



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: WCR-2017-7990

October 16, 2017

Ms. Alicia Kirchner  
Chief, Planning Division  
Department of the Army  
United States Army Corps of Engineers  
Sacramento District  
1325 J Street  
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Biological Opinion Reinitiation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Sacramento River Bank Protection Project at Sacramento River Mile 71.3

Dear Ms. Kirchner:

Thank you for your letter dated October 3, 2017, requesting reinitiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.) for the Sacramento River Bank Protection Project on the Sacramento River at river mile 71.3.

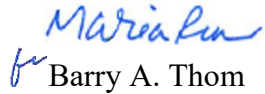
Thank you also for your request for reinitiation of consultation pursuant to the essential fish habitat (EFH) provisions in section 305 (b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)) for this action. NMFS' review concludes that the project will adversely affect the EFH of Pacific Coast Salmon in the action area.

The enclosed biological opinion (BO), based on the biological assessment, and best available scientific and commercial information, concludes that the project is not likely to jeopardize the continued existence of the federally listed threatened Central Valley spring-run Chinook salmon Evolutionarily Significant Unit, (*Oncorhynchus tshawytscha*), the threatened California Central Valley steelhead distinct population segment (DPS) (*O. mykiss*), and the threatened Southern DPS of the North American green sturgeon (*Acipenser medirostris*), and is not likely to destroy or adversely modify their designated critical habitats. NMFS has included an incidental take statement with reasonable and prudent measures and non-discretionary terms and conditions that are necessary and appropriate to avoid, minimize, or monitor incidental take of listed species associated with the project. The new BO replaces the original BO, and thus the original opinion is no longer in effect.



Please contact Tancy Moore in NMFS' West Coast Region's California Central Valley Office at (916) 930-3605 or via email at Tancy.Moore@noaa.gov if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

  
for Barry A. Thom  
Regional Administrator

Enclosure

Cc: To the File: ARN 151422-WCR2017-SA00318

Mr. Daniel Artho, Chief, Environmental Planning Section, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814

Ms. Patty Goodman, Environmental Planning Section, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814



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**Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion Reinitiation**

**Sacramento River Bank Protection Project River Mile 71.3  
 NMFS Consultation Number: WCR-2017-7990**

Action Agency: U.S. Army Corps of Engineers


Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?*	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
CV spring-run Chinook salmon ESU ( <i>Oncorhynchus tshawytscha</i> )	Threatened	Yes	No	No
Sacramento River winter-run Chinook salmon ESU ( <i>O. tshawytscha</i> )	Endangered	Yes	No	No
California CCV steelhead DPS ( <i>O. mykiss</i> )	Threatened	Yes	No	No
Southern DPS of North American green sturgeon ( <i>Acipenser medirostris</i> )	Threatened	Yes	No	No

Fishery Management Plan That Describes 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:

  
 for Barry A. Thom  
 Regional Administrator

Date: October 16, 2017





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## **1. INTRODUCTION**

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

### **1.1 Background**

NOAA's 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.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System <https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts>. A complete record of this consultation is on file at the NMFS California Central Valley Office.

### **1.2 Consultation History**

On November 2, 2007, NMFS received a formal consultation request from the U.S. Army Corps of Engineers (USACE) for Phase II of the Sacramento River Bank Protection Project (SRBPP). In response, NMFS issued a programmatic BO for this project on July 02, 2008. The programmatic BO requires subsequent formal consultations for site specific projects developed under the Phase II authority for SRBPP.

On April 4, 2017, NMFS issued a BO for a levee repair at river mile 71.3 of the Sacramento River, which was tiered off the above BO.

On September 20, 2017, NMFS was informed that there were changes to the project that may require reinitiation of consultation for the work at river mile 71.3. NMFS received a request for reinitiation of consultation via email on October 3, 2017, and initiated consultation that day.

### **1.3 Proposed Federal Action**

“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). USACE and the Central Valley Flood Protection Board (CVFPB) propose to implement bank protection measures on the Sacramento River at river mile (RM) 71.3, located near the Sacramento International Airport in Yolo County, California.

The levee erosion at site RM 71.3 is likely due to high-velocity flood flows, boat wake wave impacts, and erodible levee materials.

Figures 1 and 2 below shows a cross section of the repair, which will be 515 feet long. The uppermost section of the bank repair (at A – B on Figure 1), will have a rock slope of 2.5H:1V (horizontal to vertical ratio), the middle section (B – C on Figure 1) will have a 10H:1V slope, and the lowermost section of the bank repair (at C – D on Figure 1) will have a slope of 2H:1V.

The placement of the following will occur during the 2017 construction season, prior to November 30, 2017: The uppermost section will be covered in a total of 4,500 cubic yards of soil-filled quarry stone with a 6 to 12 inch layer of soil cover on top and will be hydroseeded. The lowermost section of the repair (the two) will consist of bare quarry stone. The middle section will be covered in aggregate base, which based on previous SRBPP repairs, is expected to accrete sediment which will improve the survivability of onsite mitigation. An aggregate base layers was chosen for this section over a rock/soil mixture (as indicated in the original consultation) because the water elevation in the area has been unusually high during the fall of 2017, meaning any soil placed in the middle section may be washed away. Therefore, the placement of soil will only occur one foot and above the current water surface elevation at the time of construction.

During the 2018 construction season (between July 1 and November 30), the USACE will place an additional 6 to 12 inch layer of soil on the middle section. A mix of trees, willows, and native understory/grasses will be planted on both the upper and lower slope of the riparian bench. The species to be planted and the specific zones they will be planted in is described in Figure 2 and Table 1-2. A beaver barrier fence (at C on Figure 1) will be installed immediately below the riparian plantings in order to protect them from beaver predation. Table 1-1 describes the repair site characteristics.

**Table 1-1. Repair Site Characteristics**

<b>Repair Site Characteristics</b>	<b>Value</b>
Length of Repair Site (feet)	515
Site Area (acres)	4.48
Quarry stone volume (cubic yards)	8,134
Soil-filled quarry stone volume (cubic yards)	4,500
Soil cover volume (cubic yards)	700
Final bank slope outside of planted bench area (H:V)	2.5:1
Final slope within riparian bench (H:V)	10:1
Instream Woody Material to be removed (linear feet along bank)	123
Instream Woody Material to be anchored at MSWL (linear feet)	257.5

Three trees ranging from 4.8 to 36.3 inches diameter breast height will be removed as part of the proposed project: two cottonwoods and one valley oak. Three additional trees will be trimmed. Removal and trimming of these trees is required to facilitate equipment access to the site. The total canopy cover lost from tree trimming and removal is 0.025 acres.



Although a total of 123 linear feet of instream woody material (IWM) will need to be removed to facilitate the repair of the bank, 257.5 linear feet of IWM will be installed as mitigation for this removed wood. The IWM will be installed at SMWSE in grouping spaced 20-25 feet apart with one end buried in the quarry stone to anchor it. In-water construction will be limited to between July 1 and November 30. A complete description of avoidance and mitigation measures for the proposed project can be found in the Sacramento River Bank Protection Project Phase II programmatic BO, issued on July 02, 2008.

In an effort to improve the evaluation of impacts to green sturgeon from bank protection actions, USACE will conduct pre and post construction monitoring to monitor changes to benthic form and function. The goals of the monitoring will be to establish an understanding of existing benthic form and communities within the project reach, explore and develop monitoring techniques, and provide information for future monitoring. Monitoring will be conducted upstream, downstream, and at RM 71.3. Pre and post construction monitoring will occur at a minimum once quarterly, but may be conducted as often as once per month if relevant to achieving the goals stated above. Post-construction monitoring would continue for at least 5 years, but may be continued up to 10 years. USACE anticipates that long term monitoring conducted in conjunction with construction of the bank protection action at RM 71.3 will be superseded by more comprehensive monitoring efforts. Monitoring results will be reported to NMFS at a minimum once per year, or as appropriate. In addition, USACE will coordinate regularly with NMFS through the Interagency Working Group to ensure that monitoring continues to meet the stated goals above.

The USACE plans to mitigate for project impacts to salmon and steelhead by purchasing credits from an approved mitigation bank at a 1:1 ratio. Specifically, a total of 0.635 acres of credits will be purchased, which represents the maximum negative weighted response index value (WRI) estimated by the standard assessment methodology (SAM) analysis (0.61 acres) plus the canopy cover of the above removed and the trimmed trees (0.025 acres). NMFS-approved mitigation banks with service areas that include the proposed action area include the Bullock Bend Mitigation Bank and the Fremont Landing Conservation Bank.

### 1.3.1 Interrelated and Interdependent Actions

“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). There are no interdependent or interrelated activities associated with the proposed action.

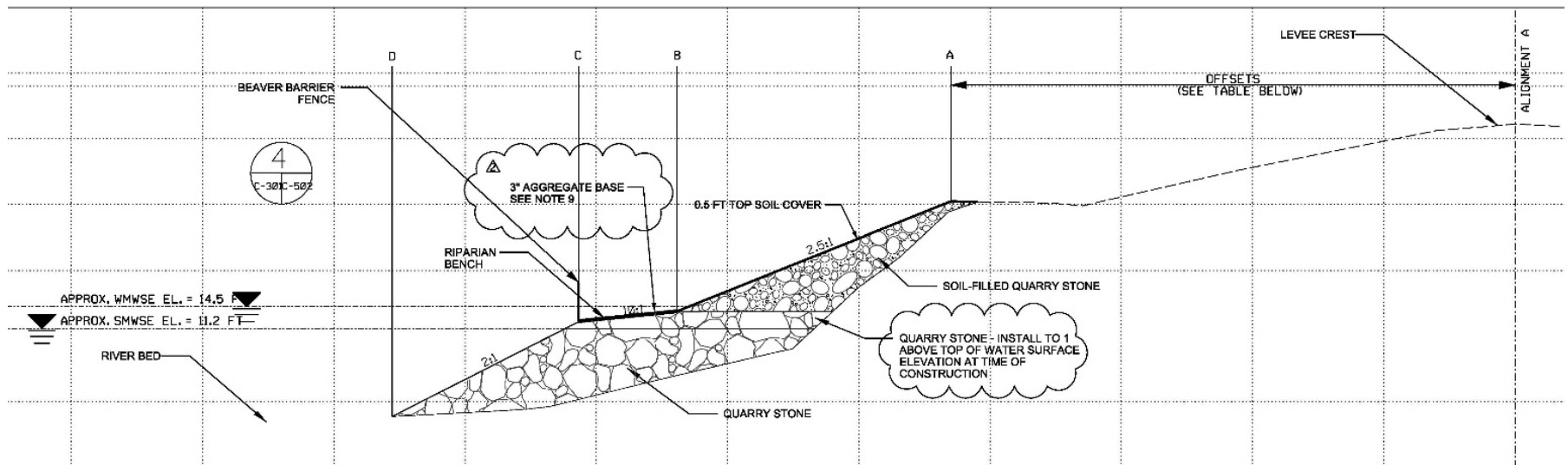


Figure 1. Cross section of the bank repair for the Sacramento River Bank Protection Project work to be completed at river mile 71.3 of the Sacramento River

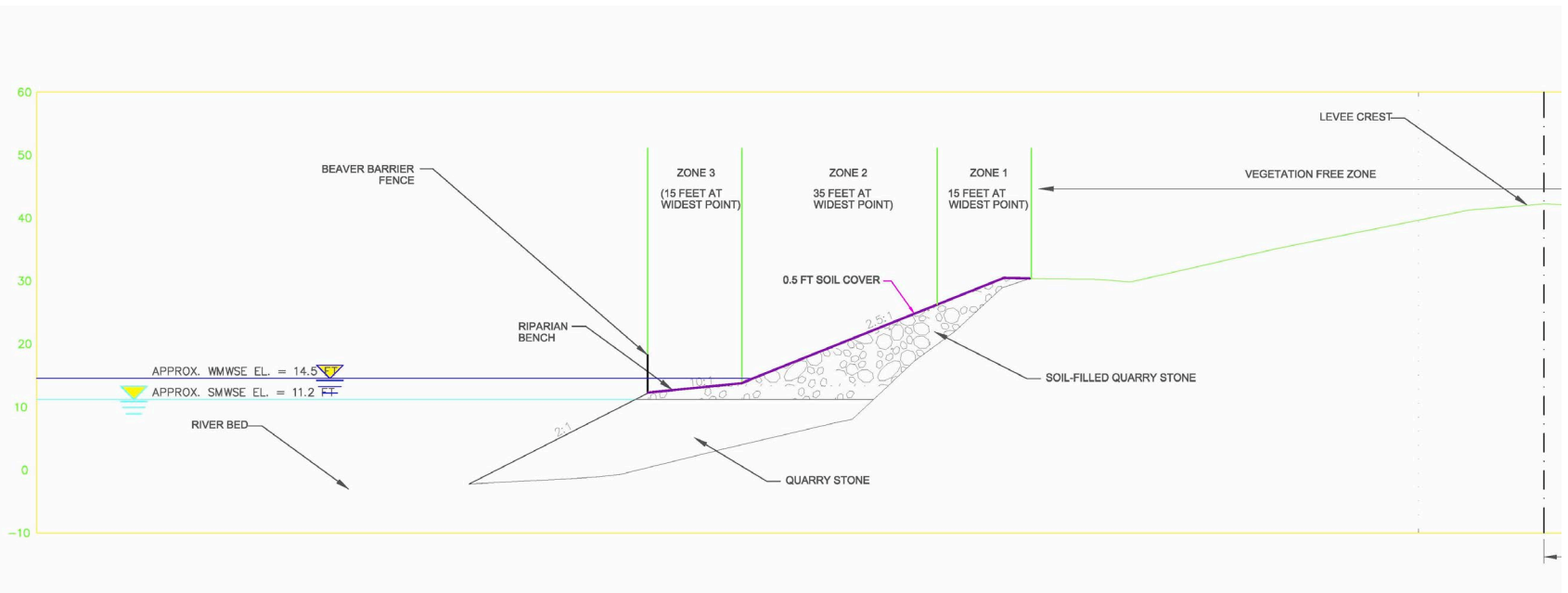


Figure 2. Cross section of the bank repair for the Sacramento River Bank Protection Project work to be completed at river mile 71.3 of the Sacramento River

**Table 1-2. Riparian planting palette**

Planting Zone	Area of Planting Zone (sq. ft)	Area of Planting Zone (ac)	Notes	Species Name	Common Name			
Zone 1	20,977	0.48	Zone 1A Overstory	<i>Quercus lobata</i>	Valley oak			
				<i>Quercus wislizeni</i>	Interior live oak			
				<i>Artemisia douglasiana</i>	California mugwort			
				<i>Baccharis salicifolia</i>	mule fat			
			Zone 1A-Understory Hydroseed Mix	<i>Achillea millefolium</i>	yarrow			
				<i>Elymus glaucus</i>	blue wildrye			
				<i>Hordeum brachyantherum ssp. californicum</i>	California barley			
				<i>Leymus triticoides</i>	creeping wild rye			
				<i>Leymus triticoides</i>	creeping wild rye			
				<i>Lotus purshianus var. purshianus</i>	Spanish clover			
				<i>Lupinus bicolor</i>	miniature lupine			
				<i>Nasella pulchra</i>	purple needle grass			
				<i>Trifolium wildenovii</i>	tomcat clover			
<i>Vulpia microstachys</i>	small fescue							

Planting Zone	Area of Planting Zone (sq. ft)	Area of Planting Zone (ac)	Notes	Species Name	Common Name
Zone 2	20,263	0.47	Zone 2 Over & Middle Story	<i>Acer negundo</i>	Box elder
				<i>Alnus rhombifolia</i>	White Alder
				<i>Cephalanthus occidentalis</i>	Buttonbush
				<i>Fraxinus latifolia</i>	Oregon ash
				<i>Populus fremontii</i> ssp. <i>Fremontii</i>	Fremont cottonwood
				<i>Quercus lobata</i>	Valley oak
			Zone 2 Understory grasses	<i>Agrostis exarta</i>	spike bentgrass
				<i>Ambrosia psilostachya</i>	western ragweed
				<i>Artemisia douglasiana</i>	California mugwort
				<i>Carex barbarae</i>	Santa Barbara carex
				<i>Deschampsia elongata</i>	slender hairgrass
				<i>Elymus trachycaulus</i>	slender wheatgrass
				<i>Hordeum brachyantherum</i> ssp. <i>californicum</i>	California barley
<i>Juncus Balticus</i>	Baltic rush				
<i>Juncus Effusus</i>	Common rush				
<i>Leymus triticoides</i>	creeping wild rye				

Planting Zone	Area of Planting Zone (sq. ft)	Area of Planting Zone (ac)	Notes	Species Name	Common Name
Zone 3	20,263	0.47	Zone 3 Over & Middle Story	<i>Acer negundo</i>	Box elder
				<i>Alnus rhombifolia</i>	White Alder
				<i>Cephalanthus occidentalis</i>	Buttonbush
				<i>Fraxinus latifolia</i>	Oregon ash
				<i>Populus fremontii</i> ssp. <i>Fremontii</i>	Fremont cottonwood
				<i>Salix exigua</i>	Sandbar willow
				<i>Salix lasiolepii</i>	Arroyo willow
			Zone 3 Understory grasses	<i>Agrostis exarta</i>	spike bentgrass
				<i>Ambrosia psilostachya</i>	western ragweed
				<i>Artemisia douglasiana</i>	California mugwort
				<i>Carex barbarae</i>	Santa Barbara carex
				<i>Deschampsia elongata</i>	slender hairgrass
				<i>Elymus trachycaulus</i>	slender wheatgrass
				<i>Hordeum brachyantherum</i> ssp. <i>californicum</i>	California barley
				<i>Juncus Balticus</i>	Baltic rush
				<i>Juncus Effusus</i>	Common rush
<i>Leymus triticoides</i>	creeping wild rye				
Fascine Bundles				<i>Salix exigua</i>	Sandbar willow

## **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:

1. Identify the rangewide status of the species and critical habitat expected to be adversely affected by the Proposed Action.
2. Describe the environmental baseline in the Action Area.
3. Analyze the effects of the Proposed Action on both species and their habitat using an "exposure-response-risk" approach.
4. Describe any cumulative effects in the Action Area.

5. 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.
6. Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
7. If necessary, suggest a RPA to the Proposed Action.

### 2.1.1 Use of Analytical Surrogates

#### *Analytical Surrogates for Salmonids*

The effects of the SRBPP RM 71.3 levee repair on salmonids are primarily analyzed using Standard Assessment Methodology (SAM). The USACE provided the background data, assumptions, analyses, and assessment of habitat compensation requirements for the Federally protected fish species relevant to this consultation.

The SAM was designed to address a number of limitations associated with previous habitat assessment approaches and provide a tool to systematically evaluate the impacts and compensation requirements of bank protection projects based on the needs of listed fish species.

It is a computational modeling and tracking tool that evaluates bank protection alternatives by taking into account several key factors affecting threatened and endangered fish species. By identifying and then quantifying the response of focal species to changing habitat conditions over time, project managers, biologists and design engineers can make changes to project design to avoid, minimize, or provide on- or off-site compensatory mitigation for impacts to habitat parameters that influence the growth and survival of target fish species by life stage and season. The model is used to assess species responses as a result of changes to habitat conditions, either by direct quantification of bank stabilization design parameters (*e.g.*, bank slope, substrate). The preferred hierarchy of mitigation in all cases is avoid, minimize, compensate onsite and compensate off-site. In the case of most levee projects, most or all of these mitigation strategies are applied due to their large size, challenges associated with completely avoiding and minimizing impacts to species and habitat, temporal delays in habitat function of onsite compensatory mitigation, and limitations associated with being able to provide full compensation at project sites, which warrants the need for some form of off-site compensation.

In 2003, the USACE established a program to carry out “a process to review, improve, and validate analytical tools and models for USACE Civil Works business programs”. Reviews are conducted to ensure that planning models used by the USACE are technically and theoretically sound, computationally accurate, and in compliance with the USACE planning policy. As such, all existing and new planning models developed by the USACE are required to be certified through the appropriate Planning Center of Expertise and Headquarters in accordance with USACE rules and procedures. The assumptions, model variables, and modeling approaches used in the SAM have been developed to be adapted and validated through knowledge gained from monitoring and experimentation within the SRBPP while retaining the original overall assessment method and framework.



In late 2010, the certification process for the SAM was initiated by the USACE, Sacramento District in coordination with the Ecosystem Planning Center of Expertise. The process entailed charging a panel of six experts to review the SAM, along with the SAM (version 3.0). The Review Panel was composed of a plan formulation expert, fisheries biologist, aquatic ecologist, geomorphologist/geologist, population biologist/modeling expert, and software programmer. A major advantage of the SAM is that it integrates species life history and seasonal flow-related variability in habitat quality and availability to generate species responses to project actions over time. The SAM systematically evaluates the response of each life stage to habitat features affected by bank protection projects.

The SAM quantifies habitat values in terms of a weighted species response index (WRI) that is calculated by combining habitat quality (i.e., fish response indices) with quantity (i.e., bank length or wetted area) for each season, target year, and relevant species/life stage. The fish response indices are derived from hypothesized relationships between key habitat attributes (described below) and the species and life stage responses. Species response indices vary from 0 to 1, with 0 representing unsuitable conditions and 1 representing optimal conditions for survival, growth, and/or reproduction. For a given site and scenario (i.e., with or without project), the SAM uses these relationships to determine the response of individual species and life stages to the measured or predicted values of each habitat attribute for each season and target year, and then multiplies these values together to generate an overall species response index. This index is then multiplied by the linear feet or area of shoreline to which it applies to generate a weighted species response index expressed in feet or square feet. The species WRI provides a common metric that can be used to quantify habitat values over time, compare project conditions to existing conditions, and evaluate the effectiveness of onsite and off-site compensation actions.

The WRI represent an index of a species growth and survival based on a 30-day exposure to post project conditions over the life of the project. As such, negative SAM values can be used as a surrogate to quantify harm to a target fish species by life stage and season. Also, although SAM values represent an index of harm to a species, since the values are expressed as “weighted bankline feet” or “weighted area”, these values can be used to help quantify compensatory conservation actions such as habitat restoration, and are used for that purpose in this BO. The *Effects of the Action* section of this BO analyzes the effects of the SRBPP RM 71.3 levee repair project.

#### *Analytical Surrogates for Green Sturgeon*

Impacts to the Southern DPS of the North American green sturgeon are also estimated using an analytical surrogate. Although the SAM model does have a green sturgeon component, NMFS has determined that the model may not have the precision to accurately index green sturgeon responses to changes in modeled habitat attributes and that a more rigorous modeling approach needs development. Critical habitat for green sturgeon in the action is designated in the Sacramento River below ordinary high water (OHW). For this BO, NMFS has determined the amount of critical habitat covered by rock revetment would serve as the best analytical surrogate for impacts to all life stages of green sturgeon. However, the OHW mark could not be collected

at the time of this consultation due to the unusually high flows. Therefore, the amount of bare rock revetment will serve as the analytical surrogate for project effects.

### 2.1.2 Conservation Banking in the Context of the ESA Environmental Baseline

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

When NMFS is consulting on a proposed action that includes conservation bank credit purchases, it is likely that physical restoration work at the bank site has already occurred and/or that a section 7 consultation occurred at the time of bank establishment. A traditional interpretation might suggest that the overall ecological benefits of the conservation bank actions belong in the *Environmental Baseline*. Under this interpretation, where proposed actions include credit purchases, it would not be possible to attribute their benefits to the proposed action, without double-counting. Such an interpretation does not reflect the unique circumstances that conservation banks serve. Specifically, conservation banks are established based on the expectation of future credit purchases. Conservation banks would not be created and their net beneficial effects would not occur in the absence of this expectation.

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

This BO will analyze the beneficial effects of the credit transaction associated with the proposed action and recognizes the beneficial effects associated with the remainder of the credits at the bank that have not been subject to a transaction (and their associated ecological benefits) will not be considered in the *Environmental Baseline*.

## **2.2 Rangewide Status of the Species and Critical Habitat**

The rangewide status of the species, their critical habitat, and the effects of global climate change has not changed since the original BO was issued six months ago. Since this material is still relevant, it has not been reproduced in this BO. Instead, the reader may refer to this section in the original BO, issued April 4, 2017, for this section.

## **2.3 Action Area**

“Action area” means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area is not the same as the project boundary area because the action area must delineate all areas where Federally-listed populations of salmon, steelhead, and green sturgeon may be affected by the implementation of the proposed action. The action area for the proposed action analyzed in amended programmatic BO for Phase II of the SRBPP extends from south-to-north along the Sacramento River from the town of Collinsville, at river mile (RM) 0 upstream to Chico at RM 194, and includes reaches of lower Elder and Deer creeks. The SRBPP also includes Cache Creek, the lower reaches of the American River (RM 0–23), Feather River (RM 0–61), Yuba River (RM 0–11), and Bear River (RM 0–17), as well as portions of Threemile, Steamboat, Sutter, Miner, Georgiana, and Cache sloughs. This represents the full geographic extent of the 24,000 linear feet of bank protection described in the amended programmatic BO for Phase II of the SRBPP and the effects that are associated with these projects. The action area for this repair at RM 71.3 is within this broader action area.

The proposed action is located on the Sacramento River at river mile 71.3, near the Sacramento International Airport in Yolo County, California. For projects with in-water construction activities, such as installation of riprap, the downstream extent of the action area is defined by the distance of potential turbidity and sediment deposition. For the proposed repair, turbidity impacts are expected to occur up to 100 feet from the shoreline and up to 400 feet downstream of any in-water construction activities. This estimation is based on previous turbidity monitoring efforts at other SRBPP project sites, which found that the level of turbidity 300 feet downstream from construction resembled baseline conditions. The levee repair itself will be approximately 515 feet in length. The action area also encompasses the associated floodplains and riparian areas at and adjacent to the project site.

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

## **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.

The action area, which encompasses the Sacramento River and associated floodplains and riparian areas at and adjacent to river mile 71.3 of the Sacramento River, functions primarily as a rearing and migratory habitat for Sacramento River 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 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 Sacramento River 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 the SRBPP Phase II programmatic 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 of the SRBPP Phase II programmatic BO). However, utilization of the area by several green sturgeon life stages means the habitat is still of high conservation value.

#### 2.4.1 Mitigation Banks and the Environmental Baseline

There are several conservation or mitigation banks approved by NMFS with service areas that include the action area considered in this BO. Both these banks occur within critical habitat for 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.

### **2.5 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.

To evaluate the effects of the SRBPP RM 71.3 levee repair, NMFS examined the potential proposed actions in the designated action areas. We analyzed construction-related impacts and the expected short- and long-term fish response to habitat modifications using the SAM. We also reviewed and considered the USACE’s proposed conservation measures. This assessment relied heavily on the information from the USACE’s SAM analysis in the Supplemental Information and Analysis for the SRBPP – Sacramento River Mile 71.3.

The purchase of 0.635 acres of mitigation credit from a NMFS approved bank creates beneficial effects that will restore and protect floodplain and riparian habitat and improve juvenile rearing habitat for all species analyzed in this BO. Although the banks technically do not include green sturgeon credits, we expect that individual Sacramento River green sturgeon will benefit from the purchase of these credits.

### 2.5.1 Construction Impact Analysis for Salmonids and Green Sturgeon

NMFS original analysis of construction impacts on salmonids and green sturgeon is still applicable to the revised project since no changes have been made to the construction methodology or BMPs. Since this material is still relevant, it has not been reproduced in this BO. Instead, the reader may refer to this section in the original BO, issued April 4, 2017 for this section.

### 2.5.2 Project Effects on Salmonids, Estimated Using Standard Assessment Methodology as an Analytical Surrogate

#### ***2.5.2.1 Methodology for the SAM analysis***

NMFS original description of the SAM methodology is still applicable to the revised project as the methodology has not changed. Since this material is still relevant, it has not been reproduced in this BO. Instead, the reader may refer to this section in the original BO, issued April 4, 2017 for this section.

#### ***2.5.2.2 Results of the SAM Analysis***

USACE utilizes a reasonable worst-case scenario approach when evaluating the SAM results. This approach errs on the side of caution so that bank protection actions and onsite mitigation are more likely to meet or exceed modeled expectations, while limiting temporal and permanent effects. The SAM results presented below in Table 2-1 and Figures 3 through 8 are based on such a worst case scenario analysis. Table 2-1 shows negative WRI values, but there are several areas where the action will result in improved conditions. These are discussed below, and are summarized in the Supplemental Information and Analysis for the SRBPP – Sacramento River Mile 71.3, here after referred to as the SRBPP 71.3 SAM Analysis. In Table 2-1, year 0 refers to the year of construction.

The impacts will occur along approximately 515 feet of the right bank of the Sacramento River. For salmon and steelhead the main factor driving SAM deficits is the reduction in riparian habitat.

Certain life stages of salmonids have been omitted from the SAM analysis, as their responses to bank stabilization projects cannot be accurately modeled by SAM. These life stages include the following: adult migration for salmon and steelhead, outmigration of post spawning adult steelhead, and spawning and egg incubation for salmon and steelhead.

SAM modeled results for the adult migration life stages of salmon and steelhead were omitted since migrating adult salmonids are not expected to utilize the area near the shore where the project will occur or be influenced by the shoreline habitat features modeled by SAM, as they prefer deeper water. Furthermore, these fish are unlikely to be affected by the project because there will be no increase in predation and their upstream migration will not be impeded by any structural features. The site is only 515 feet in length and migrating adult salmonids are more likely to continue moving past the site if it does not provide habitat conditions that they prefer.

Therefore, the project is not expected to impact the quality of the area as an adult migration corridor. The adult steelhead that are outmigrating as post spawning adults are not expected to be negatively impacted by the project for the same reasons.

The salmon and steelhead adult spawning and egg incubation life stages were not included in the SAM analysis as the impacts of bank modifications on these life stages has not been modeled for use in SAM analyses. Furthermore, these life stages do not occur in the RM 71.3 action area, and thus they are not expected to be impacted by the proposed project.

### **Summary of CV spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, CCV steelhead and sDPS green sturgeon effects by water surface elevation:**

#### ***At fall water surface elevations:***

The reduction in riparian vegetation along 515 feet of the right bank of the Sacramento River leading to reduced growth and survival of fry and juvenile rearing CV spring-run Chinook salmon, winter-run Chinook salmon, and CCV steelhead is expected to last at least 50 years after any construction activities associated with the bank repair actions at RM 71.3. The amount and extent of this effect is quantified in Table 2-1. These adverse effects are greatest in Year 7 with a magnitude of -3,536 ft<sup>2</sup> WRI for all Chinook runs and -5,776 ft<sup>2</sup> for CCV steelhead, and continue for at least 50 years.

Reduced growth and survival of juvenile migrating (smolts) CV spring-run Chinook salmon, winter-run Chinook salmon, and CCV steelhead due to reductions in riparian vegetation and placement of rock-revetment along 515 feet of the right bank of the Sacramento River is expected for at least 50 years after any construction activities associated with the bank repair actions at RM 71.3. The amount and extent of this adverse effect is quantified in Table 2-1. These adverse effects are greatest in Year 7 following construction, with a magnitude of -23,800 ft<sup>2</sup> WRI for all Chinook runs and -26,422 ft<sup>2</sup> WRI for CCV steelhead, and continue for at least 50 years.

#### ***At winter water surface elevations:***

Improved growth and survival of fry and juvenile rearing CV spring-run Chinook salmon, winter-run Chinook salmon, and CCV steelhead are expected after any construction activities associated with the bank repair actions at RM 71.3 due to construction of a riparian bench and installation of IWM along 515 feet of the right bank of the Sacramento River. The amount and extent of this beneficial effect is quantified in Table 2-1. Beneficial effects are expected immediately following construction, and would increase to a magnitude of 10,563 ft<sup>2</sup> WRI for all Chinook runs, and 14,178 ft<sup>2</sup> WRI for CCV steelhead, by Year 50.

Reduced growth and survival of juvenile migrating (smolts) CV spring-run Chinook salmon and winter-run Chinook salmon is expected for at least 5 years after any construction activities associated with the RM 71.3 due to reductions in riparian vegetation along 515 feet of the right bank of the Sacramento River. Reduced growth and survival of juvenile migrating (smolts) CCV steelhead is expected for at least 8 years after any construction activities due to reductions in

riparian vegetation along 515 feet of the right bank of the Sacramento River. The amount and extent of this adverse effect is quantified in Table 2-1. These adverse effects are greatest in Year 1 following construction, with a magnitude of  $-13,203 \text{ ft}^2$  WRI for all Chinook runs and  $-10,903 \text{ ft}^2$  WRI for CCV steelhead. Beneficial effects are expected by Year 7 for all Chinook runs and Year 9 for CCV steelhead; by Year 50, beneficial effects would increase to a magnitude of  $9,658 \text{ ft}^2$  WRI and  $5,151 \text{ ft}^2$  for all Chinook runs and CCV steelhead respectively.

***At spring water surface elevations:***

Reduced growth and survival of fry and juvenile rearing CV spring-run Chinook salmon, winter-run Chinook salmon, and CCV steelhead are expected after any construction activities associated with RM 71.3 due to the one year delay of vegetation and increased size of bank substrate on the riparian bench along 515 feet of the right bank of the Sacramento River. The amount and extent of this adverse effect is quantified in Table 2-1. Adverse effects are expected during the first construction season for all Chinook salmon and second construction season for CCV steelhead; reaching magnitudes of  $-1000 \text{ ft}^2$  and  $-1,661$  respectively. One year following construction beneficial effects are anticipated, and would increase to a magnitudes of  $14,764 \text{ ft}^2$  WRI for all Chinook runs, and  $18,254 \text{ ft}^2$  WRI for CCV steelhead, by Year 50.

Reduced growth and survival of juvenile migrating (smolts) CV spring-run Chinook salmon and winter-run Chinook salmon are expected for at least 6 years for Chinook salmon and 8 years for CV steelhead after any construction activities associated with the RM 71.3 due to reductions in riparian vegetation along 515 feet of the right bank of the Sacramento River. These adverse effects are greatest in Year 1 of construction, with a magnitude of  $-13,877 \text{ ft}^2$  WRI for all Chinook runs and in Year 2 of construction, with a magnitude of  $-12,599 \text{ ft}^2$  WRI for CCV steelhead. The amount and extent of these adverse effects is quantified in Table 2-1. For Chinook runs, beneficial effects are expected by Year 6, and by Year 50 would increase to a magnitude of  $10,461 \text{ ft}^2$  WRI. For CCV steelhead, beneficial effects are expected by Year 8, and by Year 50 would increase to a magnitude of  $5,500 \text{ ft}^2$  WRI.

***At summer water surface elevations:***

Reduced growth and survival of fry and juvenile rearing CV spring-run Chinook salmon, winter-run Chinook salmon, and CCV steelhead are expected to last at least 50 years after any construction activities associated with bank repair actions at RM 71.3 due to reductions in riparian vegetation and placement of rock-revetment along 515 feet of the right bank of the Sacramento River. The amount and extent of this effect is quantified in Table 2-1. These adverse effects are greatest with a magnitude of  $-3,536 \text{ ft}^2$  WRI for all Chinook runs in Year 7, and  $-5,766 \text{ ft}^2$  for CCV steelhead in Year 6, and are expected to last for at least 50 years.

Reduced growth and survival of juvenile migrating (smolts) CV spring-run Chinook salmon, is expected for at least 50 years after any construction activities associated with bank repair actions at RM 71.3 due to reductions in riparian vegetation and placement of rock-revetment along 515 feet of the right bank of the Sacramento River. The amount and extent of this adverse effect is quantified in Table 2-1. This adverse effect is greatest in Year 7 following construction, with a



magnitude of -23,801 ft<sup>2</sup> WRI for CV spring-run Chinook salmon, and continue for at least 50 years.

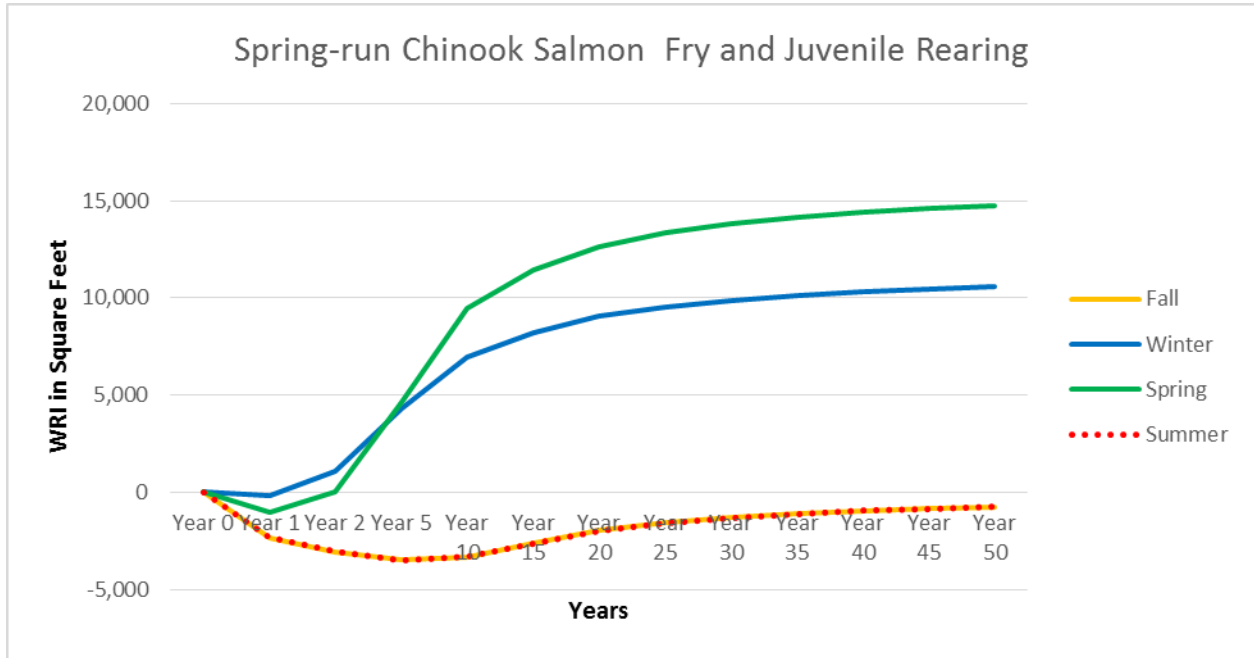


Figure 3. Wetted-area weighted response indices for spring-run Chinook salmon fry and juvenile rearing

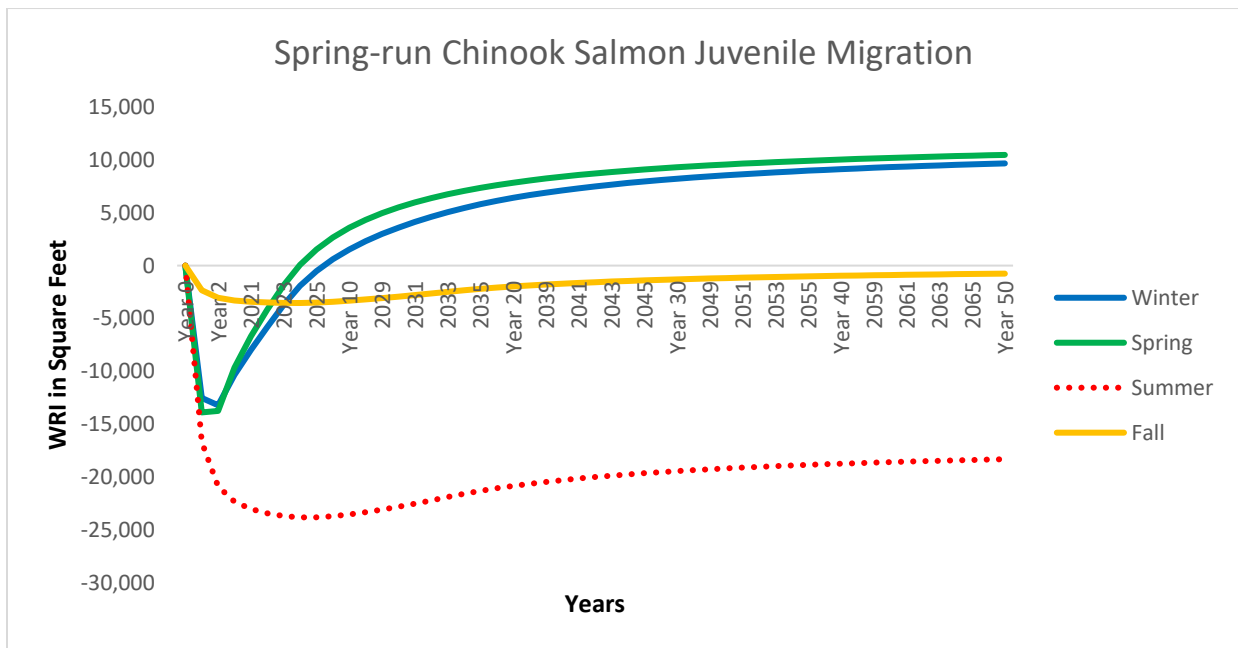


Figure 4. Wetted-area weighted response indices for spring-run Chinook salmon juvenile migration

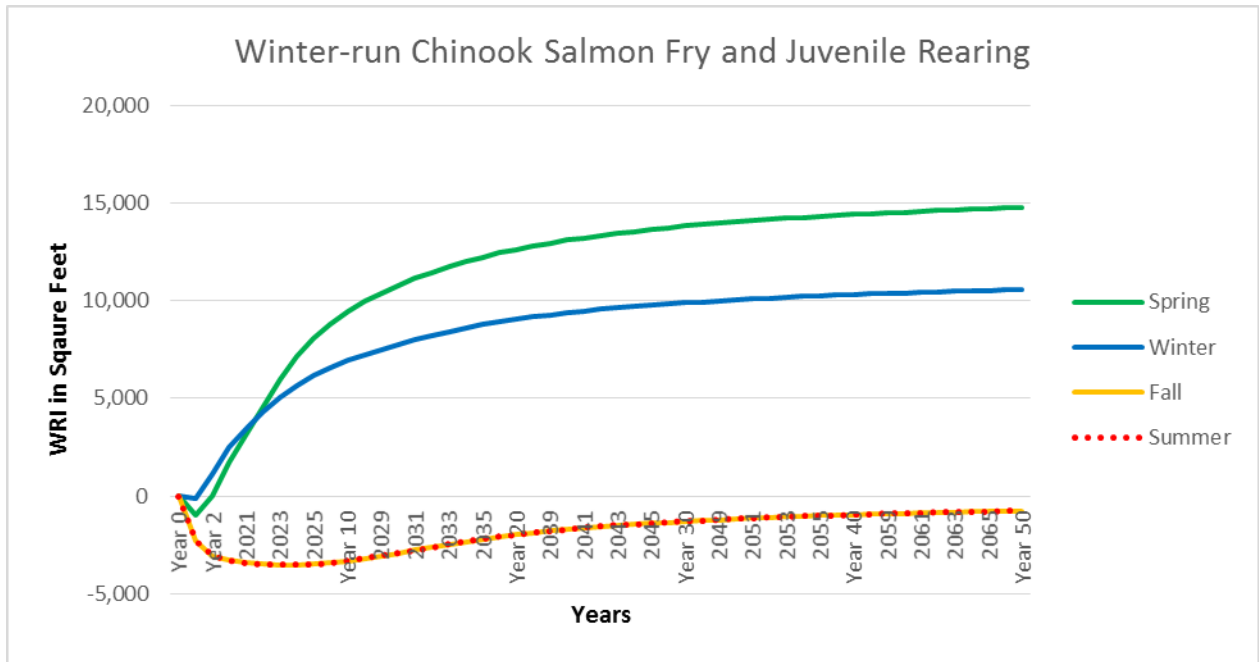


Figure 5. Wetted-area weighted response indices for winter-run Chinook salmon fry and juvenile rearing

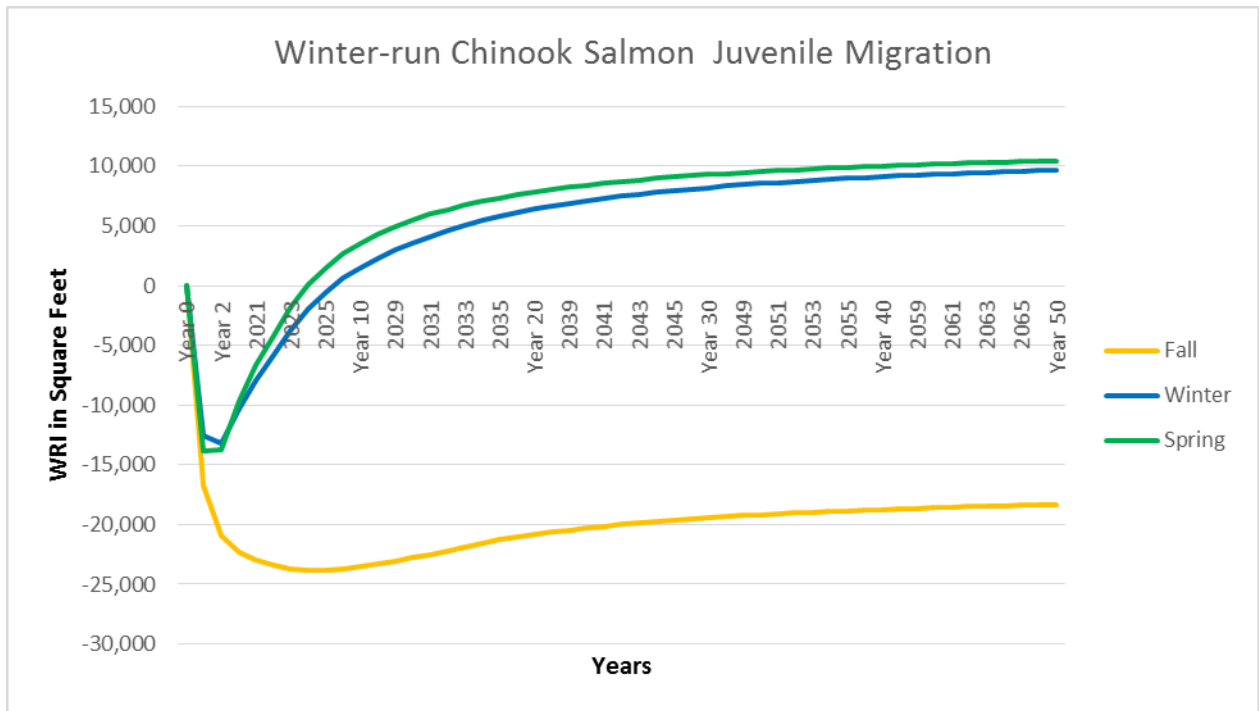


Figure 6. Wetted-area weighted response indices for winter-run Chinook salmon juvenile migration

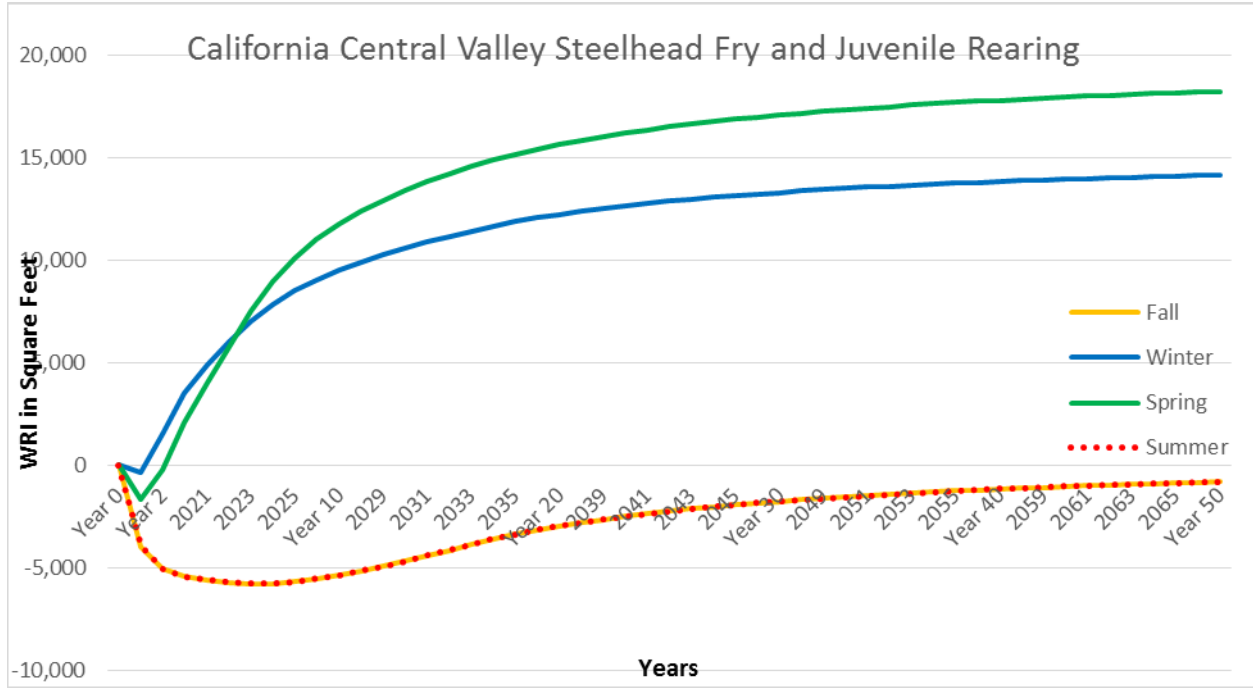


Figure 7. Wetted-area weighted response indices for steelhead fry and juvenile rearing

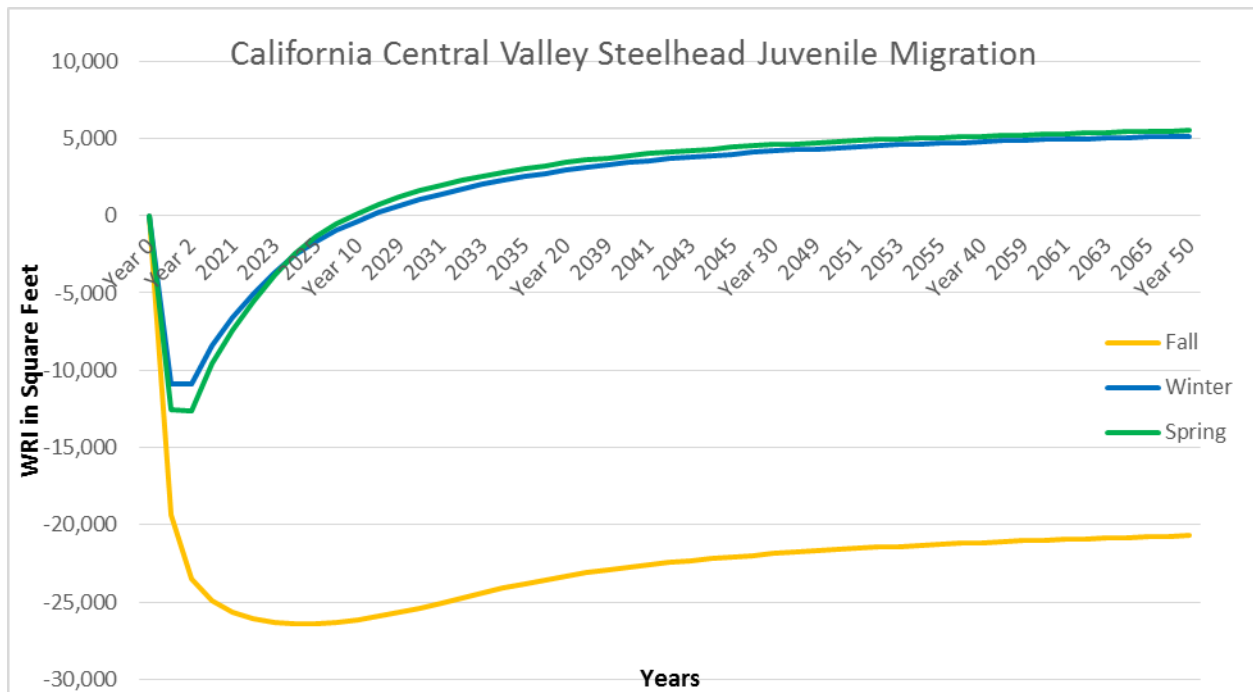


Figure 8. Wetted-area weighted response indices for steelhead juvenile migration

**Table 2-1. Summary of SAM Results for the Proposed Levee Erosion Repair at RM 71.3**

Season	Life Stage	Maximum Negative WRI <sup>1</sup> (ft <sup>2</sup> )	Duration of Adverse Effect (Years after Construction)	Maximum Positive WRI <sup>1</sup> (ft <sup>2</sup> )
<b>Spring-run Chinook Salmon</b>				
Fall	Fry and Juvenile Rearing	-3,536	50+	-
	Juvenile Migration	-23,800	50+	-
Winter	Fry and Juvenile Rearing	-155	1	10,563
	Juvenile Migration	-13,203	7	9,658
Spring	Fry and Juvenile Rearing	-1,000	1	14,764
	Juvenile Migration	-13,877	6	10,461
Summer	Fry and Juvenile Rearing	-3,536	50+	-
	Juvenile Migration	-23,801	50+	-
	Juvenile Migration <sup>2</sup>	-	-	-
<b>Winter-run Chinook Salmon</b>				
Fall	Fry and Juvenile Rearing	-3,536	50+	-
	Juvenile Migration	-23,800	50+	-
Winter	Fry and Juvenile Rearing	-155	1	10,563
	Juvenile Migration	-13,203	7	9,658
Spring	Fry and Juvenile Rearing	-1000	1	14,764
	Juvenile Migration	-13,877	5	10,461
Summer	Fry and Juvenile Rearing	-3,536	50+	-
	Juvenile Migration <sup>2</sup>	-	-	-
<b>Steelhead</b>				
Fall	Fry and Juvenile Rearing	-5,776	50+	-
	Juvenile Migration	-26,422	50+	-
	Adult Residence	-23,619	50+	-
Winter	Fry and Juvenile Rearing	-343	1	14,209
	Juvenile Migration	-10,903	9	5,223
	Adult Residence	-7,584	50+	-
Spring	Fry and Juvenile Rearing	-1,661	2	18,295
	Juvenile Migration	-12,599	8	5,571
	Adult Residence	-10,646	50+	-
Summer	Fry and Juvenile Rearing	-5,776	50+	-
	Juvenile Migration <sup>2</sup>	-	-	-
	Adult Residence	-23,619	50+	-

<sup>1</sup>Results presented as wetted-area Weighted Response Indices (WRI)

<sup>2</sup>Results omitted from the table, as they are not biologically meaningful given the species's life history

### 2.5.3 Project Effects to sDPS Green Sturgeon, Estimated Using Habitat Loss as an Analytical Surrogates

The SAM is somewhat limited in its ability to predict a complete range of potential project impacts on all focus fish species and life stages, as it is focused primarily on changes to nearshore/bank habitat. The SAM does not adequately assess potential impacts to deeper benthic habitat where green sturgeon are more likely to be present. Although the SAM model does have a green sturgeon component, NMFS has determined that the model may not have the precision to accurately index green sturgeon responses to changes in modeled habitat attributes and that a more rigorous modeling approach needs development.

Critical habitat for green sturgeon in the action is designated in the Sacramento River below ordinary high water (OHW). For this BO, NMFS has determined the amount of critical habitat covered by rock revetment would serve as the best analytical surrogate for impacts to all life stages of green sturgeon. However, the OHW mark could not be collected at the time of this consultation due to the unusually high flows. Therefore, the amount of bare rock revetment will serve as the analytical surrogate for project effects. The amount of bare rock revetment (no vegetation) installed serves as the best analytical surrogate since it represents a direct quantification of the loss of soft benthic substrate where green sturgeon forage, described in greater detail below.

The proposed project will result in a loss of benthic substrate where adult green sturgeon forage for invertebrates to consume, as a total of 13,684 ft<sup>2</sup> will be permanently covered with bare rock revetment. Thus, adult green sturgeon utilizing the SRBPP RM 71.3 action area are expected to be adversely affected by the proposed project due to the reduction in food availability. Juvenile green sturgeon rearing and migrating in the SRBPP RM 71.3 action area are expected to be impacted by the permanent reduction in available habitat for the same reasons. However, the increase in IWM resulting from the project is expected benefit to juvenile green sturgeon by providing underwater structure.

The green sturgeon adult spawning and egg incubation life stages are not expected to be impacted by the proposed bank repair at RM 71.3, as there is no evidence to support the presence of spawning or egg incubation in the Sacramento River within the action area for SRBPP RM 71.3. Spawning and egg incubation are presumed to occur farther upstream. Thus, these life stages are not expected to be impacted by the proposed project.

### 2.5.4 Project Effects on Critical Habitat

#### *Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, and CCV steelhead Critical Habitat*

The SAM model, which models fish response, serves as a good proxy for measuring impact to Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and because the model evaluates changes to important attributes of PBFs and essential features including overhanging shade, substrate size, instream woody material, bank slope, and instream aquatic vegetation. Therefore the SAM can serve to identify appropriate mitigation for short- and

longer-term losses and modifications to PBFs of critical habitat. The changes to these features are recognized in Table 2-1 above.

SAM modeled impacts to PBFs for these species generally will last for 1 to at least 50 years and result from loss or modification of riparian vegetation. These losses and modifications affect juvenile rearing and migration PBFs by reducing in-stream cover, food production, and the quantity of sediment that allow for normal physiological and behavioral responses to the environment. However, with purchase of off-site mitigation, planting of riparian habitat onsite, and the implementation of conservation measures, the above impacts will be adequately compensated. The action, through the purchase of compensatory mitigation credits, will restore and preserve in perpetuity, 0.635 acres of designated critical habitat for CV spring-run Chinook and CCV steelhead. The purchase of credits at a mitigation bank would occur concurrently with implementation of the proposed action, which would ensure that no temporal loss to habitat is experienced. For these reasons we do not expect project impacts to the quality and availability of PBFs of critical habitat in this reach of the river to impact the current function of the action area or affect its ability to reestablish essential features that have been impacted by past and current actions. Therefore, we do not expect project-related impacts to reduce the conservation value of designated critical habitat of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead.

#### *Southern DPS of the North American Green Sturgeon Critical Habitat*

The bank repair at RM 71.3 is expected to cause a reduction in critical habitat by permanently replacing up to 13,684 ft<sup>2</sup> of the natural river bed with bare rock revetment. The project is expected to adversely impact several of the essential features of critical habitat for sDPS green sturgeon. The PBF of food resources, which refers to the availability of prey items for juvenile, subadult, and adult life stages, is expected to be adversely affected by the installation of 13,684 ft<sup>2</sup> bare rock revetment at the toe of the bank repair. The rock revetment will permanently cover green sturgeon foraging habitat, thereby reducing the availability of prey. Similarly the PBF of substrate type and size will also be adversely affected, as part of the natural river bed will be permanently covered with large rocks and will no longer be available as foraging habitat.

SRBPP RM 71.3 is not expected to impact the PBFs of water flow or water quality, migration corridors (migratory pathways necessary for the safe and timely passage of all life stages), or depth (availability of deep pools for use as holding habitat).

## **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.

NMFS original description of cumulative effects is still applicable to the revised project. Since this material is still relevant, it has not been reproduced in this BO. Instead, the reader may refer to this section in the original BO, issued April 4, 2017 for this section.

## 2.7 Integration and Synthesis

The *Integration and Synthesis* section is the final step of NMFS' assessment of the risk posed to species and critical habitat as a result of the proposed action. In this section, NMFS performs two evaluations: whether, given the environmental baseline and status of the species and critical habitat, as well as future cumulative effects, it is reasonable to expect the proposed action is not likely to: (1) reduce the likelihood of both survival and recovery of the species in the wild; and (2) result in the destruction or adverse modification of designated critical habitat (as determined by whether the critical habitat will remain functional to serve the intended conservation role for the listed anadromous species or retain its current ability to establish those features and functions essential to the conservation of the species).

The *Analytical Approach* described the analyses and tools we have used to complete this analysis. This section is based on analyses provided in the *Status of the Species*, the *Environmental Baseline*, and the *Effects of the Action*.

In our *Status of the Species* section, NMFS summarized the current likelihood of extinction of each of the listed species. We described the factors that have led to the current listing of each species under the ESA across their ranges. These factors include past and present human activities and climatological trends and ocean conditions that have been identified as influential to the survival and recovery of the listed species. Beyond the continuation of the human activities affecting the species, we also expect that ocean condition cycles and climatic shifts will continue to have both positive and negative effects on the species' ability to survive and recover. The *Environmental Baseline* reviewed the status of the species and the factors that are affecting their survival and recovery in the action area. The *Effects of the Action* reviewed the exposure of the species and critical habitat to the proposed action and interrelated and interdependent actions, cumulative effects. NMFS then evaluated the likely responses of individuals, populations, and critical habitat. The *Integration and Synthesis* will consider all of these factors to determine the proposed action's influence on the likelihood of both the survival and recovery of the species, and on the conservation value of designated critical habitat.

The criteria recommended for low risk of extinction for Pacific salmonids are intended to represent a species and populations that are able to respond to environmental changes and withstand adverse environmental conditions. Thus, when our assessments indicate that a species or population has a moderate or high likelihood of extinction, we also understand that future adverse environmental changes could have significant consequences on the ability of the species to survive and recover. Also, it is important to note that an assessment of a species having a moderate or high likelihood of extinction does not mean that the species has little or no chance to survive and recover, but that the species faces moderate to high risks from various processes that can drive a species to extinction. With this understanding of both the current likelihood of extinction of the species and the potential future consequences for species survival and recovery,

NMFS will analyze whether the effects of the proposed action are likely to in some way increase the extinction risk each of the species faces.

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

In designating critical habitat, NMFS considers the PBFs within the designated areas that are essential to the conservation of the species and that may require special management considerations or protection. Such requirements of the species include, but are not limited to: (1) space for individual and population growth, and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing offspring, and generally; and (5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species [see 50 CFR § 424.12(b)]. In addition to these factors, NMFS also focuses on the PBFs within the defined area that are essential to the conservation of the species. PBFs may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation.

The basis of the “destruction or adverse modification” analysis is to evaluate whether the proposed action results in negative changes in the function and role of the critical habitat in the conservation of the species. As a result, NMFS bases the critical habitat analysis on the affected areas and functions of critical habitat essential to the conservation of the species, and not on how individuals of the species will respond to changes in habitat quantity and quality.

#### 2.7.1 Status of the Sacramento River Winter-Run Chinook Salmon ESU

Lindley et al. (2007) determined that the winter-run population is at a moderate extinction risk according to population viability analysis, and at a low risk according to other criteria (i.e., population size, population decline, the risk of wide ranging catastrophe, hatchery influence). Data used in Lindley et al. (2007) did not include the significant decline in escapement numbers from 2007 to 2012. Lindley et al. (2007) also states that the winter-run ESU fails the “representation and redundancy rule” because it has only one population and that population spawns outside of the eco-region in which it evolved. An ESU represented by only one spawning population at moderate risk of extinction is at a high risk of extinction (Lindley et al. 2007). NMFS concludes that the winter-run ESU remains at a high risk of extinction.

#### 2.7.2 Status of the CV Spring-Run Chinook Salmon ESU

In the 2016 status review, NMFS found, with a few exceptions, CV spring-run Chinook salmon populations have increased through 2014 returns since the last status review (2010/2011), which has moved the Mill and Deer creek populations from the high extinction risk category, to



moderate, and Butte Creek has remained in the low risk of extinction category. Additionally, the Battle Creek and Clear Creek populations have continued to show stable or increasing numbers the last five years, putting them at moderate risk of extinction based on abundance. Overall, the Southwest Fisheries Science Center concluded in their viability report that the status of CV spring-run Chinook salmon (through 2014) has probably improved since the 2010/2011 status review and that the ESU's extinction risk may have decreased, however the ESU is still facing significant extinction risk, and that risk is likely to increase over at least the next few years as the full effects of the recent drought are realized (NMFS 2016b).

### 2.7.3 Status of the CCV Steelhead DPS

The 2016 status review (NMFS 2016a) concluded that overall, the status of CCV steelhead appears to have changed little since the 2011 status review when the Technical Recovery Team concluded that the DPS was in danger of extinction. Further, there is still a general lack of data on the status of wild populations. There are some encouraging signs, as several hatcheries in the Central Valley have experienced increased returns of steelhead over the last few years. There has also been a slight increase in the percentage of wild steelhead in salvage at the south Delta fish facilities, and the percentage of wild fish in those data remains much higher than at Chipps Island. The new video counts at Ward Dam show that Mill Creek likely supports one of the best wild steelhead populations in the Central Valley, though at much reduced levels from the 1950's and 60's. Restoration and dam removal efforts in Clear Creek continue to benefit CCV steelhead. However, the catch of unmarked (wild) steelhead at Chipps Island is still less than 5 percent of the total smolt catch, which indicates that natural production of steelhead throughout the Central Valley remains at very low levels. Despite the positive trend on Clear Creek and encouraging signs from Mill Creek, all other concerns raised in the previous status review remain.

### 2.7.4 Status of the Green Sturgeon southern DPS

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 because, 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 (National Marine Fisheries Service 2010).

Although the population structure of sDPS green sturgeon is still being refined, it is currently believed that only one population of sDPS green sturgeon exists. Lindley *et al.* (2007), in discussing winter-run Chinook salmon, states that an ESU represented by a single population at moderate risk of extinction is at high risk of extinction over the long run. This concern applies to any DPS or ESU represented by a single population, and if this were to be applied to sDPS green sturgeon directly, it could be said that sDPS green sturgeon face a high extinction risk. However, the position of NMFS, upon weighing all available information (and lack of information) has stated the extinction risk to be moderate (National Marine Fisheries Service 2010).

There is a strong need for additional information about sDPS green sturgeon, especially with regards to a robust abundance estimate, a greater understanding of their biology, and further information about their micro- and macro-habitat ecology.

#### 2.7.5 Status of the Environmental Baseline and Cumulative Effects in the Action Area

The action area is used by most diversity groups and populations of the salmon, steelhead and green sturgeon ESUs and DPSs that are the subject of this BO. Salmon, steelhead and green sturgeon use the action area as an upstream and downstream migration corridor and for rearing.

Within the action area, the essential features of freshwater rearing and migration habitats for salmon, steelhead and green sturgeon have been transformed from a meandering waterway lined with a dense riparian vegetation, to a highly leveed system under varying degrees of constraint of riverine erosional processes and flooding. Levees have been constructed near the edge of the river and most floodplains have been completely separated and isolated from the Sacramento River. Severe long-term riparian vegetation losses have occurred in this part of the Sacramento River, and there are large open gaps without the presence of these essential features due to the high amount of riprap. The change in the ecosystem as a result of halting the lateral migration of the river channel, the loss of floodplains, the removal of riparian vegetation and IWM have likely affected the functional ecological processes that are essential for growth and survival of salmon, steelhead and green sturgeon in the action area.

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

#### 2.7.6 Summary of Project Effects on Sacramento River Winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and sDPS Green Sturgeon Individuals

##### 1. Construction and O&M-related Effects

During construction and O&M, some injury or death to individual fish could result from rock placement (crushing), or predation related to displacement of individuals away from the shoreline or at the margins or turbidity plumes. These construction type actions will occur during summer and early fall months, when the abundance of individual salmon and steelhead is low and should result in correspondingly low levels of injury or death.

##### 2. Long-term Effects Related to the Presence of Project Features

For juvenile and outmigrating salmon and steelhead, the proposed action will result in some short term and long term adverse effects to individual salmon and steelhead that are exposed to the project features along the Sacramento River. These adverse effects are indexed by SAM model results and expressed as WRI deficits. The project results in long term WRI deficits for

rearing and migrating juvenile salmon and steelhead at summer and fall water surface elevations, and do not recover over the 50 years modeled by the SAM analysis. In winter and spring, outmigrating salmon and steelhead will generally experience initial adverse effects in the years following the levee repair, but long term WRI values are positive. For juvenile and fry salmon and steelhead, both short term and long term WRI values in spring and winter are positive.

Migrating Chinook and steelhead residents (outmigrating post spawning adults) will likely not be impacted because adult salmonids are unlikely to use the nearshore habitat that will be affected by this project, as they prefer deeper water instead. Furthermore, the project is not anticipated to cause an increase in predation or install any structural features that might impede adult migration.

Although the project will result in a loss of benthic substrate where juvenile green sturgeon forage for food (13,684 ft<sup>2</sup>), the project will result in an increase in IWM, which is expected benefit to juvenile green sturgeon by providing underwater structure. Similarly, adult green sturgeon will also be adversely affected by the loss of benthic habitat due to the reduction in food availability. However, the amount of benthic substrate lost is small compared to the amount of available habitat in the Sacramento River.

Because of the relatively small size of the project, the favorable response of many life stages to integrated conservation measures, the installation of riparian habitat onsite, and the USACE proposal to purchase compensatory mitigation credits, the action is not likely to appreciably reduce the survival or recovery of anadromous salmonids or green sturgeon.

#### 2.7.7 Summary of Project Effects on Sacramento River Winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead and sDPS Green Sturgeon Critical Habitat

Within the action area, the relevant PBFs of the designated critical habitat for listed salmonids are migratory corridors and rearing habitat, and for green sturgeon the six PBFs include food resources, substrate type/size, flow, water quality, migration corridor free of passage impediments, depth (holding pools), and sediment quality.

Based on SAM modeled WRIs, we expect reductions in the value of PBFs for salmon and steelhead freshwater rearing, but these reductions are at fall and summer water surface elevations and not at water surface elevations when the habitat use is the highest and most significant. Green sturgeon PBFs of substrate type/size and food resources are expected to both be impacted by the proposed project, as project features will cover the soft benthic substrate where green sturgeon forage for food with riprap.

As mitigation for these some of these impacts, the USACE plans to purchase credits from a NMFS-approved conservation bank at a 1:1 ratio equal to the largest WRI deficit for all life stages and seasons for salmonids (0.61 acres). In addition, USACE will also purchase the acreage of the canopy lost from the three removed and three trimmed trees (0.025 acres), for a total of 0.635 acres purchased for the proposed project. Although the two conservation banks within the service area are located upstream of the proposed project, they benefit the same juvenile CV spring-run and CCV steelhead that use the construction portion of the action area by

providing suitable rearing habitat. Both the Fremont Landing Conservation Bank and Bullock Bend Mitigation Bank have adequate mechanisms in place to track credits and debits and ensure that more debits are not sold than credits that are available, and overall habitat improvement for CCV steelhead and CV spring-run Chinook is expected. A description of these tracking mechanisms can be found in the respective banking instruments for Bullock Bend (Westervelt Ecological Services 2016) and Fremont Landing (Wildlands Inc. 2006)

Because of the relatively small size of the project, the favorable response of many life stages to integrated conservation measures, the installation of riparian habitat onsite, and the USACE proposal to purchase compensatory mitigation credits, the action is not likely to appreciably reduce the conservation value of designated critical habitat.

### 2.7.8 Summary

Although there are some short-term and SAM modeled WRI deficits, the effects of these deficits, when added to the environmental baseline and cumulative effects in the action area are small, and in some cases occur during seasons when fish abundance is low. To mitigate for some of the impacts of the RM 71.3 levee repair, the USACE plans install a riparian bench on the waterside levee slope and purchase mitigation credits off-site at a 1:1 ratio. The compensatory mitigation serves as a form of advanced mitigation because the habitat at the bank was restored between one year (Bullock Bend Mitigation Bank) and eleven years (Fremont Landing Conservation Bank) before the impact of the levee repair. Therefore, the project is not expected to reduce appreciably the likelihood of either the survival and recovery of a listed species in the wild by reducing their numbers, reproduction, or distribution; or appreciably diminish the value of designated or proposed critical habitat for the conservation of the species.

## **2.8 Conclusion**

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the Action Area, the effects of the Proposed Action, any effects of 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 CCV steelhead, Sacramento River Winter-run Chinook Salmon, CV spring-run Chinook salmon, or the sDPS of the North American green sturgeon or destroy or adversely modify designated critical habitat of these species.

## **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 incidental take statement (ITS).

The measures described below are non-discretionary, and must be undertaken by the USACE so that they become binding conditions of any grant, contract or permit, as appropriate, for the exemption in section 7(o)(2) to apply. The USACE has a continuing duty to regulate the activity covered by this incidental take statement. If the USACE: (1) fails to assume and implement the terms and conditions, or (2) fails to require the permittee, contractor, or grantee to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit, contract or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the USACE must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

### 2.9.1 Amount or Extent of Take

NMFS anticipates incidental take of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon in the action area through the implementation of the proposed action. NMFS cannot, using the best available information, quantify the anticipated incidental take of these species because of the variability and uncertainty associated with the population size of each species, annual variations in the timing of migration, and uncertainties regarding individual habitat use of the project area. However, it is possible to describe the general programmatic conditions and ecological surrogates using negative SAM WRI values. Accordingly, NMFS is quantifying take of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon incidental to the action resulting from short-term construction impacts, as well as long-term impacts as indexed by the SAM model.

The amount and extent of take described below is in the form of harm due to habitat impacts that will reduce the growth and survival of individuals from predation, or by causing fish to relocate and rear in other locations and reduce the carrying capacity of the existing habitat. This SAM values represent the extent of habitat impacts that will harm fish. As described in the *Analytical Approach* and the *Effects of the Action* sections of this BO, the SAM values represent an index of fish response to habitat variables to which fish respond including bank slope, bank substrate size, instream structure, overhanging shade, aquatic vegetation and floodplain availability. Positive SAM values represent a positive growth and survival response and negative values index negative growth and survival. There is not a stronger ecological surrogate based on the information available. Due to a lack of site-specific fish data, the exact number of fish that will be affected is not known. The take related to project monitoring is not included below, because it was already described and exempted in the programmatic BO for Phase II of the SRBPP. The following level of incidental take from program activities is anticipated:

### **Incidental Take Associated with Construction:**

1. Take of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS of North American green sturgeon in the form of injury and death from predation caused by construction-related turbidity that extends up to 100 feet from the shoreline, and 400 feet downstream, along the project reach for levee construction activities.
2. Take of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon, in the form of harm or injury of fish is expected from habitat-related disturbances from the placement of up to 13,684 ft<sup>2</sup> of quarry stone and 33,837 ft<sup>2</sup> of soil filled quarry stone. Take will be in the form of harm to the species through modification or degradation of the PBFs for rearing and migration that reduces the carrying capacity of habitat.

### **Incidental Take Associated with Operations and Maintenance**

1. Take of Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and the sDPS of North American green sturgeon, in the form of harm from O&M actions is expected from habitat-related disturbances from the placement of up to 600 cubic yards of material per site under the programmatic BO for the extent of the project life (i.e., 50 years). Take will be in the form of harm to the species through modification or degradation of the PBFs for rearing and migration that reduces the carrying capacity of habitat.

### **Incidental Take Associated with Exposure to Project Facilities:**

Sacramento River Winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead

#### ***At fall water surface elevations:***

1. Take in the form of harm to fry and juvenile rearing CV spring-run Chinook salmon, winter-run Chinook salmon and CCV steelhead for at least 50 years after project construction due to reductions in riparian habitat. The amount and extent of harm is quantified in Table 2-1. The amount and extent of harm is greatest in year 6 for each species at -3,536 ft<sup>2</sup> WRI, -3,536 ft<sup>2</sup> WRI, and -5,776 ft<sup>2</sup> WRI respectively, and continue for at least 50 years.
2. Take in the form of harm to juvenile migrating (smolts) CV spring-run Chinook salmon, winter-run Chinook salmon and CCV steelhead for at least 50 years after project construction due to reductions in riparian habitat. The amount and extent of harm is quantified in Table 2-1. The amount and extent of harm is greatest in year 7 for each species at -23,800 ft<sup>2</sup> WRI, -23,800 ft<sup>2</sup> WRI, and -26,422 ft<sup>2</sup> WRI, respectively.

***At winter water surface elevations:***

1. Take in the form of harm to juvenile migrating (smolts) CV spring-run Chinook salmon, and winter-run Chinook salmon is expected for at least 6 years after construction and take of juvenile migrating (smolts) CCV steelhead is expected for at least 9 years after any construction due to reductions in riparian vegetation. The amount and extent of this adverse effect is quantified in Table 2-1. These adverse effects are greatest in Year 2 of construction, with a magnitude of -13,203 ft<sup>2</sup> WRI for all Chinook runs and -10,903 ft<sup>2</sup> WRI for CCV steelhead. Following Year 7 for all Chinook runs and Year 10 for CCV steelhead, the SAM modelled habitat conditions exceed baseline conditions, reaching magnitudes of 9,658 ft<sup>2</sup> 5,151 ft<sup>2</sup> for all Chinook salmon runs and 5,151 ft<sup>2</sup> for CCV steelhead.

***At spring water surface elevations:***

1. Take in the form of harm to juvenile migrating (smolts) CV spring-run Chinook salmon, and winter-run Chinook salmon is expected for at least 6 years after construction and take of juvenile migrating (smolts) CCV steelhead is expected for at least 8 years after any construction due to reductions in riparian vegetation. The amount and extent of harm is quantified in Table 2-1. These adverse effects are greatest in Year 1 following construction, with a magnitude of -13,877 ft<sup>2</sup> WRI for all Chinook runs and -12,599 ft<sup>2</sup> WRI for CCV steelhead. Following Year 6 for all Chinook runs and Year 7 for CCV steelhead, reaching magnitudes of 10,461 ft<sup>2</sup> for all Chinook salmon runs and 5,500 ft<sup>2</sup> for CCV steelhead.

***At summer water surface elevations:***

1. Take in the form of harm to fry and juvenile rearing CV spring-run Chinook salmon, winter-run Chinook salmon and CCV steelhead for at least 50 years after project construction due to reductions in riparian habitat. The amount and extent of harm is quantified in Table 2-1. These adverse effects are greatest in Year 7 for all Chinook, with a magnitude of -3,563 ft<sup>2</sup> WRI, and in Year 6 for CCV steelhead with a magnitude of -5,776 ft<sup>2</sup> for CCV steelhead, and are expected to last for at least 50 years.
2. Take in the form of harm to juvenile migrating (smolt) CV spring-run Chinook salmon, for at least 50 years after project construction due to reductions in riparian habitat. The amount and extent of harm is quantified in Table 2-1. These adverse effects are greatest in Year 7 following construction, with a magnitude of -23,801 ft<sup>2</sup> WRI for spring-run Chinook salmon, and continue for at least 50 years.

**Southern DPS of the North American Green Sturgeon**

1. Take in the form of harm to juvenile rearing, juvenile migrating, and adult sDPS green sturgeon due to permanent replacement of 13,684 ft<sup>2</sup> of benthic habitat with bare quarry stone.

### 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 Sacramento River winter-run Chinook salmon, CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon or destruction or adverse modification of their critical habitat.

### 2.9.3 Reasonable and Prudent Measures

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

1. Measures shall be taken to maintain, monitor, and adaptively manage all conservation measures throughout the life of the proposed project to ensure their effectiveness.
2. Measures shall be taken to minimize the impacts of bank protection by implementing integrated onsite and off-site 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. Measures shall be taken to ensure that USACE levee vegetation management policies that influence SRBPP repair design are based on best available science and consider the potential benefits of levee vegetation to levee integrity, public safety, and ESA-listed fish species.
5. Measures shall be taken to minimize the amount and duration of placement of rock revetment below the OHW of the Sacramento River.

### 2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the USACE or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The USACE 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 incidental take statement (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. Measures shall be taken to maintain, monitor, and adaptively manage all conservation measures throughout the life of the proposed project to ensure their effectiveness.
  - a. The USACE shall continue to coordinate with the IWG agencies and the Technical Team of the Interagency Collaborative Flood Management Program during the implementation and monitoring of this repair.
  - b. The USACE shall update their O&M Manual to ensure that the self-mitigating efforts and repair designs meet the expectation of the SAM values.



- c. The USACE shall provide additional annual reports, as necessary, to describe the implementation of O&M actions, and summarize monitoring results.
  - d. The USACE shall increase the duration of project-specific monitoring from 5 to 10 years for all SAM-modeled measures. This requirement is based on the need to help validate that projects with SAM-modeled results are on a positive trajectory and successfully reaching or exceeding baseline values. Monitoring the effectiveness of the measures installed to meet SAM values may require scientific inquiry that extends beyond in-stream data collection. Tools such as computer modeling and hydraulic models as well as tagging studies should be used as necessary to assess the relative value of each element of the SAM model. In-stream studies must include sampling procedures to determine species composition and abundance together with physical observations and measurements at selected construction and control sites.
  - e. The USACE shall ensure that, for the life of the project, future maintenance actions ensure performance of the site to a level necessary to retain the SAM-modeled habitat values.
  - f. The USACE shall begin implementation of a Green Sturgeon Habitat Mitigation and Monitoring Program (HMMP). At a minimum, this shall include developing a work plan for implementation of the HMMP elements that have been described in the NMFS 2015 BOs for the West Sacramento and American River GRRs. This work plan should a plan for conducting pre- and post-project hydraulic monitoring of the action area, conducting benthic sampling in order to evaluate green sturgeon food availability, and developing a compensatory mitigation strategy for offsetting the spatial footprint of permanently lost benthic habitat that will occur as a result of project construction. The compensatory mitigation strategy shall account for temporal effects between project implementation and implementation of the mitigation measures. If the mitigation occurs offsite, the initial compensatory mitigation rate shall be at a 3:1 ratio to the project footprint. USACE shall send this work plan to NMFS within 60 days of receiving this BO. Benthic sampling and green sturgeon diet studies shall be conducted in collaboration with the Interagency Ecological Program (IEP).
2. Measures shall be taken to minimize the impacts of bank protection by implementing integrated onsite and off-site conservation measures that provide beneficial growth and survival conditions for juvenile salmonids, and the sDPS of North American green sturgeon.
- a. The USACE shall minimize the removal of existing riparian vegetation and IWM to the maximum extent practicable, and where appropriate, removed IWM will 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. The USACE shall only purchase salmon and steelhead credits from a conservation bank that is NMFS-approved. Credits shall be purchased prior to completing the repair.

3. Measures shall be taken to ensure that contractors, construction workers, and all other parties involved with this project implement the project as proposed.
  - a. The USACE shall provide a copy of the programmatic BO and 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 of the programmatic BO and 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 and the programmatic BO. Written documentation of the training must be submitted to NMFS within 30 days of the completion of training.
4. Measures shall be taken to ensure that USACE levee vegetation management policies that influence the SRBPP are based on best available science and consider the potential benefits of levee vegetation to levee integrity, public safety, and ESA-listed fish species.
  - a. The USACE shall sponsor an independently facilitated workshop, inviting NMFS, USFWS, CDFW, DWR, local maintainers such as Sacramento Area Flood Control Agency, and the authors of the Synthesis of Levee Vegetation Research Results (2007-2014) to discuss the conclusions of this report and how local tree risk models that incorporate the best available science can be used in future risk assessments for levee repair programs.
  - b. USACE tree risk assessments for SRBPP shall consider the benefits of levee vegetation to levee integrity, public safety, and ESA-listed fish species.
5. Measures shall be taken to minimize the amount and duration of placement of rock revetment below the OHW of the Sacramento River.
  - a. Construction involving the placement of rock revetment below the OHW will occur in accordance with BMPs and conservation measures described in the programmatic BO.

- b. Updates and reports required by these terms and conditions shall be submitted to:

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

## **2.10 Conservation Recommendations**

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

1. The USACE should complete a study of potential rock revetment removal sites on the Sacramento River where rock revetment does not serve a flood risk reduction benefit and can be removed for the purpose of enhancing green sturgeon and salmonid habitat. The USACE should consider remediating one of these sites as mitigation for the next consultation to be completed under the SRBPP programmatic if there are impacts to green sturgeon habitat.
2. The USACE should make set-back levees integral components of their authorized bank protection or ecosystem restoration efforts.
3. USACE should engage with NMFS on opportunities for implementing actions under the Sacramento River Bank Protection Program - 80,000 linear feet (SRBPP 80,000 lf) that avoid, minimize and effectively offset impacts to fish species and critical habitat. USACE should collaborate with NMFS to develop a prioritization framework that identifies and implements site-level and system improvements that avoid in-water work to the maximum extent practicable. This should include the following, but not necessarily limited to:
  - a. Developing a prioritization framework for SRBPP 80,000 lf with a project design hierarchy that starts with set-back levees and landside levee repairs.
  - b. Proactively seeking variance solutions ahead of consultation requests and/or project planning and implementation.
  - c. Proactively conducting real-estate investigations for landside work before consultation requests and/or project planning and implementation.
  - d. Proactively investigating and identifying riparian corridor enhancement opportunities that could be implemented in the vicinity of future projects that impact fish species and critical habitat.

- e. Proactively investigating and planning rock removal projects to mitigate future placement of revetment in critical habitat. For example, the USACE Chico Landing to Red Bluff project has legacy rock placement areas that are not serving any purpose toward protecting human safety and could be removed to facilitate riverine function such as side channel and floodplain inundation.

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

## **2.11 Reinitiation of Consultation**

This concludes formal consultation for the Sacramento River Bank Protection Project (SRBPP) River Mile 71.3.

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

## **3. MAGNUSON-STEVENSON 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 USACE and descriptions of EFH for Pacific coast salmon contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

### 3.1 Essential Fish Habitat Affected by the Project

EFH designated under the Pacific Coast Salmon Fisheries Management Plan (FMP) may be affected by the Proposed Action. Additional species that utilize EFH designated under this FMP within the Action Area include fall-run/late fall-run Chinook salmon. Habitat Areas of Particular Concern (HAPCs) that may be either directly or indirectly adversely affected include (1) complex channels and floodplain habitats, (2) thermal refugia.

### 3.2 Adverse Effects on Essential Fish Habitat

Construction activities would result in increased sedimentation, turbidity, and the potential for contaminants to enter the waterway. Installation of revetment would result in adverse effects to Pacific coast salmon EFH due to losses of riparian habitat and natural substrate. Effects to the HAPCs listed in Section 3.1 are discussed in context of effects to critical habitat PBFs as designated under the ESA in Section 2.5 and subsections. Effects to ESA-listed critical habitat and EFH HAPCs are appreciably similar, therefore no additional discussion is included. A list of temporary and permanent adverse effects to EFH HAPCs is included in this EFH consultation. Affected HAPCs are indicated by number, corresponding to the list in Section 3.1:

#### Sedimentation and Turbidity

- Reduced habitat complexity (1)
- Degraded water quality (1, 2)
- Reduction in aquatic macroinvertebrate production (1)

#### Contaminants and Pollution-related Effects

- Degraded water quality (1, 2)
- Reduction in aquatic macroinvertebrate production (1)

#### Installation of Revetment

- Permanent loss of natural substrate at levee toe (1)
- Reduced habitat complexity (1)
- Increased bank substrate size (1)
- Increased predator habitat (1)

#### Removal of Riparian Vegetation

- Reduced shade (2)
- Reduced supply of terrestrial food resources (1)
- Reduced supply of IWM (1)

The terms and conditions and conservation recommendations in the preceding BO contain adequate measures to avoid, minimize, or otherwise offset the adverse effects to EFH. Therefore, NMFS has no additional EFH conservation recommendations to provide.

### 3.3 Supplemental Consultation

USACE must reinitiate EFH consultation with NMFS if the Proposed Action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(1)).

## 4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

### 4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this BO is the Army Corps of Engineers. Other interested users could include the United States Fish and Wildlife Service and California Department of Fish and Wildlife. Individual copies of this BO were provided to USACE. This BO will be posted on the Public Consultation Tracking System website (<https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts>). The format and naming adheres to conventional standards for style.

### 4.2 Integrity

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

### 4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

## 5. REFERENCES

Lindley, S. T., R. S. Schick, E. Mora, P. B. Adams, J. J. Anderson, S. Greene, C. Hanson, B. P. May, D. McEwan, R. B. MacFarlane, C. Swanson, and J. G. Williams. 2007. Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin. *San Francisco Estuary and Watershed Science* 5(1):26.

National Marine Fisheries Service. 2010. Biennial Report to Congress on the Recovery Program for Threatened and Endangered Species. U.S. Department of Commerce, 129-130 pp.