
MA	maintenance area
mg/L	milligram per liter
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
OHWM	ordinary high water mark
Opinion	biological opinion
PL	Public Law
PBFs	physical or biological features
PCE	primary constituent element
RBDD	Red Bluff Diversion Dam
RD	Reclamation District
RM	river mile
RPA	reasonable and prudent alternative
RPMs	reasonable and prudent measures
s	seconds
sDPS	southern distinct population segment
SJR	San Joaquin River
SR	Sacramento River
SWE	snow water equivalent
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
VSP	viable salmonid population

LIST OF TABLES

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 (BO) 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 (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law (PL) 106-554). A complete record of this consultation is on file at the NMFS California Central Valley Office.

1.2 Proposed Federal Action

Under ESA implementing regulations, “action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). Under MSA implementing regulations, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (50 CFR 600.910). Under the FWCA, an agency is required to consult 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 Corps has authority under PL 84-99, Flood Control and Coastal Emergencies (33 U.S.C. 701n) (69 Stat. 186) for emergency management activities. Under PL 84-99, the Chief of Engineers, acting for the Secretary of the Army, is authorized to undertake activities including disaster preparedness, advance measures, emergency operations (flood response and post flood response), rehabilitate flood control works threatened or destroyed by floods, protect or repair of federally authorized shore protective works threatened or damaged by coastal storms, and provide emergency water due to the effects of drought or contaminated water sources. The PL 84-99 authority would address seepage, boils, erosion, and slough-slips in the levees located in

the California Central Valley Sacramento River basin. Portions of the levee systems on the Feather River, Sacramento River, Colusa Basin Drainage Ditch, Yolo Bypass, and the Willow Slough Bypass were damaged during the series of storms that struck Northern California from early January 2017 to March 2017. The proposed action includes several features across the Central Valley of California. Of the initial sites put forward for PL 84-99 assistance, this BO focuses on three sites anticipated to have or will have adverse effects to listed anadromous fishes and their habitats in the Sacramento River basin due to the levee repair construction that must take place.

1.2.1 Reach 0441; Maintenance Area 09

Reach 0441 is part of the Sacramento River Left Bank levee segment, located within Maintenance Area 09 (MA09). Of the nine total sites located within this area, only Site 0441- 23 has potential to impact NMFS ESA-listed species.

Site 0441-23 is approximately 65 feet long and is located between 38.47479, -121.53553 and 38.47473, -121.53516 at River Mile (RM) 48.7 on the Sacramento River. The Corps proposes to install erosion protection (rock) at this site. The excavation repair extents would be verified by a Corps engineer in the field. The site would initially be stripped of organics, and non-soil filled quarry stone would be placed below the water level. The total volume of quarry stone required for the repair is estimated to be approximately 450 cubic yards. Cofferdams would not be used during the construction of this site. Imported soil-filled quarry stone would be placed above the water level so that the stone has three points of contact with other stones. The total volume of soil-filled quarry stone required for the repair is estimated to be approximately 130 cubic yards. There are two large cottonwood trees marking the edges of Site 0441-23. If the two trees cannot be worked around, it is likely that one or both would be removed as part of the project. Impacts to approximately 0.05 acres of salmon habitat below the ordinary high water mark (OHWM) would be mitigated at a 3:1 ratio, or 0.15 acres of revegetation. Revegetation would involve the planting of 10 sandbar willows and 10 arroyo willows. Planting would be spaced in three rows on the constructed riparian bench, approximately 100 square feet in area. Staging, borrow and disposal sites would be determined and approved by the Corps in order to ensure that no additional impacts to habitat would occur.

1.2.2 Reach 0544; Reclamation District 70 and 1660, Sutter Basin North

The Reclamation District (RD) 70 and 1660 - Sutter Basin North levee system consists of five levee segments (approximately 40 miles). The system is located in an unincorporated area in Sutter County, California, and is part of the Sacramento River Flood Control System, within the Sutter Basin North system. Sutter Basin North is encompassed by the Sacramento River to the west, the Sutter Bypass and Butte Slough to the east, and the Tisdale Bypass to the south. The town of Meridian and agricultural lands are located within the basin. The two RD 70 maintained segments are located along the Sacramento River and Butte Slough in the northern portion of the Basin.

Site 0544-11 is located on the Sacramento River between 39.068188, -121.863069 and 39.068228, -121.862669. The Corps proposes to install erosion protection (rock) using imported quarry stone at these sites. The repair extents would be verified by a Corps engineer in the field.

Quarry stone and soil-filled quarry stone would be placed at an approximate 2H:1V slope such that the stone has three points of contact with other stones. Loose material along the face of the slope would be excavated. A 1-foot layer of rip-rap would be placed along the access road bench. The intake and out-take concrete structures would remain in place. Levee erosion protection material placement would take place around the structures.

The total volume of soil-filled quarry stone required to repair both erosion sites is estimated to be approximately 995 cubic yards. Quarry stone (non-soil filled) would be placed below the water level. The total volume of quarry stone required for the repair is estimated to be approximately 1,069 cubic yards. For estimating purposes, a total site length has been assumed to be 125 feet, which includes each erosion location plus a transition zone of 5 feet on each side of the erosion features. Rock would be placed directly in the water. No cofferdams or dewatering actions are anticipated to be used at this site. The approximate impacts due to construction below the OHWM would result in a 3:1 mitigation ratio. Therefore, impacts to approximately 0.1 acres of critical habitat would result in 0.3 salmon credits to be purchased from an approved mitigation bank.

Site 0544-13 is in the Sutter Bypass between 39.145292, -121.842575 and 39.144858, -121.842556. This area encompasses two smaller erosion sites; however, due to the proximity of the two sites they have been combined into one larger site approximately 160 feet long. The Corps proposes to install erosion protection (rock) using imported quarry stone at these sites. The repair extents would be verified by a Corps engineer in the field. Quarry stone and soil-filled quarry stone would be placed at an approximate 1.5H:1V slope such that the stone has three points of contact with other stones. The total volume of soil-filled quarry stone required to repair both erosion sites is estimated to be approximately 468 cubic yards. Quarry stone (non-soil filled) would be placed below the water level. The total volume of quarry stone required for the repair is estimated to be approximately 2,822 cubic yards. For estimating purposes, a total site length has been assumed to be 160 feet, which includes two smaller erosion location plus a transition zone of 10 feet on each side of the erosion features. Rock would be placed directly in the water. No cofferdams or dewatering actions are anticipated to be used at this site.

Construction at Site 0544-13 would involve the removal of approximately six trees located on the levee slope and waterside toe, as well as ruderal herbaceous grasses and forbs. Blackberry, elderberry, and other low shrubs are located adjacent to this site. Most if not all of this vegetation is anticipated to be removed, though some of the larger trees might be worked around depending on site conditions. The approximate impacts due to construction below the OHWM would result in a 3:1 mitigation ratio. Therefore, impacts to approximately 0.12 acres of critical habitat would result in 0.36 acres of revegetation. Revegetation would involve the planting of 32 sandbar willows and 16 arroyo willows. Planting would be spaced in three rows on the constructed riparian bench, approximately 1650 square feet in area. Staging, borrow, and disposal sites have been determined and approved by the Corps.

1.2.3 Avoidance and Minimization Measures

The following avoidance and minimization measures (AMMs) would be implemented by the Corps, its local partners, and/or the construction contractor in order to avoid or minimize project effects on the California Central Valley (CCV) steelhead, Central Valley (CV) spring-run

Chinook salmon, Sacramento River (SR) winter-run Chinook salmon and the southern Distinct Population Segment (sDPS) of North American green sturgeon.

1.2.3.1 Construction AMMs

- To the greatest extent practicable, in-water work in or near habitat for listed salmonids and/or green sturgeon would begin by July and be completed by or before November 1, in years 2019 and 2020, in order to avoid the most active periods of migration and rearing of these species, and to avoid additional rainy season sediment from entering into the river. In the event that in-water work must be completed after November 1, additional coordination with NMFS would be conducted by the Corps.

- All in-water construction activities would be limited to daylight hours, leaving a nighttime period of passage for listed species.

- The removal and disturbance of existing, native riparian vegetation would be minimized to the maximum extent practicable. When permitted by design, riprap would be placed around trees in order to preserve existing vegetation. Where practicable, large vegetation such as trees and large shrubs would be protected in place. Trees would be wrapped in burlap in order to prevent damage during construction activities. Upon completion of construction, the burlap would be removed.

- The placement of filter fabric would be kept to a minimum necessary to facilitate construction. The fabric would only be installed as a barrier between the quarry stone and the soil-filled quarry stone in order to prevent excessive sedimentation during construction. The filter fabric would be a natural fiber mesh that would biodegrade quickly; no plastics are to be used. Additionally, discussions regarding the use of a gravel material in place of the filter fabric are ongoing. A gravel interface between the in-water rock and the soil-filled rock would reduce potential impacts to fish and may result in higher natural recruitment of sediment, which would overall reduce potential impacts to fish species. The use of a gravel layer in construction is pending approval.

Additionally, the following best management practices (BMPs) would be followed during construction of all project sites in or near water:

- If requested, the Corps would participate in a joint onsite inspection with NMFS upon the completion of construction activities to review project effects to EFH.

- The contractor would be responsible for providing erosion and sediment control measures in accordance with federal, state, and local laws and regulations to help ensure compliance with water quality standards. This would be accomplished by installing temporary and permanent erosion and sediment control best management practices. These may include, but are not limited to, vegetation cover, stream bank stabilization, slope stabilization, and silt fences. Any temporary measures would be removed after the area has been stabilized.

- A Corps representative would be identified as the point of contact for any contractor who might incidentally take a listed Chinook salmon, steelhead, or green sturgeon, or find a dead, injured, or entrapped listed Chinook salmon, steelhead, or green sturgeon. This point of contact would be identified to all construction employees during an orientation regarding the potential effects on listed Chinook salmon, steelhead, and green sturgeon. The orientation would be conducted by a qualified fisheries biologist and cover specific information on identification of the subject listed fish species, measures to prevent injury to listed fish, and what to do if any are found in the project area. NMFS would be notified if any listed Chinook salmon, steelhead, or green sturgeon are found dead or injured. Follow-up written notification would include the date, time, and location of the dead or injured specimen, a photograph, cause of injury or death (if known), and name and agency affiliation of the individual who found the specimen.

- Equipment and machinery will be checked daily prior to construction for any leaking lubricants.

- Contractors will be made aware of critical habitat and potential species that may occupy the work area.

1.2.3.2 Compensatory mitigation purchase

To compensate for impacts to salmonids resulting from the proposed set of repairs, off-site mitigation credits for salmon and steelhead would be purchased by the Corps from Bullock Bend Mitigation Bank or Fremont Weir Conservation Bank, both are NMFS-approved conservation banks. The credit purchase is at a 3:1 ratio for impacts to habitat below the OHWM where revegetation is not being proposed. The Corps anticipates 0.1 acre of impacts resulting from material placement below the OHWM at site 0544-11 requiring 0.3 credits of salmon mitigation.

“Interrelated actions” are those that are part of a larger action and depend on the larger action for their justification. “Interdependent actions” are those that have no independent utility apart from the action under consideration (50 CFR 402.02). No other actions have been identified as interrelated with or interdependent to the proposed action under consideration.

1.3 Consultation History

April 1, 2017. A Federal Disaster Declaration was issued by President Trump for thirty-four California counties for the storms and resultant flooding, mudslides, and landslides.

May 30 to June 18, 2017. Site visits were conducted by United States Army Corps of Engineers (Corps) staff to determine habitat value and potential impacts to species.

June 21, 2017. A meeting was held with U.S. Fish and Wildlife Service (USFWS), NMFS, and the Corps to determine a path forward regarding consultation.

June 13 through July 14, 2017. Draft construction designs for sites in seven districts were sent to USFWS and NMFS. Informal discussions regarding potential impacts were discussed.

July 18, 2017. The Corps determined that PL 84-99 Order 1 and 2 sites present an imminent threat to public life and property. A total of 18 sites moved forward for construction in 2017.

August 24, 2017. The Corps initiated Section 7 consultation on 17 critical sites for PL 84-99.

September 5, 2017. USFWS Opinion (08ESMF00-2017-F-2928) received.

September 27, 2017. NMFS Opinion (WCR-2017-7965) received.

October 2, 2017. Contracts for construction of 16 sites in the Sacramento River basin awarded.

October 5-November 28, 2017. Construction conducted at 15 critical sites in the Sacramento River area. Environmental monitoring conducted during construction as applicable.

December 2017-March 2018. Draft construction designs for sites to be constructed in 2018 were sent to USFWS and NMFS. Informal discussions regarding potential impacts were discussed.

August 8, 2018. The Corps reinitiated Section 7 consultation on 16 sites planned to be constructed in 2018 and 2019. Upon request from USFWS, the Corps revised this consultation for only the 8 sites with species impacts planned for construction in 2018. Further discussions with NMFS determined that only those sites with impacts to fisheries species should be considered, and the biological assessment (BA) was to be revised.

October 2018. Due to contract issues, construction was deferred to 2019. Informal discussions with USFWS and NMFS determined that a revised re-initiation of consultation would be the most appropriate approach for 2019 construction. Additionally, the Corps received a withdrawal notification from NMFS based on insufficient information and construction deferred to 2019. One repair site, 1151-12, on the San Joaquin River was completed in 2018.

November 14, 2018. A meeting was held between NMFS and the Corps staff and leadership to discuss the most appropriate path forward. Agreement on an expedited consultation on a subset of waterside sites due to be completed in 2019 or that were completed in 2018, in exchange for increased environmental consideration at the sites. The consultations were divided between the Sacramento and San Joaquin basins for review batching purposes.

March 28, 2019. A letter was received by NMFS from the Corps requesting expedited consultation on the 2018/2019 Sacramento River basin Public Law 84-99 Emergency Levee Repair Sites discussed in this opinion, and included a BA. The Corps identified the proposed action as having adverse effect on:

- California Central Valley (CCV) steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS), threatened, and its critical habitat

- Southern Distinct Population Segment (sDPS) North American green sturgeon (*Acipenser medirostris*), threatened, and its critical habitat

- Central Valley (CV) spring-run Chinook salmon (*O. tshawytscha*) evolutionarily significant unit (ESU), threatened, and its critical habitat

- Sacramento River (SR) winter-run Chinook salmon (*O. tshawytscha*) evolutionarily significant unit (ESU), endangered, and its critical habitat

- Pacific Coast Salmon EFH

April 17, 2019. NMFS reviewed the BA and requested additional information from the Corps via email.

April 23, 2019. The Corps responded via email to NMFS' request with partial information.

April 29, 2019. Site visits were conducted with the project leads from NMFS and the Corps.

May 8, 2019. The Corps informed NMFS that the existing BA considers all sites with potential impacts to species for construction in 2019 and 2020 (a change from construction in 2019 alone).

June 5, 2019. The Corps provided NMFS via email all requested information to initiate consultation.

June 5, 2019. NMFS initiated consultation with the Corps for the 2018/2019 Sacramento River basin Public Law 84-99 Emergency Levee Repair Sites.

June 24, 2019. The Corps verified with NMFS, via email, that 0.3 salmonid credits would be purchased and 0.51 acres would to be revegetated.

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

This BO relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace 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 BO, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the Proposed Action.

- Describe the environmental baseline in the Action Area.

- Analyze the effects of the Proposed Action on both species and their habitat using an "exposure-response-risk" approach.

- Describe any cumulative effects in the Action Area.

- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the Proposed Action poses to species and critical habitat.

- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.

- If necessary, suggest a reasonable and prudent alternative (RPA) to the Proposed Action.

2.1.1 Use of Analytical Surrogates

It is impossible to 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 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 take for this project is an ecological surrogate of habitat disturbance. Descriptions of the habitat disturbance anticipated during the rehabilitation of the levee repair site, including any potential loss of aquatic and riparian habitat and the placement of rock revetment, were provided in the biological assessment.

2.1.2 Mitigation Banks and the Environmental Baseline

Conservation banks present a unique factual situation, and this warrants a particular approach 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 reading of "environmental baseline," might suggest that the overall ecological benefits of the conservation bank actions therefore belong in the environmental baseline. However, under this reading, 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 their unique circumstances. 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 effects of the action. That approach is taken in this BO.

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 conservation 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 conservation value.

Detailed CCV steelhead DPS and critical habitat information:
http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/steelhead/california_central_valley/california_central_valley_steelhead.html

Detailed CV spring-run Chinook salmon ESU and critical habitat information:
http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/chinook/central_valley_spring_run/central_valley_spring_run_chinook.html

Detailed SR winter-run Chinook salmon ESU and critical habitat information:
https://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/chinook/sacramento_river_winter_run/sacramento_river_winter_run_chinook.html

Detailed sDPS North American green sturgeon and critical habitat information:
https://www.westcoast.fisheries.noaa.gov/protected_species/green_sturgeon/green_sturgeon_pg.html

Table 1. Description of CCV steelhead, CV spring-run Chinook salmon, SR winter-run Chinook salmon and sDPS green sturgeon; their current ESA listings, and summaries of their current status.

Species Population	**Listing Classification and Federal Register Notice**	**Population Status Summary**
Steelhead, *Oncorhynchus mykiss*, CCV DPS	Listed as threatened, January 5, 2006 (71 FR 834)	The 2016 status review of the CCV steelhead DPS concludes that the population's status has remained unchanged since the 2011 review, and that the DPS is likely to become endangered in the near future throughout all or a significant portion of its range (NMFS 2016a). Indications suggest CCV steelhead have continued to decrease in abundance and the proportion of natural wild fish in the population has shrank over the past 25 years (Good *et al.* 2005). This may be because most wild CCV populations may lack the resiliency to persist for extended periods when subjected to additional stressors, particularly widespread stressors such as climate change. Additionally, these facts negatively influence the overall genetic diversity of CCV steelhead. 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 of CCV steelhead. Since many of these threats and risks are projected to persist, the threatened status of this DPS is also likely to remain classified as threatened.

Species Population	Listing Classification and Federal Register Notice	Population Status Summary
Spring-run Chinook salmon, *O. tshawytscha*, CV ESU	Listed as threatened, September 16, 1999 (64 FR 50394)	The 2016 status review of the spring-run evolutionarily significant unit (ESU) reported that adult escapement to core spawning creeks had increased since the previous review (NMFS 2016b), however during 2016 – 2018, adult escapement and juvenile production of these creeks sharply declined in these creeks (California Department of Fish and Wildlife (CDFW) 2018). In 2017, the total number of returning adults held just above the trigger abundance number of the high extinction risk category, and by 2018, Mill and Deer Creeks were believed to be heading towards the local extirpation, with less than 500 adults consistently returning. NMFS and CDFW began drafting a CV spring-run Chinook salmon emergency action plan to hopefully prevent this ESU from becoming classified endangered in the next status review (Jahnava Duryea, NMFS Fish Biologist CCV Office, personal communication, December 18, 2018). Then, the Camp Fire erupted in November of 2018, which engulfed the city of Paradise, California, near Butte Creek. The debris and ash resultant from this wildfire is expected to have devastated any spring-run Chinook eggs that were incubating in the Butte Creek stream complex since the fire occurred around and upstream of many important spawning gravel beds, and are expected to result in a total run failure of the 2018 cohort from Butte Creek. In summary, the CV spring-run Chinook ESU is still facing significant extinction risk, which could result in them being moved into a high extinction risk category and reclassified as an endangered species.

Species Population	Listing Classification and Federal Register Notice	Population Status Summary
Winter-run Chinook salmon, *O. tshawytscha*, SR ESU	Listed as endangered, January 4, 1994 (59 FR 440)	The most recent 5-year status review (NMFS 2016b) on winter-run Chinook salmon concluded that the ESU has increased to a high risk of extinction, and several listing factors have contributed to the recent decline, including drought, poor ocean conditions, and hatchery production. The greatest risk factor for winter-run Chinook salmon lies within its spatial structure (NMFS 2011c). The winter-run Chinook salmon ESU is comprised of only one population that spawns below Keswick Dam. The remnant and remaining population cannot access 95 percent of their historical spawning habitat and must therefore be artificially maintained in the upper Sacramento River by spawning gravel augmentation, hatchery supplementation, and regulation of the finite cold water pool behind Shasta Dam to reduce water temperatures. With the single spawning population below Keswick Dam on the mainstem Sacramento River, the overall viability of Sacramento River winter-run Chinook Salmon has declined since the 2010 viability assessment. Large-scale fish passage and habitat restoration actions are necessary for improving the winter-run Chinook salmon ESU viability (NMFS 2016b). Recent jump-start efforts to reintroduce winter-run Chinook salmon to Battle Creek have begun, and expected to continue each year.

Species Population	Listing Classification and Federal Register Notice	Population Status Summary
North American green sturgeon, *Acipenser medirostris*, sDPS	Listed as threatened, April 7, 2006, (71 FR 17757)	The most recent 5-year status review for sDPS green sturgeon found that some threats to the species have recently been eliminated, such as take from commercial fisheries and removal of some passage barriers in critical habitats (NMFS 2015). 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 2018). Although threats due to habitat alteration are thought to be high and indirect evidence suggests a decline in abundance, there is much uncertainty regarding the scope of threats and the viability of population abundance indices. Lindley *et al.* (2007), in discussing listed CV salmonids, states that an ESU (or DPS) represented by a single population at moderate risk of extinction is at high risk of extinction over a large timescale; this would apply to the sDPS for green sturgeon. Since many of the threats cited in the original listing still exist, the threatened status of the DPS is still applicable throughout its range.

Table 2. Description of CCV steelhead, CV spring-run Chinook salmon, SR winter-run Chinook salmon, and sDPS green sturgeon designated critical habitats, and summary of its current status.

Species Critical Habitat	**Designation Date and Federal Register Notice**	**Critical Habitat Status Summary**
CCV steelhead designated critical habitat	September 2, 2005, (70 FR 52488)	Critical habitat designated for CCV steelhead 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. The geographic extent of CCV steelhead critical habitat includes: • Portions of the southern Sacramento-San Joaquin River Delta (Delta); • The stream reaches of the Sacramento, Feather, and Yuba Rivers; and Deer, Mill, Battle, and Antelope creeks in the Sacramento basin; and • The San Joaquin River (SJR) Basin and its tributaries. 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 degraded and provide limited amounts high quality habitat. Passage to historical spawning and juvenile rearing habitat has been largely reduced due to construction of dams throughout the Central Valley. Levee construction has also degraded the freshwater rearing and migration habitat and estuarine areas as riparian vegetation has been removed, reducing habitat complexity and food resources and resulting in many other ecological effects. Although the current conditions of CCV steelhead critical habitat are significantly degraded and reduced, the spawning habitat, migratory corridors, and rearing habitat that remain in the Sacramento-SJR watersheds and the Delta are considered to have high intrinsic value for the conservation of the species.

Species Critical Habitat	Designation Date and Federal Register Notice	Critical Habitat Status Summary
CV spring-run Chinook salmon designated critical habitat	September 2, 2005 (70 FR 52488)	Critical habitat includes the stream channels in the designated stream reaches and the lateral extent as defined by the OHWM. In areas where the OHWM has not been defined, the lateral extent will be defined by the bankfull elevation. Critical habitat for CV spring-run Chinook salmon includes stream reaches of the: • Sacramento, Feather, Yuba and American rivers; • Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks; and • Portions of the northern Delta. 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 CV spring-run Chinook salmon critical habitat are degraded and provide limited amounts high quality habitat. The channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento-San Joaquin system typically have low habitat complexity, low abundance of food organisms, and offer little protection from piscivorous fish and birds. Barriers, which include dams, unscreened or poorly screened diversions, or degraded water quality strongly effect migratory habitat. And, estuarine areas have been severely degraded by altered hydrologic regimes, poor water quality, reductions in habitat complexity, and competition for food and space with exotic species.

Species Critical Habitat	Designation Date and Federal Register Notice	Critical Habitat Status Summary
SR winter-run Chinook salmon designated critical habitat	June 16, 1993 (58 FR 33212)	Critical habitat for SR winter-run Chinook salmon includes the river water, river bottom, and adjacent riparian zone used by fry and juveniles for rearing. It also includes the estuarine water column and essential foraging habitat and food resources used by winter-run as part of their juvenile outmigration or adult spawning migration. Critical habitat was delineated as: • Sacramento River from Keswick Dam at 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. PBFs considered essential to the conservation of the species include: adult migration corridors, spawning habitat, adequate river flows, water temperatures, habitat areas and adequate prey that are not contaminated, riparian and floodplain habitat, and juvenile emigration corridors. Many of the PBFs of SR winter-run Chinook salmon critical habitat are degraded and provide limited amounts high quality habitat. Passage to historical spawning and juvenile rearing habitat has been largely reduced due to construction of barriers along the Sacramento River. Water quality has been affected as a result of urban development, agriculture, and other anthropogenic activities. Water pumping export facilities in the South Delta have disrupted emigration of juveniles by attracting and diverting them to the interior Delta, where they are exposed to increased rates of predation and entrainment. Levee construction has also degraded the freshwater rearing and migration habitat and estuarine areas as riparian vegetation has been removed, reducing habitat complexity and food resources and resulting in many other ecological effects.

Species Critical Habitat	Designation Date and Federal Register Notice	Critical Habitat Status Summary
sDPS green sturgeon designated critical habitat	October 9, 2009, (74 FR 52300)	Critical habitat for sDPS green sturgeon has been designated in marine, estuarine, and freshwater habitats. In freshwater, the geographical range of green sturgeon designated critical habitat includes: • The Sacramento River from the Sacramento I-Street bridge to Keswick Dam, including the Sutter and Yolo bypasses and the lower American River from the confluence with the mainstem Sacramento River upstream to the highway 160 bridge, • The Feather River from its confluence with the Sacramento River upstream to Fish Barrier Dam, • The Yuba River from its confluence with the Feather River upstream to Daguerre Point Dam, and • The Delta (as defined by California Water Code section 12220, except for listed excluded areas). PBFs include the following for both freshwater riverine systems and estuarine habitats: food resources, water flow, water quality, migratory corridor, depth, and sediment quality. Additionally, substrate type or size is also a PBF for freshwater riverine systems. In addition, the PBFs include migratory corridor, water quality, and food resources in nearshore coastal marine areas. Many of the PBFs of sDPS green sturgeon are degraded and provide limited amounts 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 the Sacramento and SJR watersheds, the Delta, and nearshore coastal areas are considered to have high intrinsic value for the conservation of the species.

2.2.1 Climate Change

One major factor affecting the range wide status of all the listed anadromous fishes and their aquatic habitats in the CV at large is global climate change. Central California has shown trends toward warmer winters since the 1940s (Dettinger and Cayan 1995). Temperatures are projected to increase steadily during the century, with a general increase from about 1.6°F in the early 21st century up to almost 4.8°F in the Sierra Nevada Mountains by the late 21st century (Reclamation 2015). The warmer temperatures associated with climate change are expected to reduce snowpack and alter the seasonality and volume of seasonal hydrograph patterns (Cohen *et al.* 2000). These changes in snowpack are partly due to more precipitation falling as rain rather than snow (Dettinger *et al.* 2004, Stewart *et al.* 2004). Total runoff into surface waterbodies is

expected to increase during the fall and winter months rather than the current pattern, and peak runoff timing may shift by more than a month earlier in some water sheds (Reclamation 2015).

The large spring snow water equivalent (SWE) percentage changes, late in the snow season, are due to a variety of factors including reduction in winter precipitation and temperature increases that rapidly melt spring snowpack rather than extending the melting season through the spring into the summer (VanRheenen *et al.* 2004). Factors modeled by VanRheenen *et al.* (2004) show that the melt season shifts to earlier in the year, leading to a large percent reduction of spring SWE (up to 100% in shallow snowpack areas) during critical juvenile anadromous fishes outmigration periods in the CV. Additionally, an air temperature increase of 2.1°C (3.8°F) is expected to result in a loss of about half of the average April snowpack storage (VanRheenen *et al.* 2004). The decrease in spring SWE (as a percentage) would be greatest in the region of the Sacramento River watershed, at the north end of the CV, where snowpack is shallower than in the San Joaquin River watersheds to the south.

Based on an ensemble of climate models, emission scenarios, and a reference temperatures from 1951 to 1980, the most plausible projection for warming in the Northern California is 2.5°C (4.5°F) by 2050 and 5°C by 2100, with a modest decrease in precipitation (Dettinger 2005). An analysis of potential CCV steelhead's response to climate change is not available, but one has been conducted considering Chinook salmon environmental requirements. Projected warming is expected to negatively affect all runs of CV Chinook salmon. Because the runs are restricted to low elevations as a result of impassable rim dams on nearly all major rivers, if the climate warms to 5°C (9°F) or more, it is questionable whether any CV Chinook salmon populations could persist (Lindley *et al.* 2006).

Although the CCV steelhead DPS will likely experience detrimental effects of climate change similar to those projected for all runs of Chinook salmon, as they are also still blocked from the vast majority of their historic spawning and rearing habitat, the effects of climate change may be even greater for CCV steelhead, in some cases. Several studies have found that steelhead require colder water temperatures for spawning and embryo incubation than Chinook salmon (McCullough *et al.* 2001). McCullough *et al.* (2001) recommended an optimal incubation temperature at or below 11°C to 13°C (52°F to 55°F), and successful smoltification in steelhead may be impaired by temperatures above 12°C (54°F) (Richter and Kolmes 2005). Stream temperatures that are currently marginal for spawning and rearing are likely to become too warm to support wild steelhead populations, severely curtailing the range of suitable reproductive habitat for this DPS. Additionally, juvenile steelhead need to rear in freshwater streams for one to two summers prior to emigrating as smolts. In the CV, summer and fall temperatures below the dams in many streams already exceed the recommended temperatures for optimal growth of juvenile steelhead, which range from 14°C to 19°C (57°F to 66°F). As stream temperatures warm beyond current conditions due to climate change, the growth rates of juvenile steelhead could increase in some systems that are currently relatively cold, but potentially at the expense of overall decreases in survival rates due to higher metabolic demands, and greater presence and activity of predators.

Green sturgeon spawn primarily in the summer in the CV; therefore, if water temperatures increase due to climate change, available spawning habitat will be greatly restricted or

eliminated. The Anderson-Cottonwood Irrigation District Diversion Dam (ACID) is considered the upriver extent of green sturgeon passage in the Sacramento River (71 FR 17757; April 7, 2006). The upriver extent of green sturgeon spawning, however, is approximately 30 kilometers downriver of ACID where water temperature is higher than ACID during late spring and summer (Heublein *et al.*, 2008). It is uncertain, if green sturgeon spawning habitat exists closer to ACID, which could allow spawning to shift upstream in response to climate change effects. Water temperatures adjacent to the ACID may remain tolerable for the embryonic and larval life stages, but temperatures at spawning locations lower in the river may be more negatively affected. Successful spawning of green sturgeon in other accessible habitats in the CV (i.e., the Feather River) is limited, in part, by late spring and summer water temperatures (NMFS 2015). Therefore, similar to salmonids in the CV, green sturgeon spawning in tributaries to the Sacramento River is likely to be further limited if water temperatures increase and higher elevation habitats remain inaccessible.

Besides facing straightforward water temperature increases at critical life stages on a region wide scale, there are additional cascading ecosystem effects that can have immediate disturbances with severe consequences on these populations. For example, increases in the frequency, duration, and/or severity of droughts and heat stress caused by climate change are linked to wide-spread increases in tree mortality beyond what would be expected even in areas that are not normally-water limited (Allen *et al.* 2010). Widespread increases in dead trees in forested areas, as well as increases in other factors associated with climate change, greatly increase the risk for wildfires (Abatzoglou and Williams 2016). Wildfire activity in the Western U.S. has increased, with wildfires having longer durations and wildfire seasons lasting longer than they did before mid-1980s (Westerling *et al.* 2006). Several watersheds critical to listed salmonids in the CCV have experienced large, intense forest fires recently, like the Camp Fire as the most recent and most devastating example. The risk of extinction posed by wildfires has already been predicted in the NMFS Recovery Plan (NMFS 2014), especially for ESUs like that of the CV spring-run Chinook salmon ESU, which is largely limited to a single area and therefore extremely vulnerable to extinction from regional catastrophes.

In summary, observed and predicted climate change effects are expected to be generally detrimental to all anadromous species in the CCV as all rely on an abundant supply of cold water at certain and predictable times of the year to successfully spawn and rear (McClure 2011, Wade *et al.* 2013). Unless environmental impacts due to climate changes are offset by improvements in other factors negatively affecting these species, the populations of CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon are likely to decline over time due to the decreases in the functionality of their aquatic habitats. The climate change projections referenced above cover the time period between the present and approximately 2100. While there is uncertainty associated with projections, which increases over the amount of time of the projections, the direction of change is relatively certain (McClure *et al.* 2013) and is expected to intensify the extinction risk of the DPSs and ESUs covered in this opinion.

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).

This action area is associated with the individual sites (Site 0441-23/SR, Site 0544-11/SR, and Site 0544-13/Sutter Bypass) as described in Section 1.2, including the direct construction areas, the staging areas, any borrow and disposal sites, and any associated haul routes, as well as the waterways impacted by the proposed action. Many of the staging, borrow, and disposal sites have not yet been determined; however, all sites associated with the individual construction sites would be selected in a manner that would avoid additional impacts to species and other resources.

For projects with in-river construction activities, such as installation of riprap, the downstream extent of the action area is defined by the distance of potential increased turbidity and sediment deposition. Based on turbidity measurements taken during construction for similar bank stabilization projects performed by the Corps, turbidity impacts for the proposed repairs are expected to occur up to 100 feet from the shoreline and up to 400 feet downstream of any in-river construction activities. The levee repairs themselves will be approximately 350 feet in length.

Since the proposed action includes the purchase of mitigation credits from a conservation bank, the action area also includes the areas affected by the mitigation bank that has service areas relevant to the project and which has been selected to purchase credits from. This includes the Bullock Bend Mitigation Bank. The Bullock Bend Mitigation Bank is an approximately 120 acre site in the Sacramento River in Yolo County, approved to offer riparian and salmonid preservation credits (Westervelt 2019).

2.4 Environmental Baseline

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 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The environmental baseline describes the status of listed species and critical habitat in the action area, to which we add the effects of the proposed erosion repair, to consider the effects of the proposed Federal actions within the context of other factors that impact the listed species. The effects of the proposed Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the status of listed species and for non-Federal activities in the action area, those actions that are likely to affect listed species in the future, to determine if implementation of the proposed erosion repair is likely to cause an appreciable reduction in the likelihood of both survival and recovery or result in destruction or adverse modification of critical habitat.

2.4.1 Sacramento River

The action area within the Sacramento River functions primarily as a rearing and migratory habitat for SR winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. The southern DPS of North American green sturgeon uses the area as a migration corridor for juveniles and adults. Holding post-spawn green sturgeon adults and rearing juveniles may utilize the area on their way to the estuary. Due to the life history timing of winter- and spring-run

Chinook salmon, steelhead and North American green sturgeon, it is possible for one or more of the following life stages to be present within the action area throughout the year: adult migrants, spawners, rearing juveniles, or emigrating juveniles.

The action area is within designated critical habitat for SR winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. Habitat requirements for these species are similar. The PBFs of salmonid habitat within the action area include: freshwater rearing habitat and freshwater migration corridors. The essential features of these PBFs include adequate substrate, water quality, water quantity, water temperature, water velocity, shelter, food, riparian vegetation, space, and safe passage conditions. The intended conservation roles of habitat in the action area is to provide appropriate freshwater rearing and migration conditions for juveniles and unimpeded freshwater migration conditions for adults. However, the conservation condition and function of this habitat has been severely impaired through several factors, discussed in more detail in the Status of the Species and Critical Habitat section of this BO. The result has been the reduction in quantity and quality of several essential features of migration and rearing habitat required by juveniles to grow and survive. In spite of the degraded condition of this habitat, the intrinsic conservation value of the action area is high as it is used by all Federally listed salmonids in the Central Valley.

The action area is also within designated critical habitat for Southern DPS of the North American green sturgeon. PBFs for sDPS green sturgeon within freshwater riverine systems include food resources, substrate type/size, flow, water quality, migration corridor free of passage impediments, depth (holding pools), and sediment quality. As is the case with salmonids, PBFs in the area been severely impaired through several factors (discussed in more detail in the Status of the Species and Critical Habitat section this BO). However, utilization of the area by several green sturgeon life stages means the habitat is still of high conservation value.

2.4.2 The Sutter Bypass

Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon also have the potential to inhabit the action area of the Sutter Bypass. Sacramento River winter-run Chinook salmon likely only use the Sutter Bypass as juvenile downstream migrants when high flows occur. Other salmonids use the Sutter Bypass as a migration corridor to and from spawning grounds located upstream in the Butte Creek System. sDPS green sturgeon and SR winter-run Chinook salmon do not spawn in Butte Creek but are present in the system because of the Sutter Bypass' hydrologic connection to the Sacramento River during high flows. The Bypass allows channeling of escapement flow of the Sacramento River from the Tisdale Weir near the Sutter Buttes to the Feather River. During Sacramento River flows greater than 23,000 cubic feet per second (650m /s), Sacramento overflow tops the 53 foot (16m) Tisdale Weir and flows via the Sutter Bypass to Feather RM 7 (the west levee of the bypass continues along the Feather River to the Sacramento River). The Bypass also receives similar Sacramento escapement flow from the Colusa Weir, the Snake River, Gilsizer Slough, Wadsworth Canal, and other west side watercourses of the Lower Feather Watershed (Corps 2019). When this occurs, fish from the Sacramento River may enter the Sutter Bypass.

The Sutter Bypass offers excellent rearing habitat for anadromous fish when it is flooded. After floodwaters recede, water temperatures begin to increase, reducing the quality of habitat for special-status fish species. An important feature of the Sutter Bypass is the multiple migration pathways through the Sutter Bypass that are available to anadromous fish species.

CV spring-run Chinook salmon and CCV steelhead adults use the Sutter Bypass in the winter months primarily for upstream migration to spawning habitat. Juvenile salmonids use the Sutter Bypass for rearing and downstream migration to the Sacramento River, then to the ocean.

2.4.3 Factors Affecting the Species in the Action Area

The flows in the action area have been highly modified through dams and the export of water from upstream areas and the delivery of water to downstream areas. Dams are considered a major cause of the widespread decline of CV salmonids. Lindley *et al.* (2006) estimated that 80 percent of historically available steelhead habitat has been lost to impassable dams. The construction of Keswick and Shasta dams (upstream of the action area) in the 1940s blocked access to historical spawning and rearing habitat, which is no longer accessible to anadromous fish. Winter-run Chinook salmon have lost access to historical habitat in the Upper Sacramento River (upstream of Shasta Dam), the McCloud River, and the Pit River. This blockage merged at least three independent winter-run Chinook populations into a single population, resulting in a substantial loss of abundance, genetic diversity, life history variability, and local adaptation.

The Redd Bluff Diversion Dam (RBDD) (also upstream of the action area) historically created impediments to fish passage by utilizing gates to divert water for agriculture and urban uses. RBDD has impaired passage to upstream migrating adults and out-migrating juveniles, and the dam's lighting system attracted predatory fish that were responsible for devouring many out-migrating juveniles. The gates have remained open since 2012, however, to allow passage for green sturgeon and anadromous individuals (USFWS 2014).

The river and river bank in the action area have been subject to many changes over the years. The construction of the massive levee system in the Central Valley in the 19th and early 20th centuries to prevent flooding of agricultural fields was historically the biggest impact agriculture had on salmonids. Levee development in the Central Valley affects PBFs including: spawning habitat, freshwater rearing habitat, freshwater migration corridors, and estuarine habitat. Except in a few places such as Yolo and Sutter bypasses, levee building on the Sacramento River has prevented Chinook salmon and steelhead juveniles from accessing these habitats.

Floodplains and backwater habitat are important for rearing juveniles. Sommer *et al*. (2001), Jeffres *et al.* (2008), and Katz *et al.* (2017) indicate significantly higher growth rates for juvenile Chinook rearing on floodplains as opposed to those rearing in riverine habitats. Hill and Webber (1999) found juvenile CV spring-run Chinook rearing on the Sutter Bypass will likely emerge from that habitat nearly double their size at emigration from Butte, Mill, and Deer Creeks. This significant weight increase in the floodplain habitats is directly tied to increased survival at sea (Williams 2006).

Flooding events in the winter of 2016-17 have also impacted survival of ESA listed salmonids, and adversely impacted the designated critical habitat within the action area. The high flows coupled with reduced amount of floodplains resulted in juvenile salmonids being stranded, eggs being scoured out of the gravel, and juvenile fish prematurely being moved downstream. The high flows have resulted in erosion of the river banks and high loads of sediment being deposited into the rivers. The adverse effects of the high flows in the winter of 2016-17, coupled with the drought conditions from 2012 through 2016, have likely impacted the recovery of ESA listed salmonids. It is likely that the numbers of ESA listed salmonids has declined, and the critical habitat has degraded in the Sacramento, Feather and Yuba rivers since the most recent status reviews for SR winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead. At this time, it unclear if there were adverse impacts to green sturgeon, due to the high flows. Adult green sturgeon were present in the Sacramento, Feather and Yuba rivers in 2017.

2.4.4 Mitigation Banks and the Environmental Baseline

There are two conservation or mitigation banks approved by NMFS with service areas that include the action area considered in this BO. Both of these banks occur within critical habitat for SR winter-run Chinook salmon, CV spring-run Chinook salmon and 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 Sacramento River 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 15.6 of 100 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this BO.

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 Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon and CCV steelhead. There are salmonid floodplain restoration, salmonid floodplain enhancement and salmonid riparian forest credits available. To date, there have been 12.5 of 119.65 credits sold and the ecological value (increased rearing habitat for juvenile salmonids) of the sold credits are part of the environmental baseline. All features of this bank are designated critical habitat for the species analyzed in this BO.

2.4.5 NMFS Recovery Plans

2.4.5.1 NMFS Salmon and Steelhead Recovery Plan Action Recommendations

The NMFS Recovery Plan that includes SR winter-run Chinook, CV spring-run Chinook salmon, and CCV steelhead (NMFS 2014) identifies recovery goals for Sacramento River area

populations that include the proposed action area. Recovery efforts focus on addressing several key stressors that are vital to CV salmonids: (1) adverse water temperatures affecting adult migration and holding; (2) passage impediments; (3) physical habitat alteration; and (4) harvest in the sport fishery and poaching.

Recovery actions identified in the recovery plan that are relevant to this consultation include:

1. Restore and maintain riparian and floodplain ecosystems along both banks of the Sacramento River;
2. Ensure that river bank stabilization projects along the Sacramento River utilize biotechnical techniques;
3. Provide and/or improve fish passage through the Sutter Bypass allowing for improved adult salmonid re-entry into the Sacramento River; and
4. Develop and implement State and National levee vegetation policies to maintain and restore riparian corridors.

2.4.5.2 NMFS sDPS of North American Green Sturgeon Recovery Plan Action Recommendations

The most important recovery efforts in the NMFS Recovery Plan for sDPS green sturgeon focus on the Sacramento River Basin and San Francisco Bay Delta Estuary environments, as threats in spawning and rearing habitats were considered the greatest impediments to recovery (NMFS 2018). Key stressors that are vital to sDPS green sturgeon in the Sacramento River Basis are listed as: (1) altered water flows; (2) barriers to migration; (3) altered water temperature; (4) predation: and (5) non-point and point source contaminants.

Recovery actions identified in the sDPS green sturgeon recovery plan that are relevant to this consultation include:

1. Until the Fremont Weir (Yolo Bypass) and Tisdale Weir (Sutter Bypass) are improved structurally to reduce stranding and to provide passage, ensure that any stranded green sturgeon are immediately relocated to the Sacramento River;
2. Construct a structure that will provide volitional passage for upstream migrating adults at Fremont and Tisdale weirs;
3. Develop temperature and flow targets in accessible spawning, incubation, and rearing habitat through long-term monitoring of spawning, larvae, and juvenile distribution and recruitment;
4. Identify current and proposed water diversions posing significant risk to green sturgeon; and
5. Improve compliance and implementation of Best Management Practices (BMPs) to reduce input of point and non-point source contaminants within the Sacramento River Basin and San Francisco Bay Delta Estuary.

2.4.6 Climate Change Impacts in the Action Area

Information discussed above in section 2.2.1 indicates that listed salmonids and green sturgeon in the action area have already experienced some impacts from climate change. In the future,

impacts in the action area from climate change are likely to increase as air and water temperatures warm and precipitation rates change. Thus, for long-term actions, we can no longer assume current environmental variability adequately describes environmental baseline conditions. Based on the likely climate change impacts, NMFS assumes that the action area will be less suitable for listed salmonids and green sturgeon by the latter half of this century, absent efforts to improve habitat conditions and increase resistance and resiliency to climate change impacts.

2.5 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

2.5.1 Direct and indirect effects to species

Construction activities have the potential to introduce noise, vibration, artificial light, and other physical disturbances into the immediate environment in and around the construction zone that can result in the harassment of fish by disrupting or delaying their normal behaviors and use of areas, and in extreme cases causing injury or mortality, directly or indirectly. The potential magnitude of effects depends on a number of factors, including type and intensity of disturbance, the proximity of disturbance-generating activities to the water body, the timing of the activities relative to the use and occurrence of the sensitive species in question, the life stages of the species affected, and the frequency and duration of disturbance periods. In the context of the proposed levee repairs, the use of the area by adult and juvenile salmonids and green sturgeon are expected to be adversely affected by various construction-related effects.

Fish are expected to exhibit avoidance movements near construction activities that will displace them from locations they would normally occupy due to the noise generated by the operation of construction machinery or movement of soils and rocks during earthwork and riprap placement periods. Depending on the innate behavior that is being disrupted, direct and indirect adverse effects could be varied. An example of a significant, direct adverse effect would be cessation or alteration of migratory behavior of both juveniles and adults. For juvenile fish, an additional effect may include alteration of behaviors that are essential to their maturation and survival, such as feeding or sheltering. Fish vacating protective habitat due to disturbance are expected to experience increased predation rates and decreased survival rates compared to those left undisturbed.

The movement of materials and soils both below the OHWM and along the river banks/levee tops is likely to mobilize sediment and increase the likelihood of erosion, possibly sending it into associated waterways at elevated rates, unless sufficiently controlled. Numerous erosion and sediment control BMPs will be implemented during construction. With the implementation of erosion/sedimentation control measures onsite, project-related soil/sediment mobilization is expected to be sufficiently controlled, and direct adverse effects to listed fishes from in-water turbidity increases are expected to be minor.

The proposed in-water work window of July 1st through November 1st is expected to greatly reduce the possibility of listed fishes using or occupying the nearby waterways due to their natural life history patterns and use periods. Also, the daily work window of daylight hours only further minimizes impact of construction activities on peak fish movement periods in the nearby waterways. However, these two avoidance tactics do not completely remove the potential for listed anadromous fishes to occur in the action area while construction is ongoing. Though the work window period largely avoids the expected peaks of migration and use timing for all species, adult green sturgeon may be using the waterways throughout the entire work window, if water flows and temperatures remain suitable in the action area. Any harassment and adverse effects associated with general construction activities will persist only as long as construction is ongoing.

As part of the proposed construction activities, Riprap/revetment will be removed and then replaced to protect and stabilize the already leveed banks of the Sacramento River and Sutter Bypass. A total of 0.27 acres of habitat below to OHWM will be covered with new riprap along 350 feet of levee. When hard revetment or riprap is installed on stream banks, it removes the ability of shallow water habitat at the water/land interface to provide refugia and feeding opportunities for rearing salmonids, and reduces the total amount of riparian vegetation that can establish this zone, it changes the prey base through alteration of the benthic substrate type and local water dynamics, and it provides ambush habitat for (often) non-native piscivorous fishes. Therefore, the habitat changes associated with the repair and replacement of riprap/hard revetment are expected to have a negative impact on juvenile SR winter-run Chinook, CV spring-run Chinook, CCV steelhead survivorship and growth in the action area over the long term. We expect there to be adverse effects along 350 feet (0.27 acres) of shoreline below the OHWM for a period of at least 50 years, which is the standard engineered life expectancy of a levee repair project.

Adult CCV steelhead, SR winter-run Chinook, and CV spring-run Chinook salmon are not expected to be negatively affected by the placement of riprap, as they are not reliant on margin habitat for foraging or refuge, though its placement discourages the establishment of large, overhanging trees that would otherwise be beneficial to migrating adult salmonids by providing a resting location.

sDPS green sturgeon are also expected to experience negative effects and decreased fitness from the placement of riprap/hard revetment through decreases in local benthic prey abundance. Green sturgeon are bottom feeders heavily reliant on prey items that live on or in soft sediments, and increases in hard surfaces below the water line effectively decreases the amount of area available for them to forage and feed.

2.5.2 Effects to critical habitat

The levee repair is located within critical habitat for SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and sDPS green sturgeon. The repair is expected to cause a reduction in critical habitat by installing rock revetment. Stabilizing a streambank with rock or other hard structures will result in continued fragmentation of existing habitat and conversion of nearshore aquatic to simplified habitats that have adverse effects on salmonids and green sturgeon. The act of bank stabilization is also expected to negatively impact critical habitat by

preventing normal stream processes from occurring, such as natural channel braiding, and erosion and deposition cycles, which would otherwise eventually create habitat complexity that supports rearing salmonids.

This project is expected to adversely impact several of the PBFs of critical habitat, including freshwater rearing habitat and migration corridors for juvenile salmonids. Implementing the proposed repair may affect freshwater rearing sites due to the installation of riprap and vegetation removal, which reduces natural cover and support of juvenile growth and mobility. The PBFs of migratory corridors for adults is not expected to be impacted, as migrating adult salmonids are unlikely to use the nearshore habitat that will be affected by the project, since they tend to stay in deeper waters. No spawning habitat for SR winter-run Chinook, CV spring-run Chinook, and CCV steelhead is present in the action area, therefore no adverse effects to spawning adults or incubating eggs are expected.

The project is expected to adversely impact several of the PBFs of critical habitat for sDPS green sturgeon, including food resources and substrate. The PBF of food resources, which refers to the availability of prey items for juvenile, sub-adult, and adult life stages, is expected to be adversely affected by the installation of 0.27 acres of rock revetment at the levee repair sites. The installation of rock revetment below OHWM will impair green sturgeon foraging habitat, thereby reducing the availability of prey. Similarly, the PBF of sediment quality will also be adversely affected, as part of the natural substrate will be permanently covered with large rocks and will no longer be available as foraging habitat. The levee repair is not expected to permanently impact the PBFs of water flow or water quality, migration corridors (*i.e.*, pathways necessary for the safe and timely passage of all life stages), or depth (*i.e.*, availability of deep pools for use as holding habitat), since the site will not install any features that are expected to block or impede juvenile or adult migration, alter any deep pools, or permanently alter water quality. No spawning habitat for green sturgeon is present in the action area, therefore no adverse effects to spawning adults or incubating eggs are expected.

Site preparation is required for the levee repairs, and will likely occur early in the work window periods. It includes some vegetation removal and soil excavation. Beyond the disruption of normal fish behavior as associated with general construction described above, the decreases in riparian vegetation will create changes to important attributes of PBFs and essential features of critical habitat, which cumulatively are expected to decrease the functionality of the riparian habitat and negatively affect the survivorship of juvenile salmonids using the area (Bjornn and Reiser 1991). Changes in vegetative cover can influence the macroinvertebrate prey assemblage through alterations in shading, water temperatures, and nutritive inputs to an aquatic habitat and prey web less supportive of juvenile salmonid growth (Meehan *et al.* 1977). Removal of riverine vegetation near or at the water line reduces the natural cover that was previously available on site and reduces the general habitat complexity that would otherwise be beneficial to salmonid freshwater rearing and juvenile freshwater migration PBFs.

Modifications may be short-term (e.g., during construction) or long-term. The short-term removal of riparian vegetation may reduce prey availability and increase predation due to reduced cover. In addition, removal of vegetation, especially riparian shade trees, may remove thermal refugia and result in an incremental increase in water temperature. The long-term

removal of riparian vegetation could result in reduced in-stream habitat quality and riparian habitat complexity, increased water temperatures, decreased trophic input from terrestrial sources, decreased floodwater and stormwater attenuation, and increased potential for erosion and sedimentation in the cleared riparian areas. Higher water temperatures can cause stress to anadromous fish and allow warm water fish species, which may compete with or prey upon salmonids, to establish residence (McCullough *et al.* 2001).

Furthermore, the removal of riparian vegetation can reduce the amount of large woody debris that enters into aquatic habitat. Large woody debris in the stream helps retain gravel for spawning habitat, create pools and habitat complexity, provide long-term nutrient storage and substrate for aquatic invertebrates that listed fish may prey upon, and provide refuge for fish and prey during high- and low-flow periods (Spence *et al.* 1996).

The likelihood and severity of these effects related to riparian habitat removal is largely dependent on the quality and quantity and nature of riparian habitat affected. The potential for such effects occurring increases as the size of riparian habitat affected increases. The proposed project may require the trimming or removal of riparian vegetation at sites 0544-13 and 0441-23. In addition to ruderal herbaceous grasses and low shrubs, approximately 6 trees located on the levee slope and waterside toe are likely to be removed at site 0544-13, and two large cottonwood trees are likely to be removed at site 0441-23. The Corps proposes to minimize the removal and disturbance of existing, native riparian vegetation to the maximum extent practicable and re-plant any riparian vegetation onsite that will be removed. Any bare topsoil will be seeded with native grasses to control onsite erosion after construction is complete. Additionally, repairs involving a quarry stone/soil mixture may eventually re-vegetate naturally over time. The interim period of regrowth, however, is expected to result in the short-term adverse effects described above to the rearing and migratory corridor PBFs of designated critical habitat.

2.5.3 Mitigation credit purchase

At locations where the re-planting of removed vegetation may be deferred, the Corps intends to offset the long-term negative effects to critical habitat functionality associated with the levee repair project by purchasing mitigation credits from a NMFS-approved bank that offers salmonid credits, which also contains the action area in the bank's service area. This purchase will ensure that the ESA-listed, CV salmonids will receive benefits through the restoration and preservation of accessible riparian habitat and rearing habitat elsewhere in their critical habitat range though the repair project will cause negative impacts locally. There remains some question whether the sDPS of green sturgeon will benefit to the same degree as salmonids might from any mitigation credit purchase that target salmonid habitat offsets. Since green sturgeon have historically used many of the same waterways as steelhead and Chinook salmon, and Bullock Bend Mitigation Bank is located in green sturgeon designated critical habitat, individual green sturgeon are also expected to experience some amount of positive increase in freshwater habitat functionality from the mitigation credit purchases. These benefits to individuals of each listed species are expected to be provided in perpetuity.

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). 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 Aquaculture and Fish Hatcheries

More than 32-million fall-run Chinook salmon, 2-million spring-run Chinook salmon, 1-million late fall-run Chinook salmon, 0.25-million winter-run Chinook salmon, and 2-million steelhead are released annually from six hatcheries producing anadromous salmonids in the CV. All of these facilities are currently operated to mitigate for natural habits that have already been permanently lost as a result of dam construction. The loss of this available habitat results in dramatic reductions in natural population abundance which is mitigated for through the operation of hatcheries. Salmonid hatcheries can, however, have additional negative effects on ESA-listed salmonid populations. The high level of hatchery production in the CV can result in high harvest-to-escapements ratios for natural stocks. California salmon fishing regulations are set according to the combined abundance of hatchery and natural stocks, which can lead to over-exploitation and reduction in the abundance of wild populations that are indistinguishable and exist in the same system as hatchery populations. Releasing large numbers of hatchery fish can also pose a threat to wild Chinook salmon and steelhead stocks through the spread of disease, genetic impacts, competition for food and other resources between hatchery and wild fish, predation of hatchery fish on wild fish, and increased fishing pressure on wild stocks as a result of hatchery production. Impacts of hatchery fish can occur in both freshwater and the marine ecosystems. Limited marine carrying capacity has implications for naturally produced fish experiencing competition with hatchery production. Increased salmonid abundance in the marine environment may also decrease growth and size at maturity, and reduce fecundity, egg size, age at maturity, and survival (Bigler *et al.* 1996). Ocean events cannot be predicted with a high degree of certainty at this time. Until good predictive models are developed, there will be years when hatchery production may be in excess of the marine carrying capacity, placing depressed natural fish at a disadvantage by directly inhibiting their opportunity to recover (NPCC 2003).

2.6.2 Increased Urbanization

Increases in urbanization and housing developments can impact habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased growth 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 which 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 also is expected to result in increased recreational activities in the region. Among the activities expected to increase in volume and frequency is recreational boating. Boating activities typically result in increased wave action and propeller wash in waterways. This potentially 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 re-suspension of 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 riprap projects. Depending on the scope of the action, some non-Federal riprap projects carried out by state or local agencies do not require Federal permits. These types of actions and illegal placement of riprap occur within the Sacramento River watershed. For example, most of the levees have roads on top of the levees which are either maintained 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 BO 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 diminishes the value of designated or proposed critical habitat for the conservation of the species.

The action area for this project includes sites throughout the lower portion of the Sacramento River Basin, and contains the following listed species: North American green sturgeon sDPS, CCV steelhead DPS, SR winter-run Chinook salmon ESU, and CV spring-run Chinook salmon ESU. As described in the Status of the Species (Section 2.2), populations of the above listed species have all experienced significant declines in abundance and available habitat in California, relative to historical conditions. The current status of listed species within the action area, based on their risk of extinction, has not significantly improved since their listing (see Section 2.2), and the severe decline in populations of listed species, coupled with the degraded

environmental baseline (Section 2.4), demonstrates the need for actions that will assist the recovery of all ESA-listed species in the action area. According to the most recently released status review for listed salmonids, most salmonid species in the action area have experienced little to no change in extinction risk since the previous status reviews, but climatic conditions in California in recent years have increasingly contributed to negative impacts encountered by such species. Climatic conditions in the past few years have caused exceptionally high air, stream, and upper-ocean temperatures, which have all had negative effects on all freshwater, estuary, and marine phases for many populations of Chinook salmon and steelhead (Williams *et al*. 2016). If actions are not taken to reverse current trends, the listed species in the program action area will continue to be at risk.

Currently, accessible aquatic habitat throughout the action area has been severely degraded, and the condition of PBFs of designated critical habitats, specifically their ability to provide for long-term conservation, has also been degraded from conditions known to support viable populations. The flows in the action area have been highly modified through dams and the export of water from upstream areas and the delivery of water to downstream areas. Agriculture in the Central Valley degraded valuable habitat through the construction of the massive levee system in the 19th an early 20th centuries. Today, these problems are further exacerbated by climatic conditions, including below average precipitation, high surface air temperatures and low snowpack. While historically salmonids have been able to adapt to changing climatic conditions, their ability to do so now is quite limited due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation (Williams *et al*. 2016). Cumulative effects (described in Section 2.6) are likely to add to these effects on salmon, steelhead, and green sturgeon population abundance, productivity, and spatial structure. A proposed action that maintains the status quo of the ubiquitous leveed river systems that were historically vast floodplains will only perpetuate the degraded nature of the habitat used by listed anadromous fish.

The proposed action involves construction work within critical habitat for listed species of sDPS green sturgeon, CCV steelhead, SR winter-run Chinook salmon, and CV spring-run Chinook salmon, which is expected to further degrade habitat of each species. Implementation of the project is expected to disturb up to 0.27 acres of aquatic habitat through the placement of riprap below the OHWM along 350 feet of levee, potentially affecting all listed species and their critical habitat. Implementation of these levee repairs has the potential to subject the species to an elevated exposure risk for a range of direct and indirect effects, described in section 2.5. Adverse effects to species and their critical habitat are expected in the form of short-term behavioral changes, increased predation rates, and decreased survivorship. Fish are expected to exhibit avoidance movements near construction activities that will displace them from locations they would normally occupy. Increases in erosion, turbidity, and sedimentation are expected to lead to temporary displacement from or avoidance of preferred rearing areas. Riparian habitat removal is expected to reduce prey availability, increase predation due to reduced cover, and reduce thermal refugia. And, the installation of riprap/revetment is expected to increase predation rates by providing ambush habitat for predatory fish, decrease margin shallow habitat essential for juvenile salmonid growth and mobility, and decrease adult and juvenile green sturgeon foraging habitat.

Proposed avoidance and minimization measures, however, within the project are expected to significantly reduce the potential risk and/or degree of impact for many of these effects. Also, the direct exposure experienced by a low number of individuals is expected to be temporary during construction and will cease once the levee repairs are complete.

The Corps' mitigation credit purchase is expected to offset impacts by providing benefits to the CCV steelhead DPS, SR winter-run Chinook salmon ESU, and the CV spring-run Chinook salmon ESU by improving riverine or floodplain habitat conditions elsewhere through restoration and ensuring their preservation into the future. The sDPS of North American green sturgeon are also expected to benefit to a lesser degree from these purchases, as long as sturgeon may access the waterways of the mitigation bank. The benefits offered to these populations are expected to exist in perpetuity.

Adding together all of the adverse and beneficial effects associated with this proposed action, the environmental baseline, and the cumulative effects; and taking into account the status of the species and critical habitat in the action area, the proposed levee repairs are not expected to appreciably reduce the likelihood of survival or recovery of the listed species examined in the opinion, because it is anticipated only a few individuals of each population will experience severe adverse effects from the implementation of the project, and the habitat related impacts to the populations are similar to the status quo (i.e., not individually responsible for the populations' decline and suppression). Though adverse habitat effects will continue into the future, the potential reduction in numbers is anticipated to be small compared to the total populations over their entire range.

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 interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of sDPS green sturgeon, CCV steelhead, SR winter-run Chinook salmon, and CV spring-run Chinook salmon or destroy or adversely modify their 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

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

NMFS anticipates incidental take of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the sDPS green sturgeon in the action area through alteration of habitat conditions in a manner that is expected to disrupt normal behavior. Because of proposed project timing, actual numbers of fish adversely affected are expected to be low. 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 due to the variability and uncertainty associated with the long-term 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 harassed, 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 adverse effects to listed species, 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 aquatic habitat degradation, through the placement of rock revetment below the OHWM. The behavioral modifications or fish responses that result from the habitat disturbance are described below. NMFS anticipates incidental take will be limited to the following forms:

1. Take in the form of harm to rearing juvenile SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and adult and juvenile sDPS green sturgeon from the placement of 0.27 acres of riprap below to OHWM along 350 feet of levee. This loss will affect juvenile listed anadromous fish, as well as adult sDPS green sturgeon through displacement, increased predation, and loss of food, resulting in decreased growth and survival for a period of up to 50 years, which is the standard engineered life expectancy of rock revetment placed on a levee project.

2. Take in the form of short-term harassment to rearing juvenile SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and adult and juvenile sDPS green sturgeon is expected through impairment or alteration of essential behavior patterns relating to migration, rearing, feeding, and sheltering during general construction activities within the footprint of the levee repairs.

Incidental take will be exceeded if the amount of habitat disturbance described in the surrogate is exceeded.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

1. Measures shall be taken by the Corps, its applicant, or their contractors, to minimize the extent of take of CCV steelhead, SR winter-run Chinook salmon, CV spring-run Chinook salmon, and sDPS green sturgeon, related both to direct and indirect adverse effects of the action, as discussed in this opinion.

2. Measures shall be taken to minimize the impacts of bank protection by implementing integrated onsite conservation measures that provide beneficial growth and survival conditions for juvenile salmonids, and the sDPS of North American green sturgeon.

3. Measures shall be taken to ensure that contractors, construction workers, and all other parties involved with these projects implement the projects as proposed in the biological assessment and this BO.

4. The Corps, its applicant, or their contractors shall prepare and provide NMFS with updates, reports, and monitoring plans concerning the proposed levee repairs, as they relate to:

    a. The implementation and performance of onsite AMMs and BMPs that help to achieve RPMs 1 & 2.

    b. The invoice associated with the proposed mitigation bank purchases concerning NMFS species made by the Corps or its applicants for this project.

2.9.4 Terms and Conditions

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

1. The following terms and conditions implement RPM 1:

    a. The in-water construction work window shall be limited to July 1st through November 1st.

    b. Daily construction work hours shall be limited to 0800 to 1800 hours or one hour after sunrise to one hour before sunset.

2. The following terms and conditions implement RPM 2:

a. The Corps shall minimize the removal of existing riparian vegetation and instream woody material (IWM) to the maximum extent practicable, and where appropriate, removed IWM shall be anchored back into place. The trunks of trees left in place shall be protected from construction damage by wrapping them with coir fiber, jute fabric, 2X4s or other mechanisms that prevent trunk damage while minimizing the risk or levee scour.

b. Disturbed and bare topsoil shall be reseeded with native grasses to reduce erosion after levee repair is complete.

c. Soil mixtures shall be placed to facilitate re-vegetation at the levee repairs sites.

d. Placement of filter fabric shall be kept to a minimum and filter fabric shall be a natural, biodegradable mesh fiber, not made of plastic.

e. Riprap and hard slope protection installation shall be not exceed the spatial extent that existed at the repair locations before the levees were damaged.

f. An in-river turbidity curtain shall be installed and assessed regularly to ensure its ability to control and contain project-related sediment disturbance and mobilization during rock/slope protection placement activities.

g. The Corps and its contractors shall follow and remain in compliance with all federal, state, and local laws and regulations relating to erosion and sediment control by:

    i. Installing and checking temporary and permanent erosion/sediment control BMPs onsite (temporary measures shall be removed after the area is stabilized and construction is complete).

    ii. A stormwater protection plan shall be created to control and treat project-created stormwater during the construction period, kept onsite, and referenced periodically to ensure proper execution onsite.

3. The following terms and conditions implement RPM 3:

    a. The Corps shall provide a copy this BO to the prime contractor, making the prime contractor responsible for implementing all requirements and obligations included in these documents and to educate and inform all other contractors involved in the project as to the requirements this BO. A notification that contractors have been supplied with this information will be provided to the reporting address below.

    b. A NMFS-approved Worker Environmental Awareness Training Program for construction personnel shall be conducted by the NMFS-approved biologist for all construction workers prior to the commencement of construction activities. The program shall provide workers with information on their responsibilities with regard to Federally-listed fish, their critical habitat, an overview of the life-history of all the species, information on take prohibitions, protections afforded these

animals under the ESA, and an explanation of the relevant terms and conditions of this BO. Written documentation of the training must be submitted to NMFS within 30 days of the completion of training.

4. The following terms and conditions implement RPM 4:

    a. Updates, reports, and monitoring plans relating to RPM 3a shall be provided to NMFS by the end of the fiscal year in which the levee repair was complete.

    b. The Corps or its applicants shall provide NMFS with the invoice(s) associated with the mitigation bank purchase(s) of compensatory credits proposed to offset the impacts of the levee repairs, after the transactions are complete, within one year following levee repair.

    c. Reports and updates required by these terms and conditions shall be sent to:

    Erin Strange
    San Joaquin River Basin Branch Chief
    NOAA Fisheries
    Capitol Mall, Suite 5-100,
    Sacramento, California 95814
    erin.strange@noaa.gov

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).

- Fill voids in riprap/revetment placed below the OHWM with native gravels to reduce or prevent the creation of habitat conducive to ambush predation on juvenile salmonids. Doing so would likely increase the survival of out-migrating juvenile salmonids that use these waterways and avoid decreasing the value of their critical habitat.

- Plant native riparian vegetation (e.g., willows) in the revetment at and above the OHWM to increase bank stabilization, river margin shading, and leaf litter inputs. Doing so would likely increase the value of salmonid critical habitat by increasing local habitat heterogeneity and increasing local salmonid prey abundance, promoting listed salmonid recovery over the long term.

- Prioritize and continue to support actions that set levees back from rivers and, in instances where this is not technically feasible, land-side levee repairs should be pursued instead of waterside repairs. Setting back levees, or allowing rivers to naturally widen by only performing landside repairs, would increase the availability of floodplain habitat, which is currently limited but an important component of salmonid critical habitat. Doing

so would increase the recovery probability of the CCV steelhead DPS, SR winter-run Chinook salmon ESU, and CV spring-run Chinook salmon ESU through improved juvenile rearing conditions.

- Purchase compensatory mitigation credits to address impacts to sDPS green sturgeon foraging habitat, when they become available. Placement of hard revetment below the OHWM decreases sturgeon feeding areas in their critical habitat, but currently there are no other options for supporting or augmenting green sturgeon foraging PCBs locally.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Corps.

As 50 CFR 402.16 states, reinitiation of formal consultation is required 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 agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this 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.

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for Pacific Coast salmon (PFMC 2014, 2016) contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

Within the Action Area, EFH designations have been made for inland watersheds that support all runs of Chinook salmon that historically and currently use these watersheds (spring-run, winter-run, fall-run, and late fall-run). The Pacific Coast salmon fishery management plan also identifies Habitat Areas of Particular Concern (HAPCs) as complex channel and floodplain habitat, spawning habitat, thermal refugia, estuaries, and submerged aquatic vegetation. The HAPCs that would be adversely affected by the proposed action include: complex channel and floodplain habitat.

3.2 Adverse Effects on Essential Fish Habitat

3.2.1 Floodplain alteration
(Pacific Coast salmon EFH, Complex Channel & Floodplain HAPC)

Many river valleys in the west were once marshy and well vegetated, filled with mazes of floodplain sloughs, beaver ponds, and wetlands. Salmon evolved within these systems. Juvenile salmon can spend large portions of their fresh water residence rearing and over-wintering in floodplain environments and riverine wetlands. Spring-run Chinook salmon may spend up to a year rearing in freshwater and will rely on floodplains for refuge during flood conditions, and access to such floodplain refuge improves overall growth and fitness of Chinook salmon (Sommer *et al.* 2001). Salmon survival and growth are often better in floodplain channels, oxbow lakes, and other river-adjacent waters than in mainstream systems (National Research Council 1996). Additionally, floodplains and wetlands provide other ecosystem functions important to salmonids such as regulation of stream flow, stormwater storage and filtration, and often provide key habitat for beavers (that in turn may provide instream habitat benefits to salmon from their active and continual placement of wood in streams).

The construction areas/sites for this project no longer offer substantial floodplain habitat HAPCs since the Sacramento River has been leveed for flood protection prior to this proposed project, and this levee repair project will perpetuate these adverse effects into the future.

3.2.2 Bank stabilization and protection actions
(Pacific Coast salmon EFH, Complex Channel & Floodplain HAPC)

The alteration of riverine and estuarine habitats due to bank and shoreline stabilization, and protection from flooding events, can result in varying degrees of change in the physical, chemical, and biological characteristics of the existing shoreline and riparian habitats that support Pacific salmon. Armoring of shorelines to prevent erosion and maintain or create shoreline real estate simplifies habitats, reduces the amount of complex freshwater and intertidal habitats by design, and affects nearshore processes and the ecology of a myriad of species (Williams and Thom 2001). The physical, chemical, and biological processes driving the riverine ecosystem are often not correctly considered in bank stabilization and shoreline protection project designs (Beechie *et al.* 2010) and frequently result in alterations of stream flows and temperatures and reduction of the heterogeneity of rearing habitat, while also eventually requiring routine repairs. These physical changes can also decrease the effectiveness of salmon habitat restoration efforts (Beechie *et al.* 2005).

These levee repairs and placement or replacement of riprap and hard armoring on the leveed bank will cause negative associated effects to habitat functionality and individual salmon and are discussed in Section 2.5 of the BO above. Though the Sutter Bypass and Sacramento River mainstem banks to be riprapped under this proposed action are already leveed, the addition and replacement of hard stabilization methods already in use make it unlikely that this area will ever be set-back or restored to be more beneficial to Chinook salmon rearing.

See section 2.5 of the ESA portion of the opinion for more details on the potential adverse effects of this project.

3.3 Essential Fish Habitat Conservation Recommendations

The species managed under the Pacific Coast salmon that may be affected by this project are: Chinook salmon, *O. tshawytscha*. Fall, spring and winter-runs of Chinook salmon may use these areas as rearing juveniles, and adults will be migrating past these sites to spawning grounds upstream. Juveniles are known to grow and rear in the lower Sacramento River/Delta. The EFH of Chinook salmon is adversely effected by the proposed project through the pathways identified above: floodplain alteration and bank stabilization/levee protection.

Floodplain Alteration effects: As previously stated, much of the floodplain rearing habitat in the CCV has already been highly altered and its functionality has been greatly reduced. As such, the preservation and enhancement of any remaining floodplain is crucial to maintain the ability of Pacific Coast salmon to naturally rear in the CCV. In general, to support the floodplain HAPC, the Corps should promote the restoration of degraded floodplains and wetlands, including in part, reconnecting rivers with their associated floodplains and wetlands. Some of these concerns are addressed through ESA consultation RPM's 1-3. In addition, the following EFH Conservation Recommendations (CRs) are intended to address the adverse effects of floodplain alteration:

1. Protect existing riparian vegetation, and wherever practicable, establish new vegetated zones of appropriate width at and above the OHWM on all permanent and ephemeral streams that include or influence EFH and are affected by the proposed action. To address the impacts of this project in particular, plant new individuals of appropriate native species like willows in the riprap and disturbed areas to increase bank cover and shade at the water line and above (Complex Channel and Floodplain HAPC).

2. While repairing the levees in the action area, attempt to set back the levees wherever possible to begin reclaiming historical floodplain areas and allow for natural stream processes to shape natural riverine habitat. (Floodplain HAPC).

Bank Stabilization effects: The placement of riprap associated with this project is likely to reduce the remaining suitable rearing areas for Pacific Coast salmon by introducing hard artificial elements while simultaneously preventing future restoration of the immediate area and creating piscivorous predator ambush habitat. Some of these concerns are addressed through ESA consultation RPM's 1-3. In addition, the following EFH CRs are intended to address the adverse effects of bank stabilization:

3. Use vegetative or "soft' bank erosion control methods such as beach/shoreline nourishment, vegetative plantings, and placement of large woody debris to help anchor the levee rather than the currently proposed shoreline modifications, as feasible. Hard bank protection should be used as a last resort and the following options should be explored before selection (tree revetments, stream flow deflectors, and vegetative riprap). Develop design criteria based on site-specific geomorphological, hydrological and sediment transport processes appropriate for the stream channel for any stabilization, protection and restoration projects (Complex Channel and Floodplain HAPC).

4. Replace lost in-stream fish habitat in homogenous river stretches in the construction areas by providing root wads and deflector logs below the stabilized bank, and by planting shaded riverine aquatic cover vegetation, as part of bank revitalization during the stabilization actions in a way that reduces the likelihood of scour caused by long-term stormwater discharge (Complex Channel HAPC).

5. Fill voids in riprap with smaller boulders and/or gravel to fill up the potential ambush habitat created by placing riprap (Complex Channel and Floodplain HAPC).

Full implementation of these EFH CRs will help avoid or offset the expected negative impacts described in section 3.2 above for the Sacramento River PL 84-99 levee repairs proposed by the Corps for completion in 2019 – 2020, and would protect approximately 0.27 acres of designated EFH for Pacific Coast salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Corps must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the

Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

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

3.5 Supplemental Consultation

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

4. FISH AND WILDLIFE COORDINATION ACT

The purpose of the 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:

- Examine alternative methods of river bank stabilization to riprap and hard armoring, proven to both control erosion along shorelines and also reducing or eliminating negative effects on wildlife, especially fish. Consider the adverse effects of hard armoring on fish and wildlife as much as the effectiveness and long-term functionality of potential repair designs to traditional repair tactics that have failed in those locations to the point of requiring repair.

- Begin incorporating more natural bank stabilization methods into practice for levee repair actions, such as those described in "Engineering with Nature: Alternative Techniques to Riprap Bank Stabilization" (FEMA 2009). Many of these options focus on maintaining their integrity by using plantings and sediment deposition to reinforce their functionality in the long-term.

- If authorizing laws and mandates curtail or prohibit the adoption and use of alternative bank stabilization methods, begin the process of amending or modifying those policies to include a vetting and adoption process for new, viable engineering techniques to enable their employment when appropriate, so that fish and wildlife may receive equal consideration in the Corps' levee repair deliberations.

Adopting more natural bank stabilization methods as opposed to traditional hard armoring techniques are expected to control and minimize bank erosion, stream migration, and flooding near human populations and properties while decreasing the negative environmental aspects by allowing for more natural riverine processes, decreasing water speed along the armored reach, filter pollutants from surface runoff, trap and hold sediments to the point of actually rebuilding banks, and increase the functionality aquatic shoreline habitats.

The Action Agency 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 specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these Data Quality Act components, documents compliance with the Data Quality Act, 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 the Corps. Other interested users could include the citizens of affected areas or others members of the public interested in the conservation of the affected ESUs/DPSs. Individual copies of this opinion were provided to the Corps. The document will be available at the California Central Valley Office in Sacramento. 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 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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