US Army Corps of Engineers®

Sacramento District
Planning Division

Yuba River Ecosystem Restoration Feasibility Study

Yuba County, California

Appendix D: Environmental Appendix

October 2018

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Table of Contents

Attachment 1 – NMFS Biological Opinion
Attachment 2 – Letter of Concurrence
Attachment 3 – 404(b)(1) Analysis
Attachment 4 – Final Coordination Act Report
Attachment 5 – CWA Section 401 WQC Coordination Letter
Attachment 6 – Monitoring and Adaptive Management Plan
Attachment 7 – Model Approval Memorandum
Attachment 8 – Habitat Evaluation Assessment Approach
Attachment 9a – Notice of Intent
Attachment 9b – Response to Public Comments
Attachment 10a – Air Quality Emissions Analysis
Attachment 10b – Carbon Sequestration Modeling
Attachment 11 – Traffic Analysis

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Environmental Appendix D
Attachment 1

Biological Opinion – National Marine Fisheries Service

Yuba River Ecosystem Restoration Feasibility Study

Prepared By:

National Marine Fisheries Service

October 2018

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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-2018-9075

October 18, 2018

Mark T. Ziminske
Chief
Environmental Resources Branch
Sacramento District
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response and Fish and Wildlife Coordination Act Recommendations for the Yuba River Ecosystem Restoration Feasibility Study

Dear Mr. Ziminske:

Thank you for your letter of January 3, 2018, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS), and for the additional information you provided on May 2, 2018, pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Yuba River Ecosystem Restoration Feasibility Study.

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

This biological opinion (opinion) is based on the final biological assessment, received by NMFS on May 2, 2018. Based on the best available scientific and commercial information, the opinion concludes that the project is not likely to jeopardize the continued existence of the ESA listed threatened Central Valley (CV) spring-run Chinook salmon evolutionarily significant unit (ESU), (*Oncorhynchus tshawytscha*), the threatened California Central Valley (CCV) steelhead distinct population segment (DPS) (*O. mykiss*) or the southern DPS of the North American green sturgeon (*Acipencer medirostris*). and is not likely to destroy or adversely modify their designated critical habitats. NMFS has identified that the proposed action may adversely affect all of the above identified species. NMFS has also identified that the proposed action may adversely affect the designated critical habitat for all of the species identified above.

NMFS has also 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 Corps serves as the lead Federal Action Agency for the proposed action.

The Corps has a statutory requirement under section 305(b)(4)(B) of the MSA to submit a detailed written response to NMFS within 30 days of receipt of these conservation recommendations, and 10 days in advance of any action, that includes a description of measures for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR 600.920(j)). If unable to complete a final response within 30 days, the Corps should provide an interim written response within 30 days before submitting its final response. In the case of a response that is inconsistent with our recommendations, the Corps must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

Because the proposed action will modify a stream or other body of water, NMFS also provides recommendations and comments for the purpose of conserving fish and wildlife resources under the Fish and Wildlife Coordination Act (16 U.S.C. 662(a)).

Please contact Gary Sprague in NMFS California Central Valley Office at (916) 930-3615 or via email at Gary.Sprague@NOAA.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

for Maria Chen
Barry A. Thom
Regional Administrator

Enclosure

cc: To the File 151422-WCR2018-SA00406
Chelsea D. Stewart, Corps, Chelsea.D.Stewart@usace.army.mil
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
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Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response and Fish and Wildlife Coordination Act Recommendations.

Yuba River Ecosystem Restoration Feasibility Study

NMFS Consultation Number: WCR-2018-9075

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	Yes	No
California Central Valley steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Southern distinct population segment of North American green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	Yes	No

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

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

Issued By:

Maria C Rea
for Barry A. Thom
Regional Administrator

Date: October 18, 2018

TABLE OF CONTENTS

1. INTRODUCTION 1
   1.1 Background 1
   1.2 Consultation History 1
   1.3 Proposed Federal Action 2
   1.3.1 Habitat Increment 2 (Upper Gilt Edge Bar) 4
   1.3.2 Habitat Increment 3a (Lower Gilt Edge Bar) 5
   1.3.3 Habitat Increment 5a 6
   1.3.4 Habitat Increment 5b 7
   1.4 Project Feature Types 8
   1.4.1 Side Channel 8
   1.4.2 Floodplain Grading 9
   1.4.3 Riparian Planting 9
   1.4.4 Structural Complexity features 9
   1.5 Construction Methods 10
   1.5.1 Fish Relocation 10
   1.5.2 Fish Relocation through Herding 11
   1.5.3 Fish Capture and Relocation 12
   1.6 Long Term Monitoring and Maintenance 13
   1.7 Avoidance, Minimization, and Conservation Measures 13
   1.8 Construction Schedule, Access, and Staging 17
2. ENDANGERED SPECIES ACT: 19
   2.1 Analytical Approach 19
   2.2 Rangewide Status of the Species and Critical Habitat 20
   2.2.1 Central Valley Spring-run Chinook salmon 21
   2.2.2 California Central Valley Steelhead 23
   2.2.3 Southern Distinct Population Segment of North American Green Sturgeon 26
   2.2.4 Global Climate Change 29
   2.3 Action Area 30
   2.4 Environmental Baseline 30
   2.4.1 Historical Usage of the Lower Yuba River 31
   2.4.2 Mercury Contamination 32
   2.4.3 Existing Conditions 33
   2.4.4 CV Spring-run Chinook Salmon and CCV Steelhead and their Critical Habitat in the Action Area 34
   2.4.5 North American Green Sturgeon and their Critical Habitat in the Action Area 34
   2.4.6 Global Climate Change 35
   2.5 Effects of the Action 35
   2.5.1 Potential Effects of Fish Relocation on Individuals 36
   2.5.2 Potential Effects of Instream Construction on Individuals 38
   2.5.3 Potential Effects of Sediment and Turbidity on Individuals 39
   2.5.4 Potential Effects of Elevated Levels of Mercury on Individuals 41
   2.5.5 Potential Effects of Contaminants on Individuals 42
   2.5.6 Potential Effects of Noise on Individuals 42
   2.5.7 Potential Effects of Monitoring on Individuals 43

2.5.8 Potential Effects to Critical Habitat ... 43
2.6 Cumulative Effects ... 45
2.7 Integration and Synthesis ... 45
2.7.1 Rangewide Status ... 46
2.7.2 Environmental Baseline ... 47
2.7.3 Effects of the Proposed Action to Listed Species ... 48
2.7.4 Effects of the Proposed Action to Critical Habitat ... 48
2.7.5 Survival and Recovery ... 49
2.8 Conclusion ... 50
2.9 Incidental Take Statement ... 50
2.9.1 Amount or Extent of Take ... 50
2.9.2 Effect of the Take ... 52
2.9.3 Reasonable and Prudent Measures ... 52
2.9.4 Terms and Conditions ... 52
2.10 Conservation Recommendations ... 53
2.11 Reinitiation of Consultation ... 54
3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE ... 55
3.1 Essential Fish Habitat Affected by the Project ... 55
3.2 Adverse Effects on Essential Fish Habitat ... 55
3.3 Essential Fish Habitat Conservation Recommendations ... 56
3.4 Statutory Response Requirement ... 56
3.5 Supplemental Consultation ... 56
4. FISH AND WILDLIFE COORDINATION ACT ... 57
5. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW ... 58
5.1 Utility ... 58
5.2 Integrity ... 58
5.3 Objectivity ... 58
6. REFERENCES ... 59

1. INTRODUCTION

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

1.1 Background

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

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

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available 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 NMFS California Central Valley Office in Sacramento, California.

1.2 Consultation History

August 5, 2014, Meeting with the Corps to discuss the Yuba Reconnaissance Study
This meeting included a status update of the 905(b) report, and identified the potential range of actions.

October 2014, Yuba River Ecosystem Restoration Section 905(b) Analysis report available.

September 22-25, 2015 SMART Planning Charrette
The charrette included an overview of the purpose and need for the feasibility study, identified the study area, identified fish resources, a site visit, screening criteria for options, identification of risks, and next steps.

December 4, 2015, NMFS provides scoping comments to the Corps regarding the intent to prepare an Integrated Feasibility Report and Draft Environmental Impact Statement.

March 9, 2016, NMFS and Corps met to discuss measures being considered.

April 6, 2016, Corps value engineering workshop to identify modifications and cost savings to the Corps proposal

December 12, 2016, Discussion regarding Daguerre Point Dam and the potential inclusion of fish passage improvements at the dam.

January 3, 2018, Corps requests ESA consultation with NMFS.

March 19, 2018, NMFS requests additional information regarding scour flows and effects on incubating California Central Valley steelhead eggs, in order to initiate consultation.

May 2, 2018, Corps provided additional information regarding peak flow events.

July 13, 2018, NMFS requests a 40-day extension of the formal consultation deadline, in order to address another Corps project.

July 30, 2018, the Corps grants the 40-day extension request.

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). The Corps and the Yuba County Water Agency (YCWA) proposed to implement a number of fish habitat restoration measures along the lower Yuba River, California. The feasibility study was conducted under the general authority for flood control investigations in the River and Harbors Act of 1962. The proposed activities are at approximately 30 percent design.

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

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

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). No interrelated or interdependent actions were identified.

The U.S. Army Corps of Engineers (Corps), in partnership with the Yuba County Water Agency (YCWA) propose to restore 178.6 acres of aquatic and riparian habitat along the lower Yuba River in Yuba County, California. The principal features of the proposed action include restoration of 42.5 acres of aquatic habitat including side channels, backwater areas, bank scallops, and channel stabilization. These features will provide shallow, low velocity, rearing habitat and refugia for juvenile anadromous salmonids and potentially increase benthic macroinvertebrate producing habitat. Engineered log jams (ELJs) and placement of boulders and large woody material (LWM) have been incorporated in the proposed action at strategic locations. ELJs and boulders would be placed at actively eroding banks or sites with high velocities and shear stresses. These features would promote bank stabilization, add structural complexity, provide velocity refuge for juvenile fish, and modify local hydraulics and sediment transport.

The proposed action includes about 136 acres of riparian habitat restoration consisting of floodplain lowering and grading and riparian vegetation plantings, which would increase the quantity and quality of riparian habitat in the river corridor. The proposed action addresses fragmentation of habitat by targeting areas adjacent to existing vegetation that have been unable to initiate revegetation through natural processes due to substrate composition and depth to groundwater. Floodplain lowering reconnects the river to its floodplain and makes planting feasible where it was not previously due to excessive groundwater depths.

The proposed action includes 4 units along the lower Yuba River, referred to as habitat increments. These habitat increments occur between the USGS Marysville gage and the Hwy 20 bridge (Figure 1). A description of the 4 habitat increments (2, 3a, 5a, and 5b) are provided below.

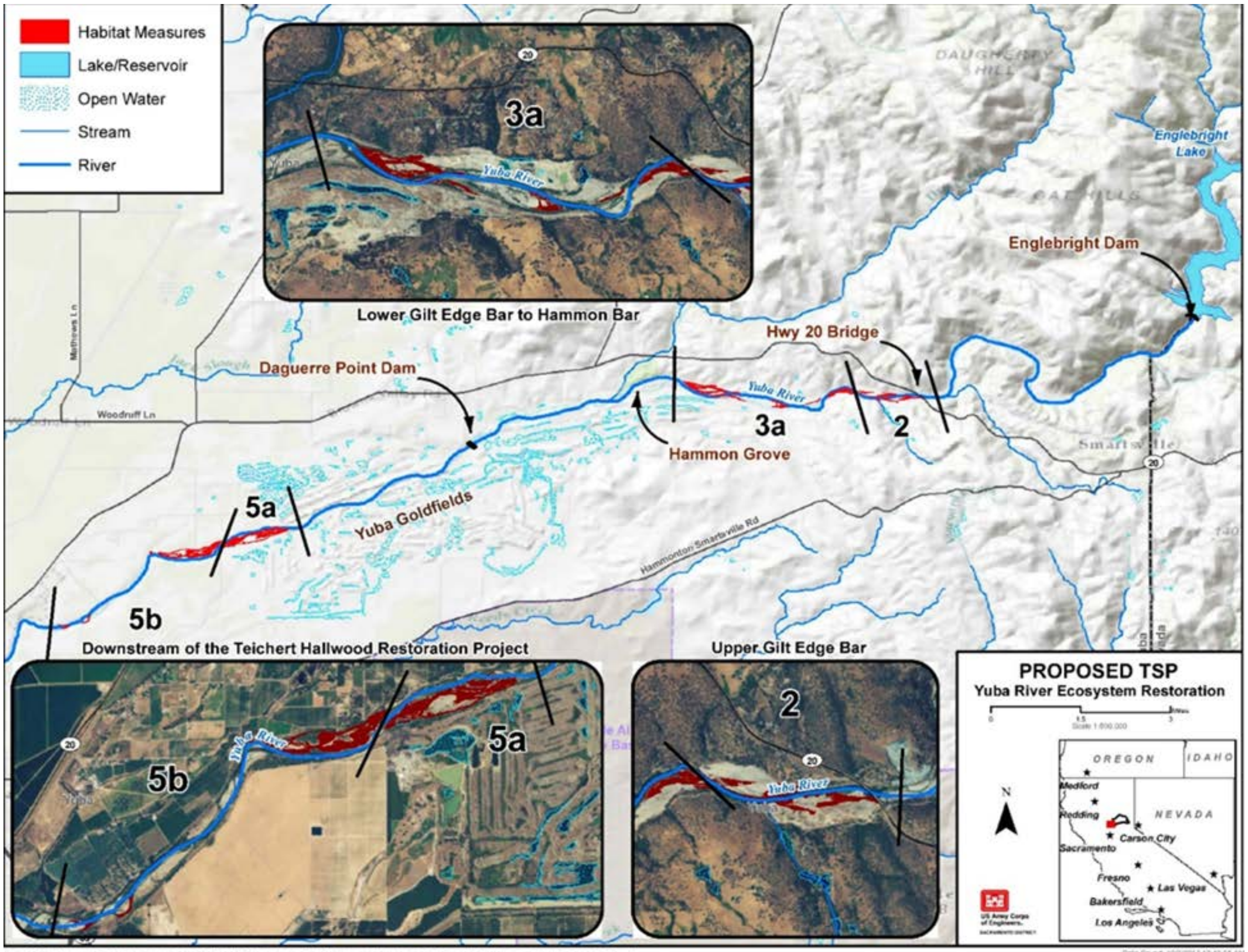

Figure 1. Proposed action area on the lower Yuba River (Corps 2018).

1.3.1 Habitat Increment 2 (Upper Gilt Edge Bar)

Just downstream of the Highway 20 Bridge at Upper Gilt Edge Bar, the floodplain would be lowered to facilitate inundation at 2,000 cubic feet per second (cfs) and riparian vegetation would be planted along the channel edge.

On the southern bank of Upper Guilt Edge Bar, where the bank is 8-15 feet high, and the edge of the channel lacks habitat complexity, small scallops would be excavated into the tall and steep banks to increase local topographic diversity and wetted edge.

These scallops are designed to create an inundated alcove at all discharges with the steep slopes surrounding the alcoves feathered to at least a 10:1 slope, providing additional shallow inundated areas with desirable depth/velocity combinations. Initially, these scallops would provide year round rearing habitat to juvenile salmonids. Over time, it is expected that fine sediment may deposit in the scallops creating nursery sites where natural woody vegetation recruitment could occur. The scallops would further facilitate natural recruitment of riparian vegetation, due to shallow access to the water table, and the fine texture of deposited sediments.

In addition, LWM would be placed within and protruding from the scallops. An existing backwater area would be restored allowing for inundation in a typical 50% to 100% annual chance exceedance (ACE) flood. Riparian vegetation would be planted to increase the structural diversity and extent of existing riparian vegetation. Additional fine material would be introduced to the upper 3 feet of the soil column in excavated areas to increase soil absorption and the amount of soil moisture available to riparian vegetation. LWM would be placed within the backwater to provide aquatic structure.

Riparian vegetation would be planted at the Unnamed Bar on the north side of the river near River Mile (RM) 17. The site would be restored by lowering areas to increase lateral floodplain connectivity and provide additional opportunity to plant riparian vegetation. Table 1 shows details for features on Increment 2.

1.3.2 Habitat Increment 3a (Lower Gilt Edge Bar)

At Lower Gilt Edge Bar, the existing swale feature (at upstream end of Lower Gilt Edge Bar) would be lowered and connected to the channel to become inundated at 2,000 cfs. A patchwork floodplain network of LWM surrounding the restored groundwater-fed swale would be constructed to encourage fine sediment deposition and potential riparian recruitment, as well as provide edgewater refugia at flows above baseflow.

Table 1. Habitat Increment 2 Details (all phases)

Feature Type	Acres	Volume (cubic yards)	Length (miles)
Floodplain Lowering	14.0	30,673	0.66
Riparian Planting	8.7	N/A	N/A
Bank Scalloping	0.3	N/A	N/A
Backwater Area	0.3	2,489	0.05

Downstream of Lower Gilt Edge Bar, on Hidden Island, the alluvial bar on the north side of the river, riparian vegetation would be planted.

First Island has large expanses of floodplain and high floodplain, and a side channel on river left provides spawning and rearing habitat. This area may provide immediate benefit to emerging salmonid fry if they are allowed access to larger expanses of shallow habitat with riparian cover. To encourage sediment deposition and riparian vegetation recruitment, Engineered Log Jams (ELJs) would be installed in a patchwork configuration, particularly along the apex of First Island just above bankfull elevation. For the purposes of documenting benefits in this report, direct planting of riparian vegetation was substituted for ELJ placement.

Rock and sediment would be deposited along the left bank of Silica Bar, and ELJs would be placed to aid constriction at this location. LWM would be placed along the margins of the downstream terminus of the existing side channel/backwater that is surrounded by an existing stand of diverse, mature, native riparian vegetation, in areas that would not disrupt existing riparian vegetation along the banks of the side channel/backwater area. Floodplain areas would be lowered to facilitate more frequent inundation and riparian vegetation would be planted.

North Silica Bar is located on the river right just downstream of First Island, floodplain surfaces would be lowered and riparian vegetation would be planted to facilitate more frequent inundation between 3,000 and 5,000 cfs. Rock and sediment would be deposited along the left bank of Silica Bar, coupled with placement of ELJs to aid river constriction at this location.

A side channel would be created that activates above 3,000 cfs and connects to the low lying area downstream, providing beneficial off-channel habitat with established riparian vegetation. This would create an anabranching side channel (stable multiple-thread channels) in an existing swale within a stand of relatively dense vegetation that presently includes willows and cottonwoods.

Habitat Increment 3a would increase habitat connectivity between Habitat Increment 2 and SYRCL's Long Bar Restoration Project and Hammon Bar Restoration Project. Table 2 shows details for features on Increment 3a.

Table 2. Habitat Increment 3a Details (all phases)

Feature Type	Acres	Volume (cubic yards)	Length (miles)
Floodplain Lowering	13.0	25,099	0.48
Riparian Planting	28.7	N/A	N/A
Side Channel	11.3	186,689	0.87
Channel Constriction	3.5	N/A	N/A

1.3.3 Habitat Increment 5a

Immediately downstream of the Hallwood Side Channel and Floodplain Restoration Project (Hallwood Project), a historical channel alignment on the north side of Bar C would be restored to inundate at 2,000 cfs and function as swale habitat. The side channel and adjacent floodplain would be lowered and graded. Additionally, riparian vegetation would be planted on each side of the restored swale/side channel. ELJs would be placed in a patchwork configuration at the inflow of the swale, at the upstream end of Bar C. In addition, LWM would be placed in the backwater area at the downstream end of Bar C to increase structural and habitat complexity in the area.

A historical channel alignment on the south side of the bar would be restored by lowering and grading a side channel within a stand of riparian vegetation. The side channel would extend into an existing backwater habitat located at the downstream edge of the Yuba Goldfields. The floodplain on the north side of the side channel would be lowered and planted with riparian vegetation. Boulder structures would be placed to provide hydraulic stability at the inflow section of the side channel at the upstream end of Bar C.

Habitat Increment 5a would connect riparian and aquatic habitat corridors to the Teichert Hallwood Restoration Project. Table 3 shows details for features on Increment 5a.

Table 3. Habitat Increment 5a details (all phases)

Feature Type	Acres	Volume (cubic yards)	Length (miles)
Floodplain Lowering	13.0	33,545	0.63
Riparian Planting	21.3	N/A	N/A
Side Channel	15.1	194,300	1.92

1.3.4 Habitat Increment 5b

A side channel would be constructed at Narrow Bar that would connect to an existing swale at the downstream end of the bar. Existing riparian vegetation would border the created side channel. Another side channel would be created, splitting off from the other side channel through the middle of the bar in the southwest direction. Boulders would be placed to maintain stable hydraulic conditions at the inflow. There is a large expanse of shallow depth to groundwater on Narrow Bar, with some areas of high floodplain. The high floodplain areas would be graded and planted with riparian vegetation. Additionally, floodplain along the main channel would be graded to increase inundation duration and frequency at 2,000 cfs. ELJs would be placed in a patchwork configuration to facilitate riparian recruitment and to restore swale habitat. At the terminus of the anabranching side channel, a backwater area would be created.

River Mile 6.5, A backwater area would be created on the right bank of River Mile 6.5 to provide shallow water refugia for salmonids.

Riparian vegetation would be planted in the downstream portion of Bar E surrounding a historical channel alignment to restore species and structural diversity. LWM would be placed in the swale/backwater downstream from the existing diversion channel.

Riparian vegetation would be planted along the upstream portion of Island B to create species and structural diversity. ELJs would be placed in a patchwork configuration to encourage native plant recruitment and improve survivability of plantings. Table 4 shows details for features on Increment 5b.

Table 4. Habitat Increment 5b Details (all phases)

Feature Type	Acres	Volume (cubic yards)	Length (miles)
Side Channel	9.2	127,625	0.75
Floodplain Lowering	7.7	9,726	0.46
Riparian Planting	29.7	N/A	N/A
Backwater Area	2.9	13,346	0.19

The total quantities for the proposed action are summarized for each feature type in Table 5.

Table 5. Summary of Proposed Action Features (all phases and increments)

Feature Type	Total Acres	Total Volume (CY)	Total Length (miles)
Riparian Planting	136.1[1]	--	--
Floodplain Grading	47.6	127,269	--
Side Channel	35.5[2]	635,769	3.5
Backwater	3.3	19,794	0.2
Bank Scalloping[3]	0.3	--	--
Total	178.6	782,832	3.7

[1] - Riparian planting includes areas with existing suitable depth to ground water and areas where proposed floodplain lowering would establish suitable depth to ground water.
[2] – Side channel quantities include features identified as Channel Constriction.
[3] – Excavation quantities were not estimated for bank scalloping features.

1.4 Project Feature Types

As discussed above, the proposed action is in early stages of development and site specific information has not been fully developed; however, the proposed actions are being developed as summarized below. The full description of design considerations is in an attachment to the biological assessment (Corps 2018a) and is included in Appendix C of the Feasibility Report and Environmental Assessment (FR/EA) (Corps 2018b).

1.4.1 Side Channel

Side channels would be created to increase juvenile rearing habitat and promote natural riparian vegetation recruitment by re-establishing favorable physical conditions. The design intent of creating channels is to create new shallow water, off channel habitat that maintains inundated and connected to the main channel throughout the year, particularly during the over summer (June through September) rearing period. The design considerations and criteria for side channels would also be applied to features such as bank scalloping and backwaters as appropriate.

Side channels would be designed to provide a water depth of 0.5 ft associated with the base flow conditions specific to the feature site. Base flow for sites upstream of Daguerre Point Dam are expected to be 730 cfs. Base flow for sites downstream of Daguerre Point Dam are expected to be 530 cfs. Water depth of 0.5ft would provide suitable depths for CCV steelhead and CV spring-run chinook rearing fry & juveniles. Side channels would be designed to minimize sedimentation and to avoid impacting the sediment transport capacity of the main channel. Side channel walls would slope at 3:1 (horizontal:vertical) from the base flow condition to a design depth (0.5 ft). A 3:1 slope was selected due to relative stability. Steep side slope walls may be preferred to prevent spawning in areas prone to dewatering. Side channels will be designed to maximize sustainability through the placement of structural complexity features (LWM and boulders) and incorporation of channel constriction to maintain desirable hydraulic conditions at channel entrance/exits.

1.4.2 Floodplain Grading

Floodplain grading would be implemented to create additional inundated habitat, increase the frequency and duration of inundation, and enhance access to groundwater to support the establishment of riparian vegetation. The design intent of grading floodplains is to enhance seasonally inundated edge habitat. Lowering elevations would increase the frequency and duration of inundation in areas between the low flow channel and high floodplain. Increased inundation would enhance juvenile rearing habitat at target flows and enhance conditions to support the establishment of riparian vegetation. The design considerations and criteria for floodplain grading would also be applied to features such as bank scalloping and backwaters as appropriate.

Floodplain grading would be designed to both enhance juvenile rearing habitat conditions and increase the area with depths to ground water suitable for supporting the establishment of riparian vegetation. In general, this would involve grading areas elevation between 7-10 ft down to an elevation that would be begin to become inundated at ~2000 cfs. This target would improve availability of habitat with suitable frequency and duration of inundations to support fish, benthic macroinvertebrates, and vegetation. Floodplains would be graded at an extrapolated slope between target flow conditions and upper limits of grading.

1.4.3 Riparian Planting

Riparian planting would be implemented to create additional riparian habitat and enhance riverine habitat during periods of inundation. The design intent of riparian plantings is to improve natural recovery of riparian vegetation by enhancing establishment conditions. Riparian plantings would be targeted for areas with existing suitable depth to ground water and in graded areas with newly established suitable depth to ground water.

Plantings would rely on a combination of four native species, including: Fremont cottonwood (*Populus fremontii*), Gooddings black willow (*Salix gooddingii*), red willow (*S. laevigata*), and arroyo willow (*S. lasiolepis*). The planting design is intended to promote hardwood structure (i.e., forest and large wood production) while also providing species and structural diversity. Planting would be conducted in a patch work design not to exceed 50% total cover to promote natural structural and spatial diversity. Plantings would be conducted at an initial density of 1,500 cuttings per acre. Planting would occur with a stinger planting method that uses a specialized planting device mounted on an excavator to quickly plant cuttings one or two at a time. The stinger device can plant to a maximum depth of nearly 7 feet and a cutting of maximum diameter of approximately two inches.

1.4.4 Structural Complexity features

Structural complexity features, including large woody material placements, engineered log jams, and boulder fields, will enhance microhabitat availability through the addition of physical structure and/or modification of local flows as well as maintain hydraulic conditions that support the hydraulic maintenance of desirable riverine morphological features (i.e., side channels).

Large wood placements would generally include material 25 feet in length and 2 feet in diameter. The material will be keyed into the bankline at a 45 degree angle downstream and protrude one third of its total length beyond the bankline into the channel. The floodplain application is where woody material is placed on a floodplain or seasonally inundated area, the woody material will be placed parallel with the flow, anchored with cables boulders and pins or partially buried Js). Boulders weighing 5 tons each will be used to slow velocities in certain areas.

1.5 Construction Methods

Construction methods will be refined in the Preconstruction Engineering and Design phase to meet project objectives, as well as to avoid and minimize adverse environmental effects. In general, construction of the proposed action would be accomplished with common heavy equipment. The coarse grained cobble, gravel and sand have been mined by local companies for many years using common heavy equipment, and should be adequate for these excavation actions. Dump trucks (13 cubic yard capacity) will likely be used for transport of excavated material to placement sites. Heavy blade graders and water trucks will be utilized to maintain haul roads and staging areas. Planting activities will utilize heavy loaders equipped with stingers for placement of cuttings. Temporary bridges (constructed from railroad car platforms or other suitable transportable structure) may be used to achieve access to some bars in the river for planting or excavation.

In general, construction methods will be conducted in a manner to avoid or minimize effects to fish and other aquatic species, including restricting work to periods where interactions with fish are minimized and sequencing work to minimize or avoid the potential for fish to be present in the immediate construction area. The proposed action includes construction activities from April 1 through November 30. In-water work would be minimized to the greatest extent possible by working during periods of low flow (June 1 – October 31) where excavation of features could occur in-the-dry. Some of the proposed features (i.e., side channels, back waters, and or floodplain grading) include permanent connectivity to the low flow channel and at a minimum in-water work would be required to establish the interface of constructed features and the low flow channel.

Construction of these features would proceed in a manner so as to limit the exposure of fish from entering project features during construction. For side channel features or other grading features being constructed in-the-dry, berms of natural substrate would be left in place while the remainder of the feature is excavated to prevent fish from entering. These berms would be removed after all other construction activity in the feature is completed. If site conditions prevent this construction method from being applied then the feature would be conducted in an open fashion, minimizing potential for fish to become stranded in the feature. It is anticipated that fish would be move away from any construction-related disturbance and that the open construction method would minimize stress caused to any individuals.

1.5.1 Fish Relocation

There is a chance that fish will need to be relocated away from a construction activity/feature, either because the feature has connectivity to the channel, or because fish have become stranded in an existing or constructed feature. If necessary, fish would be relocated through herding or capture as described below by methods described in the opinion for the Hallwood project (NMFS 2017). Fish exclusion activities could include construction of temporary berms with natural material (clean cobble or gravel) or potentially through installation of net fencing. Fish trapped in a project feature could be relocated through herding out of a feature or by capture and relocation. Herding and relocation would be performed through use of a seine net or other method as described in the opinion issued for the Hallwood Project (NMFS 2017); the sections below are sourced from that opinion.

1.5.2 Fish Relocation through Herding

If fish relocation needs to be performed then a qualified fisheries biologist will determine which fish relocation method is most appropriate for the area. Fish relocation will most likely initially be attempted by trying to herd the fish out of the work area as this would minimize impacts to fish as they would not be handled and transported. The following guidelines will apply to fish relocation through herding.

- Before fish relocation through herding begins, a qualified fisheries biologist will identify the most appropriate method and approach. Prior to beginning, the fisheries biologist will ensure that the location that fish are herded to contains suitable habitat.

- The fish relocation through herding will be conducted under the supervision of a qualified fisheries biologist. The method that will most likely be used will be to install an exclusion screen or block-net above the upstream most work area. Then an appropriately sized seine that covers the width of the channel, operated by qualified personnel, will be used and the seine pull will begin immediately below the upstream screen/net. The seine will be pulled in the downstream direction until it is below the bottom of the work area and will then be held in place, blocking the entire channel until a temporary block net can be installed. The temporary block-net will be installed immediately upstream of the seine net such that fish have been herded downstream and cannot return upstream. A minimum of three seine pulls will be performed. On each pull when the seine approaches the block-net, the block-net will be removed until the seine has passed downstream of its location and will then be re-installed immediately upstream of the seine. After the final pass, as determined by the fisheries biologist, the block-net will be left in place or replaced with an exclusion screen in such a way that fish cannot move upstream.

- After the area has been seined enough times that fish are unlikely to remain based on the judgment of a qualified fish biologist then the area will be surveyed for fish. The fisheries biologist will determine the most appropriate method to survey the area for remaining fish.

- If the survey results in an estimate of greater than 95% of individuals from each fish species that were present prior to relocation efforts being no longer present after relocation efforts and no listed species were observed then the fish relocation through herding will be considered a success. If initial relocation through herding efforts are deemed not successful then the fisheries biologist will determine whether further herding with a seine will be conducted until the success criteria is met or relocation through capture will be employed.

1.5.3 Fish Capture and Relocation

If fish relocation using herding is not successful or the fisheries biologist decides it is not worth attempting first, then fish capture and relocation will be used. The following guidelines will apply to fish capture and relocation.

- Before fish relocation begins, a qualified fisheries biologist will identify the most appropriate release location(s). Release locations will have water temperatures within 2°C of the capture location and offer suitable habitat for released fish, and will be selected to minimize the likelihood that fish will re-enter the work area or become impinged on the exclusion net or screen.

- The method used to capture fish will depend on the nature of the work site, and will be selected by a qualified fisheries biologist who is experienced with fish capture and handling. Areas of complex habitat may require the use of electrofishing equipment, whereas in other areas fish may be captured through seining or dip netting. Electrofishing will only be performed by properly trained personnel following NMFS guidelines (NMFS, 2000). Electrofishing will only be performed if seining and/or dip netting is not feasible.

- Handling of salmonids will be minimized. When it is necessary, personnel will only handle fish with wet hands or nets.

- Fish will be held temporarily in cool, shaded water in a five gallon bucket with a lid. Overcrowding in buckets will be avoided by using at least two buckets and no more than 25 fish will be kept in each five gallon bucket. Aeration will be provided with a battery powered external bubbler. Fish will be protected from jostling and noise and will not be removed from the bucket until the time of release. The water temperature in each bucket will be monitored and partial water changes or the addition of ice and stress coat will be conducted as necessary to maintain a stable water temperature (within 2°C of initial water temperature). Fish will not be held for more than a half hour. If water temperature reaches or exceeds NMFS limits, fish will be released and relocation operations will cease.

- If fish are abundant, capture will cease periodically to allow release and minimize the time fish are held in containers.

- Fish will not be anesthetized or measured. However, they will be visually identified to species level, and year classes will be estimated and recorded.

- When feasible, initial fish relocation efforts will occur several days prior to the scheduled start of construction. The fisheries biologist will perform a survey on the same day before construction.

- Reports on fish relocation activities will be submitted to California Department of Fish and Wildlife (CDFW) and NMFS in a timely fashion.
- If mortality during relocation exceeds 2%, relocation will cease and CDFW and NMFS will be contacted immediately or as soon as feasible.

1.6 Long Term Monitoring and Maintenance

Long-term monitoring and maintenance activities will be conducted post construction to ensure that desired ecological functions are established and maintained. Long-term monitoring and maintenance will be described in the Monitoring and Adaptive Management Plan (M&AMP) and Operation and Maintenance (O&M) Manual. A draft M&AMP is included in an appendix to the draft Feasibility Report/Environmental Assessment (Corps 2018b) and will be finalized along with the Final FR/EA. The O&M Manual will be developed during the Preconstruction Engineering and Design phase, subsequent to release of the Final FR/EA. The goals of the project are focused on improving ecosystem function and process rather than improving outcomes for specific species, therefore, it is anticipated that all monitoring activities described in the M&AMP and O&M Manual would focus on monitoring the condition of physical features (i.e., depth of inundation and establishment of riparian vegetation) rather than demonstrating habitat use by specific fish species. Monitoring activities will likely require staff to wade into the channel to take samples; however, no long-term monitoring activities would result in the direct handling or harassment of fish and the potential impacts to fish are expected to be negligible.

Routine operation and maintenance requirements for the proposed action are expected to be minimal. No public access facilities or other features requiring active operation will be included in the project. The project will require periodic inspect the project to prevent encroachments or other damage caused by human activities and to determine whether any repair, replacement, or rehabilitation of project features is needed.

1.7 Avoidance, Minimization, and Conservation Measures

Avoidance, minimization, and conservation measures are measures and practices adopted to reduce or avoid adverse effects that could result from project construction or operation. The following sections describe the avoidance, minimization, and conservation measures adopted for the proposed alternative. These measures would be incorporated in construction documents (plans and specifications) prepared for the proposed alternative and would thus be contractually required of all construction contractors.

Measures that will be implemented to avoid or minimize effects to water quality will include:

- Comply with relevant environmental regulations
    - The project will comply with Section 401 of the Clean Water Act and obtain certification for project-related activities to control sediment from entering the main river channel during construction. To minimize risk from additional fine sediments, all trucks and equipment will be cleaned away from flowing water.

- Minimize potential discharges
  - Straw bales, straw wattles and silt fences would be installed at source sites for each project, as appropriate.
  - Operation of heavy machinery in the active channel would be minimized to avoid disturbance of substrates.
  - The project limits would be clearly demarcated. Erosion control fencing would be placed at the edges of construction where the construction activities are upslope of aquatic habitats to prevent washing of sediments into these features. All fencing would be installed prior to any construction activities beginning and would be maintained throughout the construction period.
  - Substrates, either obtained onsite or from a commercial source, will be appropriately screened prior to being placed in the river to avoid introduction of fine material into the Yuba River. On-site substrates will be screened and sorted; substrates imported from a commercial source, if necessary, will be clean-washed and of appropriate size.
  - In-stream construction will proceed in a manner that minimizes sediment discharge.
- Monitor water quality
  - Turbidity and settleable solids would be monitored according to water quality permits. If acceptable limits are exceeded, work would be suspended until acceptable measured levels are achieved.
  - Throughout the construction period, water quality (turbidity, settleable material, and/or visible construction pollutants) will be monitored as required by Section 401 Regional Water Quality Control Board (RWQCB) certification requirements to ensure that it stays within acceptable limits. This will include regular grab samples to monitor turbidity and settleable material. Construction pace will be slowed and/or stopped if turbidity exceeds criteria established by the RWQCB.
  - Total mercury concentrations from excavated fine sediments (fines) will be evaluated to ensure materials used within the restoration footprint are below or within an acceptable range of natural background levels. Excavated fines will be monitored and tested regularly, following methods in the Stillwater Sciences Mercury Assessment conducted at Merced River Ranch (2004). For construction activities that involve fines, samples will be randomly collected every other day from the ‘fines’ pile at the processing plant. All samples will be delivered to and analyzed by a qualified laboratory located within driving distance of the project site. The laboratory will supply collection jars and collection methods, and sampling quantities will follow laboratory instructions. Thresholds shall be established for acceptable mercury levels, in coordination with the RWQCB as a part of the Section 401 permit process; sampling results will be compared to these

established thresholds. If fines contain acceptable levels of mercury, they could be placed in upslope areas away from drainages, and used to provide a soil matrix for re-vegetation of riparian species, or to serve as a base above which additional topographic variation is created. If fines are determined to contain mercury above acceptable levels, they may be buried and capped with coarser materials, or hauled off-site for proper disposal, based upon resource agency direction. As laboratory turn-around times are generally short (< 48 hrs.), the monitoring team will obtain approximate real-time information about any potential mercury-related issues. All on-site construction activities involving the use and/or placement of fines will cease, if mercury measurements above established thresholds are observed, to allow for coordination with appropriate resource agencies, for the assessment of contamination potential and the appropriate type(s) of use and/or disposal.

- Maintain clean equipment
  - Equipment used for the project would be thoroughly cleaned off-site to remove any invasive plant material or invasive aquatic biota prior to use in the action area.
  - Oil and grease used in equipment will be vegetable based.
  - All equipment working within the stream corridor will be inspected daily for fuel, lubrication, and coolant leaks; and for leak potentials (e.g., cracked hoses, loose filling caps, stripped drain plugs); and, all equipment must be free of fuel, lubrication, and coolant leaks.
  - Vehicles or equipment will be washed/cleaned only at approved off-site areas. All equipment will be steam cleaned prior to working within the stream channel to remove contaminants that may enter the river and adjacent lands. All equipment will be fueled and lubricated in a designated staging area located outside the stream channel and banks.
  - All equipment entering the river that has been used in or near other Central Valley rivers would be steam cleaned before it is used to minimize the chance of introducing New Zealand mud snails or other invasive species to the project site.
- Avoid disturbance to sensitive resources
  - Environmentally sensitive areas, sensitive plant species and wetland areas would be avoided during project activities to the maximum extent practicable.
  - High visibility fencing would be placed around these areas to minimize disturbance.
  - Soil and excavated material and/or fill material would be stockpiled in existing clearings when possible.

  - During construction operations, stockpiling of construction materials, portable equipment, vehicles, and supplies would be restricted to the designated construction staging areas. To eliminate an attraction to predators, all food-related trash items, such as wrappers, cans, bottles, and food scraps, would be disposed of in closed containers. Revegetation would occur on all areas temporarily disturbed from construction activities.

- Restore temporarily disturbed areas

  - All access and staging areas will be treated with erosion control measures after project completion each season. Erosion control measures would include placement of erosion control fabric on any upland slopes or ground areas (outside of the active channel) disturbed by equipment travel, coir logs for roadside trapping of fine sediment from the roadway, and hay and straw over other disturbed ground surfaces.

  - All temporary impact areas will be restored to pre-project contour and revegetated.

  - A revegetation plan will be developed to address all temporarily impacted native areas.

- Establish contingencies

  - A Spill Prevention and Response Plan will be prepared that identifies any hazardous materials to be used during construction; describes measures to prevent, control, and minimize spillage of hazardous substances; describes transport, storage and disposal procedures for these substances; and outlines procedures to be followed in case of a spill of a hazardous material. The Spill Prevention and Response Plan would require that hazardous and potentially hazardous substances stored onsite will be kept in securely closed containers located away from drainage courses, agricultural areas, storm drains, and areas where stormwater is allowed to infiltrate. It would also stipulate procedures, such as the use of spill containment pans, to minimize hazard during onsite fueling and servicing of construction equipment. Finally, the Spill Prevention and Response Plan would require that all agencies listed in the Spill Prevention and Response Plan will be notified immediately of any substantial spill or release.

  - Spill prevention kits will be in close proximity to construction areas and workers will be trained in their use.

Measures that will be implemented to avoid or minimize effects to special status fish species would include:

- In channel work will occur from June 1 to October 31 to avoid impacting emigrating Central Valley steelhead and Central Valley spring-run Chinook salmon smolts, incubating Central Valley steelhead eggs/alevins, and immigrating and spawning adult

Central Valley spring-run Chinook salmon. In-channel activities (i.e., grading activities associated with the proposed action) will be conducted to the greatest extent possible "in the dry".

- Heavy equipment operation will be limited to 7:00 am to 7:00 pm. Fish passage will be maintained to allow passage of adult and juvenile salmon and steelhead outside of construction hours. The majority of salmonid migration movement occurs during the low light hours of dawn and dusk and at night.

- Equipment used for the project will be thoroughly cleaned off-site to remove any invasive plant material or invasive aquatic biota prior to use in the action area.

- All equipment will be steam cleaned prior to working within the river channel to remove contaminants and/or invasives that may enter the river and adjacent lands.

- All equipment entering the river will be steam cleaned before it is used elsewhere to minimize the chance of introducing New Zealand mud snails to other water bodies.

- Prior to in-channel work, a qualified fisheries biologist will survey the work area for the presence of adult salmonids, particularly adult Central Valley spring-run Chinook salmon, and if adults are observed then work will cease until the fish have left the area to be impacted.

- All project personnel will be instructed on the protection of biological resources, and in particular the special-status species that might be encountered during project activities. They will be trained to stop work upon observation of a special-status species within the work area and to notify a project monitor for additional guidance.

- During construction, as much understory brush and as many trees as possible will be retained. The emphasis will be on retaining shade-producing and bank-stabilizing vegetation.

- USACE will provide a NMFS-approved Worker Environmental Awareness Training Program for construction personnel to be conducted by a 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 under the ESA, and an explanation of terms and conditions identified in this opinion.

- Constructed features will be monitored during construction and following construction as appropriate to ensure that features do not result in stranding of individuals.

1.8 Construction Schedule, Access, and Staging

Construction of the proposed action will take place over 4 years. The primary work of excavation, grading, and feature placement on Increments 2, 3a, 5a, and 5b is expected to be completed in 3 years; one additional year is assumed in the schedule to account for schedule slippage and repair/closeout of construction tasks. Planting will also be expected to be completed over 3 years. Planting will be conducted concurrently with the primary excavation and feature installation, beginning the second year and extending to the end of the 4 year. All in water work is expected to occur downstream of the highway 20 bridge and will be conducted between June 1 and October 31 each year. Planting is expected to occur between October 1 and November 30 each year. Pending Congressional authorization and funding, the project is expected to begin in 2021, and be completed by 2024.

Proposed access roads will be located on existing roadways (dirt and/or paved) or farm roads. Proposed staging areas will utilize previously disturbed areas and will be half an acre to an acre, depending on the amount of work to be completed. These areas will be the sole locations used for staging of vehicles, materials, and other associated construction equipment.

From the proposed staging areas, vehicles accessing the restoration sites will haul primarily on the cobble bars along the river. In some cases, access may require construction of temporary road ways (grading), creation of ramps, or establishment of temporary river crossings. Temporary river crossings will consist of 10-foot wide railroad flatcar bridge that will be placed over the river channel, minimizing the need construction vehicles to enter the channel.

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

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

2.1 Analytical Approach

This opinion includes both a jeopardy analysis and/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 opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat 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 opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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

- Describe the environmental baseline in the action area.

- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a RPA to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

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

The following Federally listed species evolutionarily significant units (ESU), distinct population segment (DPS) and designated critical habitat occur in the action area and have the potential to be affected by the action (Table 6):

Table 6. ESA Listing History.

Species	ESU or DPS	Current Final Listing Status	Critical Habitat Designated
Chinook salmon (*Oncorhynchus tshawytscha*)	Central Valley spring-run ESU	6/28/2005 70 FR 37160 Threatened	9/2/2005 70 FR 52488
Steelhead (*O. mykiss*)	California Central Valley DPS	1/5/2006 71 FR 834 Threatened	9/2/2005 70 FR 52488
Green sturgeon (*Acipenser medirostris*)	Southern DPS	4/7/2006 71 FR 17757 Threatened	10/9/2009 74 FR 52300

2.2.1 Central Valley Spring-run Chinook salmon

The Federally listed ESU of Central Valley (CV) spring-run Chinook salmon and designated critical habitat for this ESU occurs in the action area and may be affected by the proposed action. Detailed information regarding ESU listing and critical habitat designation history, designated critical habitat, ESU life history, and VSP (viable salmonid population) parameters can be found in NMFS 2014 Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon, Central Valley Spring-Run Chinook salmon, and the Distinct Population Segment of California Central Valley steelhead.

Historically, CV spring-run Chinook salmon were the second most abundant salmon run in the Central Valley and one of the largest on the west coast (CDFG 1990). These fish occupied the upper and middle elevation reaches (1,000 to 6,000 feet) of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud and Pit rivers, with smaller populations in most tributaries with sufficient habitat for over-summering adults (Stone 1872, Rutter 1904, Clark 1929). The Central Valley drainage as a whole is estimated to have supported spring-run Chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s (CDFG 1998). The San Joaquin River historically supported a large run of spring-run Chinook salmon, suggested to be one of the largest runs of any Chinook salmon on the West Coast with estimates averaging 200,000-500,000 adults returning annually (CDFG 1990).

Monitoring of the Sacramento River mainstem during CV spring-run Chinook salmon spawning timing indicates some spawning occurs in the river (CDFW, unpublished data, 2014). Genetic introgression has likely occurred here due to lack of physical separation between CV spring-run and fall-run Chinook salmon populations (CDFG 1998). Sacramento River tributary populations in Mill, Deer, and Butte creeks are likely the best trend indicators for the CV spring-run Chinook salmon ESU. Generally, these streams have shown a positive escapement trend since 1991, displaying broad fluctuations in adult abundance (CDFW 2018). The Feather River Fish Hatchery (FRFH) spring-run Chinook salmon population represents an evolutionary legacy of populations that once spawned above Oroville Dam. The FRFH population is included in the ESU based on its genetic linkage to the natural spawning population, and the potential for development of a conservation strategy (June 28, 2005, 70 FR 37160).

The Central Valley Technical Review Team (TRT) estimated that historically there were 18 or 19 independent populations of CV spring-run Chinook salmon, along with a number of dependent populations, all within four distinct geographic regions, or diversity groups (Lindley *et al.* 2004). Of these populations, only three independent populations currently exist (Mill, Deer, and Butte creeks tributary to the upper Sacramento River) and they represent only the northern Sierra Nevada diversity group. Additionally, smaller populations are currently persisting in Antelope and Big Chico creeks, and the Feather and Yuba rivers in the northern Sierra Nevada diversity group (CDFG 1998). In the San Joaquin River basin, observations in the last decade suggest that spring-running populations may currently occur in the Stanislaus and Tuolumne rivers (Franks 2015).

The CV spring-run Chinook salmon ESU is comprised of two known genetic complexes. Analysis of natural and hatchery CV spring-run Chinook salmon stocks in the Central Valley indicates that the northern Sierra Nevada diversity group CV spring-run Chinook salmon populations in Mill, Deer, and Butte creeks retain genetic integrity as opposed to the genetic integrity of the Feather River population, which has been somewhat compromised by introgression with the fall-run Chinook salmon ESU (Good *et al.* 2005, Garza *et al.* 2007, Cavallo *et al.* 2011).

Because the populations in Butte, Deer and Mill creeks are the best trend indicators for ESU viability, we can evaluate risk of extinction based VSP in these watersheds. Over the long term, these three remaining populations are considered to be vulnerable to anthropomorphic and naturally occurring catastrophic events. The viability assessment of CV spring-run Chinook salmon conducted during NMFS' 2010 status review (NMFS 2011), found that the biological status of the ESU had worsened since the last status review (2005) and recommended that the species status be reassessed in two to three years as opposed to waiting another five years, if the decreasing trend continued. In 2012 and 2013, most tributary populations increased in returning adults, averaging over 13,000. However, 2014 returns were lower again, just over 5,000 fish, indicating the ESU remains highly fluctuating. The most recent status review was conducted in 2015 (NMFS 2016a), which looked at promising increasing populations in 2012-2014; however, the 2015 returning fish were extremely low (1,488), with additional pre-spawn mortality reaching record lows. Since the effects of the 2012-2015 drought have not been fully realized, we anticipate at least several more years of very low returns, which may result in severe rates of decline (NMFS 2016a).

Spring-run Chinook salmon adults are vulnerable to climate change because they over-summer in freshwater streams before spawning in autumn (Thompson *et al*. 2011). CV spring-run Chinook salmon spawn primarily in the tributaries to the Sacramento River, and those tributaries without cold water refugia (usually input from springs) will be more susceptible to impacts of climate change. Even in tributaries with cool water springs, in years of extended drought and warming water temperatures, unsuitable conditions may occur. Additionally, juveniles often rear in the natal stream for one to two summers prior to emigrating, and would be susceptible to warming water temperatures. In Butte Creek, fish are limited to low elevation habitat that is currently thermally marginal, as demonstrated by high summer mortality of adults in 2002 and 2003, and will become intolerable within decades if the climate warms as expected. Ceasing water diversion for power production from the summer holding reach in Butte Creek resulted in cooler water temperatures, more adults surviving to spawn, and extended population survival time (Mosser *et al*. 2013).

2.2.1.1 Summary of Viability

In summary, the extinction risk for the CV spring-run Chinook salmon ESU remains at moderate risk of extinction (NMFS 2016a). Based on the severity of the drought and the low escapements as well as increased pre-spawn mortality in Butte, Mill, and Deer creeks in 2015, there is concern that these CV spring-run Chinook salmon strongholds will deteriorate into high extinction risk in the coming years based on the population size or rate of decline criteria (NMFS 2016a).

2.2.1.2 Critical Habitat and Physical or Biological Features

The critical habitat designation for CV spring-run Chinook salmon lists the PBFs (June 28, 2005, 70 FR 37160), which are described in NMFS 2014 Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon, Central Valley Spring-Run Chinook salmon, and the Distinct Population Segment of California Central Valley Steelhead (NMFS 2014a). In summary, the PBFs include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and estuarine habitat. The geographical range of designated critical habitat includes stream reaches of the Feather, Yuba, and American rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear creeks, and the Sacramento River, as well as portions of the northern Delta (June 28, 2005, 70 FR 37160).

2.2.1.3 Summary of the Value of Critical Habitat for the Conservation of the Species

Currently, many of the PBFs of CV spring-run Chinook salmon critical habitat are degraded, and provide limited high quality habitat. Features that lessen the quality of migratory corridors for juveniles include unscreened or inadequately screened diversions, altered flows in the Delta, scarcity of complex in-river cover, and the lack of floodplain habitat. Although the current conditions of CV spring-run Chinook salmon critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain are considered to have high intrinsic value for the conservation of the species.

2.2.2 California Central Valley Steelhead

The Federally listed distinct population segment (DPS) of California Central Valley (CCV) steelhead and designated critical habitat for this DPS occurs in the action area and may be affected by the proposed action. Detailed information regarding DPS listing and critical habitat designation history, designated critical habitat, DPS life history, and VSP parameters can be found in the NMFS 2014 Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon, Central Valley Spring-Run Chinook salmon, and the Distinct Population Segment of California Central Valley steelhead.

Historic CCV steelhead run sizes are difficult to estimate given the paucity of data, but may have approached one to two million adults annually (McEwan 2001). By the early 1960s the CCV steelhead run size had declined to about 40,000 adults (McEwan 2001). Current abundance data for CCV steelhead is limited to returns to hatcheries and redd surveys conducted on a few rivers. The hatchery data is the most reliable because redd surveys for steelhead are often made difficult by high flows and turbid water usually present during the winter-spring spawning period.
CCV steelhead returns to Coleman National Fish Hatchery (NFH) have increased over the last four years, 2011 to 2014. After hitting a low of only 790 fish in 2010, the last two years, 2013 and 2014, have averaged 2,895 fish. Wild adults counted at the hatchery each year represent a small fraction of overall returns, but their numbers have remained relatively steady, typically 200–300 fish each year. Numbers of wild adults returning each year have ranged from 252 to 610 from 2010 to 2014.

Redd counts are conducted in the American River and in Clear Creek (Shasta County). An average of 143 redds have been counted on the American River from 2002–2015 [data from Hannon *et al.* (2003), Hannon and Deason (2008), Chase (2010)]. An average of 178 redds have been counted in Clear Creek from 2001 to 2015 following the removal of Saeltzer Dam, which allowed steelhead access to additional spawning habitat. The Clear Creek redd count data ranges from 100-1023 and indicates an upward trend in abundance since 2006 (USFWS 2015).

The returns of CCV steelhead to the Feather River Hatchery experienced a sharp decrease from 2003 to 2010, with only 679, 312, and 86 fish returning in 2008, 2009 and 2010, respectively. In recent years, however, returns have experienced an increase with 830, 1797, and 1505 fish returning in 2012, 2013 and 2014 respectively. Overall, steelhead returns to hatcheries have fluctuated so much from 2001 to 2015 that no clear trend is present.

An estimated 100,000 to 300,000 naturally produced juvenile steelhead are estimated to leave the Central Valley annually, based on rough calculations from sporadic catches in trawl gear (Good *et al.* 2005). Nobriga and Cadrett (2001) used the ratio of adipose fin-clipped (hatchery) to unclipped (wild) steelhead smolt catch ratios in the USFWS Chipps Island trawl from 1998 through 2000 to estimate that about 400,000 to 700,000 steelhead smolts are produced naturally each year in the Central Valley. Trawl data indicate that the level of natural production of steelhead has remained very low since the 2011 status review, suggesting a decline in natural production based on consistent hatchery releases. Catches of steelhead at the fish collection facilities in the southern Delta are another source of information on the production of wild steelhead relative to hatchery steelhead (CDFW data: ftp.delta.dfg.ca.gov/salvage). The overall catch of steelhead has declined dramatically since the early 2000s, with an overall average of 2,705 in the last 10 years. The percentage of wild (unclipped) fish in salvage has fluctuated, but has leveled off to an average of 36 percent since a high of 93 percent in 1999.

About 80 percent of the historical spawning and rearing habitat once used by anadromous *O. mykiss* in the Central Valley is now upstream of impassible dams (Lindley *et al.* 2006). Many historical populations of CCV steelhead are entirely above impassable barriers and may persist as resident or adfluvial rainbow trout, although they are presently not considered part of the DPS. Steelhead are well-distributed throughout the Central Valley below the major rim dams (Good *et al.* 2005, NMFS 2016b). Most of the steelhead populations in the Central Valley have a high hatchery component, including Battle Creek (adults intercepted at the Coleman NFH weir), the American River, Feather River, and Mokelumne River.

California Central Valley steelhead abundance and growth rates continue to decline, largely the result of a significant reduction in the amount and diversity of habitats available to these populations (Lindley *et al.* 2006). Recent reductions in population size are supported by genetic analysis (Nielsen *et al.* 2003). Garza and Pearse (2008) analyzed the genetic relationships among Central Valley steelhead populations and found that unlike the situation in coastal California watersheds, fish below barriers in the Central Valley were often more closely related to below barrier fish from other watersheds than to *O. mykiss* above barriers in the same watershed. This pattern suggests the ancestral genetic structure is still relatively intact above barriers, but may have been altered below barriers by stock transfers. The genetic diversity of CCV steelhead is also compromised by hatchery origin fish, placing the natural population at a high risk of extinction (Lindley *et al.* 2007). Steelhead in the Central Valley historically consisted of both summer-run and winter-run migratory forms. Only winter-run (ocean maturing) steelhead currently are found in California Central Valley rivers, and summer-run steelhead have been extirpated (McEwan and Jackson 1996, Moyle 2002).

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

2.2.2.1 Summary of viability

All indications are that natural CCV steelhead have continued to decrease in abundance and in the proportion of natural fish over the past 25 years (Good *et al.* 2005, NMFS 2016b); the long-term trend remains negative. Hatchery production and returns are dominant. Most wild CCV steelhead populations are very small and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish.

In summary, the status of the CCV steelhead DPS appears to have remained unchanged since the 2011 status review, and the DPS is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (NMFS 2016b).

2.2.2.2 Critical Habitat and Physical or Biological Features

The critical habitat designation for CV spring-run Chinook salmon and CCV steelhead lists the PBFs (June 28, 2005, 70 FR 37160), which are described in NMFS 2014 Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook salmon, Central Valley Spring-Run Chinook salmon, and the Distinct Population Segment of California Central Valley steelhead. In summary, the PBFs include freshwater spawning sites; freshwater rearing sites; freshwater migration corridors; and estuarine areas. The geographical extent of designated critical habitat includes: the Sacramento, Feather, and Yuba rivers, and Deer, Mill, Battle and Antelope creeks in the Sacramento River basin; the San Joaquin River, including its tributaries but excluding the mainstem San Joaquin River above the Merced River confluence; and the waterways of the Delta.

2.2.2.3 Summary of the Value of Critical Habitat for the Conservation of the species

Many of the PBFs of CCV steelhead critical habitat are currently degraded and provide limited high quality habitat. Passage to historical spawning and juvenile rearing habitat has been largely reduced due to construction of dams throughout the Central Valley. Levee construction has also degraded the value for the conservation of the species of freshwater rearing and migration habitat and estuarine areas as riparian vegetation has been removed, reducing habitat complexity, food resources, and resulting in many other ecological effects. Contaminant loading and poor water quality in Central California waterways poses threats to lotic fish, their habitat and food resources. Additionally, due to reduced access to historical habitats, genetic introgression is occurring because naturally-produced fish are interacting with hatchery-produced fish which has the potential to reduce the long-term fitness and survival of this species.

Although the current conditions of CCV steelhead critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain in the Sacramento/San Joaquin River watersheds and the Delta are considered to have high intrinsic value for the conservation of the species as they are critical to ongoing recovery effort.

2.2.3 Southern Distinct Population Segment of North American Green Sturgeon

The Federally listed southern distinct population segment (sDPS) of North American green sturgeon and designated critical habitat for this DPS occurs in the action area and may be affected by the proposed action. Detailed information regarding DPS listing and critical habitat designation history, designated critical habitat, and DPS life history can be found on the NMFS West Coast Fisheries Green Sturgeon Webpage.

Green sturgeon are known to range from Baja California to the Bering Sea along the North American continental shelf. During late summer and early fall, subadults and non-spawning adult green sturgeon can frequently be found aggregating in estuaries along the Pacific coast (Emmett *et al.* 1991, Moser and Lindley 2006). Using polyploid microsatellite data, Israel *et al.* (2009) found that green sturgeon within the Central Valley of California belong to the sDPS. Additionally, acoustic tagging studies have found that green sturgeon found spawning within the Sacramento River are exclusively sDPS green sturgeon (Lindley *et al.* 2011). In waters inland from the Golden Gate Bridge in California, sDPS green sturgeon are known to range through the estuary and the Delta and up the Sacramento, Feather, and Yuba rivers (Israel *et al*. 2009, Bergman *et al.* 2011, Seesholtz *et al.* 2014). It is unlikely that green sturgeon utilize areas of the San Joaquin River upriver of the Delta with regularity, and spawning events are thought to be limited to the upper Sacramento River and its tributaries. There is no known modern usage of the upper San Joaquin River by green sturgeon, and adult spawning has not been documented there (Jackson and Van Eenennaam 2013).

Recent research indicates that the sDPS is composed of a single, independent population, which principally spawns in the mainstem Sacramento River and also breeds opportunistically in the

Feather River and possibly even the Yuba River (Bergman *et al.* 2011, Seesholtz *et al.* 2014). Concentration of adults into a very few select spawning locations makes the species highly vulnerable to poaching and catastrophic events. The apparent, but unconfirmed, extirpation of spawning populations from the San Joaquin River narrows the available habitat within their range, offering fewer habitat alternatives. Whether sDPS green sturgeon display diverse phenotypic traits such as ocean behavior, age at maturity, and fecundity, or if there is sufficient diversity to buffer against long-term extinction risk is not well understood. It is likely that the diversity of sDPS green sturgeon is low, given recent abundance estimates (NMFS 2015).

Trends in abundance of sDPS green sturgeon have been estimated from two long-term data sources: (1) salvage numbers at the State and Federal pumping facilities (see below), and (2) by incidental catch of green sturgeon by the California Department of Fish and Wildlife's (CDFW) white sturgeon sampling/tagging program. Historical estimates from these sources are likely unreliable because the sDPS was likely not taken into account in incidental catch data, and salvage does not capture range-wide abundance in all water year types. A decrease in sDPS green sturgeon abundance has been inferred from the amount of take observed at the south Delta pumping facilities, the Skinner Delta Fish Protection Facility, and the Tracy Fish Collection Facility. This data should be interpreted with some caution. Operations and practices at the facilities have changed over the decades, which may affect salvage data. These data likely indicate a high production year vs. a low production year qualitatively, but cannot be used to rigorously quantify abundance.

Since 2010, more robust estimates of sDPS green sturgeon have been generated. As part of a doctoral thesis at UC Davis, Ethan Mora has been using acoustic telemetry to locate green sturgeon in the Sacramento River, and to derive an adult spawner abundance estimate (Mora *et al.* 2015). Preliminary results of these surveys estimate an average annual spawning run of 223 (DIDSON) and 236 (telemetry) fish. This estimate does not include the number of spawning adults in the lower Feather or Yuba Rivers, where green sturgeon spawning was recently confirmed (Seesholtz *et al.* 2014).

The parameters of green sturgeon population growth rate and carrying capacity in the Sacramento Basin are poorly understood. Larval count data shows enormous variance among sampling years. In general, sDPS green sturgeon year class strength appears to be highly variable with overall abundance dependent upon a few successful spawning (NMFS 2010b). Other indicators of productivity such as data for cohort replacement ratios and spawner abundance trends are not currently available for sDPS green sturgeon.

Southern DPS green sturgeon spawn primarily in the Sacramento River in the spring and summer. Anderson-Cottonwood Irrigation District Diversion Dam (ACID) is considered the upriver extent of green sturgeon passage in the Sacramento River) (71 FR 17757, April 7, 2006). The upriver extent of green sturgeon spawning, however, is approximately 30 kilometers downriver of ACID where water temperature is higher than ACID during late spring and summer (NMFS 2016c) . Thus, if water temperatures increase with climate change, temperatures adjacent to ACID may remain within tolerable levels for the embryonic and larval life stages of green sturgeon, but temperatures at spawning locations lower in the river may be more affected. It is uncertain, however, if green sturgeon spawning habitat exists closer to ACID, which could allow spawning to shift upstream in response to climate change effects. Successful spawning of green sturgeon in other accessible habitats in the Central Valley (*i.e.*, the Feather River) is limited, in part, by late spring and summer water temperatures (NMFS 2015). Similar to salmonids in the Central Valley, green sturgeon spawning in tributaries to the Sacramento River is likely to be further limited if water temperatures increase and higher elevation habitats remain inaccessible.

2.2.3.1 Summary of viability

The viability of sDPS green sturgeon is constrained by factors such as a small population size, lack of multiple populations, and concentration of spawning sites into just a few locations. The risk of extinction is believed to be moderate (NMFS 2010a). 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 (NMFS 2010a). Lindley *et al.* (2008), in discussing winter-run Chinook salmon, states that an ESU (or DPS) represented by a single population at moderate risk of extinction is at high risk of extinction over a large timescale; this would apply to the sDPS for green sturgeon. The most recent 5-year status review for sDPS green sturgeon found that some threats to the species have recently been eliminated, such as take from commercial fisheries and removal of some passage barrier (NMFS 2015). Since many of the threats cited in the original listing still exist, the threatened status of the DPS is still applicable (NMFS 2015).

2.2.3.2 Critical Habitat and Physical or Biological Features

The critical habitat designation for sDPS green sturgeon lists the PBFs (October 9, 2009, 74 FR 52300), which are described on the NMFS West Coast Fisheries Green Sturgeon Web Page. In summary, the PBFs include the following for both freshwater riverine systems and estuarine habitats: food resources, water flow, water quality, migratory corridor, depth, and sediment quality. Additionally, for riverine systems, the designation includes substrate type or size. Substrate type or size is also a PBF for freshwater riverine systems. In addition, the PBFs include migratory corridor, water quality, and food resources in nearshore coastal marine areas.

The geographical range of designated critical habitat includes the following.
In freshwater, the geographical range includes:

- the Sacramento River from the Sacramento I-Street bridge to Keswick Dam, including the Sutter and Yolo bypasses and the lower American River from the confluence with the mainstem Sacramento River upstream to the highway 160 bridge,
- the Feather River from its confluence with the Sacramento River upstream to Fish Barrier Dam,
- the Yuba River from its confluence with the Feather River upstream to Daguerre Point Dam, and
- the Sacramento-San Joaquin Delta (as defined by California Water Code section 12220, except for listed excluded areas).

In coastal bays and estuaries, the geographical range includes:

- San Francisco, San Pablo, Suisun, and Humboldt bays in California,
- Coos, Winchester, Yaquina, and Nehalem bays in Oregon,
- Willapa Bay and Grays Harbor in Washington, and
- the lower Columbia River estuary from the mouth to river kilometer 74.

In coastal marine waters, the geographical range includes all U.S. coastal marine waters out to the 60-fathom depth bathymetry line from Monterey Bay north and east to include waters in the Strait of Juan de Fuca, Washington.

2.2.3.3 Summary of the Value of Critical Habitat for the Conservation of the Species

Currently, many of the PBFs of sDPS green sturgeon are degraded and provide limited high quality habitat. Additional features that lessen the quality of migratory corridors for juveniles include unscreened or inadequately screened diversions, altered flows in the Delta, and presence of contaminants in sediment. Although the current conditions of green sturgeon critical habitat are significantly degraded, the spawning habitat, migratory corridors, and rearing habitat that remain in both the Sacramento/San Joaquin River watersheds, the Delta, and nearshore coastal areas are considered to have high intrinsic value for the conservation of the species.

2.2.4 Global Climate Change

One factor affecting the range-wide status of CCV steelhead, CV spring-run Chinook and the sDPS of the North American green sturgeon, and aquatic habitat at large is climate change.

The world is about 1.3°F warmer today than a century ago and the latest computer models predict that, without drastic cutbacks in emissions of carbon dioxide and other gases released by the burning of fossil fuels, the average global surface temperature may rise by two or more degrees in the 21st century (IPCC 2007). Much of that increase likely will occur in the oceans, and evidence suggests that the most dramatic changes in ocean temperature are now occurring in the Pacific (Noakes *et al.* 1998). Using objectively analyzed data Liu and Huang (2000) estimated a warming of about 0.9°F per century in the Northern Pacific Ocean.

Sea levels are expected to rise by 0.5 to 1.0 meters in the northeastern Pacific coasts in the next century, mainly due to warmer ocean temperatures, which lead to thermal expansion much the same way that hot air expands. This will cause increased sedimentation, erosion, coastal flooding, and permanent inundation of low-lying natural ecosystems (*e.g.*, salt marsh, riverine, mud flats) affecting listed salmonid and green sturgeon PBFs. Increased winter precipitation, decreased snow pack, permafrost degradation, and glacier retreat due to warmer temperatures will cause landslides in unstable mountainous regions and destroy fish and wildlife habitat, including salmon-spawning streams. Glacier reduction could affect the flow and temperature of rivers and streams that depend on glacier water, with negative impacts on fish populations and the habitat that supports them.

Summer droughts along the South Coast and in the interior of the northwest Pacific coastlines will mean decreased stream flow in those areas, decreasing salmonid survival and reducing water supplies in the dry summer season when irrigation and domestic water use are greatest. Global warming may also change the chemical composition of the water that fish inhabit: the amount of oxygen in the water may decline, while pollution, acidity, and salinity levels may increase. This will allow for more invasive species to overtake native fish species and impact predator-prey relationships (Petersen and Kitchell 2001, Stachowicz *et al.* 2002).

In light of the predicted impacts of global warming, the Central Valley has been modeled to have an increase of between 2 and 7 degrees Celsius by 2100, with a drier hydrology predominated by rainfall rather than snowfall (Dettinger 2004, Hayhoe *et al.* 2004, VanRheenen 2004, Stewart *et al.* 2005). This will alter river runoff patterns and transform the tributaries that feed the Central Valley from a spring and summer snowmelt dominated system to a winter rain dominated system. It can be hypothesized that summer temperatures and flow levels will become unsuitable for salmonid survival. The cold snowmelt that furnishes the late spring and early summer runoff will be replaced by warmer precipitation runoff. This will truncate the period of time that suitable cold-water conditions exist downstream of existing reservoirs and dams due to the warmer inflow temperatures to the reservoir from rain runoff. Without the necessary cold water pool developed from melting snow pack filling reservoirs in the spring and early summer, late summer and fall temperatures downstream of reservoirs, such as Lake Shasta, could potentially rise above thermal tolerances for juvenile and adult salmonids that must hold and/or rear downstream of the dam over the summer and fall periods.

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 for the proposed action includes the project footprints and the area downstream where construction activities can temporarily decrease water quality, potentially impacting ESA listed anadromous fish species. The action area begins at the upstream extent of Habitat Increment 2 (Upper Gilt Edge Bar), which is approximately 1,000 feet upstream from Highway 20 bridge crossing over the lower Yuba River (river mile (RM) 18.2). The action area continues downstream through Habitat Increment 2, through Habitat Increment 3a (Lower Gilt Edge Bar) and 1,000 feet downstream of the downstream extent of Habitat Increment 3. The downstream extent is in the Hammon Bar area (RM 14). The action area also includes Habitat Increments 5a and 5b, and 1,000 feet downstream of the downstream extent of Habitat Increment 5b (RM 8.7). The upstream extent of Habitat Increment 5a is at north south line drawn through a point at latitude 39.190095 N, and longitude -121.487578 W. The downstream extent of Habitat Increment 5b plus 1,000 feet to account for impacts to water quality is at a north south line drawn through a point at latitude 39.164214 N, longitude -121.550255 W (RM 4.6).

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 Corps of Engineers has two dams near the action area, Englebright Dam upstream and Daguerre Point Dam between the two sections of the action area. The Corps' activities at both of these dams underwent section 7 ESA consultation in 2014. The Corps' activities at these dams, for which they consulted, are not expected to affect the action area. The Corps activities at Englebright Dam include vessel and boat ramp maintenance, pesticide and herbicide use, and portable toilet pumping. These activities all occur upstream of Englebright Dam and are not expect to result in measurable effects downstream of Englebright Dam. The Corps activities at Daguerre Point Dam are related to upstream fish passage. This includes operation and maintenance of two fish ladders, placement of flashboard on the dam to direct flow to the fish ladders, permitting of VAKI River Watcher systems in the fish ladders, spawning gravel augmentation just downstream of the original Narrows Powerhouse, and dredging upstream of Daguerre Point Dam to improve upstream fish passage. The effects of the dredging and the gravel augmentation do not reach downstream to the action area for the proposed action.

2.4.1 Historical Usage of the Lower Yuba River

The lower Yuba River has undergone significant morphological and ecological changes over the past 150 years due to a sequence of anthropomorphic disturbances, beginning with the discovery of gold in California in 1848. Most relevant of these changes:

- ***vast influx of hydraulic mining sediment*** - It is estimated that from 1849 – 1909, the Yuba River received roughly 685 million cubic yards of sediment, more than the Upper Feather, Bear, and American rivers combined (Gilbert 1917). This influx caused such severe aggradation of the Yuba River that by 1868 the channel bed had risen 20 ft and was higher than the streets of Marysville (Ayres Associates 1997). Flooding in Marysville in 1875 prompted the prohibition of in-stream disposal of hydraulic mining sediments.

- ***shifting and confinement of the river's course*** - In the early 1900s, the California Debris Commission sanctioned the re-alignment of the lower Yuba River to the north of the historic alignment and the construction of large linear "training walls" consisting of steeply mounded tailings piles in the center and along both banks of the straightened river corridor. The training walls were piled to substantial heights above the 100-yr flood elevation and with dramatically varying top widths of up to 500 ft (AECOM 2015). The makeshift training walls were intended to laterally confine the river to allow for additional widespread dredging operations (gold mining) of the naturally occurring and hydraulic mining derived sediments deposited in the valley.

- ***river regulation and coarse sediment control*** - In 1906, Daguerre Point Dam was constructed as a partial sediment barrier and base-level control point. Englebright Dam was constructed in 1941, and was designed to keep upstream hydraulic mining debris out of the lower Yuba River (YCWA 2007). In 1971, New Bullards Bar was raised to control flooding and generate power (Pasternack 2009). As a result, the influx of sediment and the major flood events have both been significantly altered, affecting the hydrologic regime and the movement of sediment in the system. Large woody material passes over the dams, but is often greatly weathered or simplified from residence time in the reservoirs upstream and through passage over the dam (i.e., canopy and rootwad removed). This most likely reduces the ability of key pieces to lock in place within the channel.

- ***recent and ongoing aggregate mining*** - Widespread processing of the remaining Yuba Goldfield sediments continues today through surface and dredge mining for the production of aggregate and other construction materials. Uncertainties related to physical parcel boundaries and contentious mining interests/claims have influenced the development of an irregular moonscape characterized by long, linear, gravel/cobble mounds, steep ravines, isolated ponds, and loss of fine sediment required for riparian vegetation establishment. Dredger ponds support invasive predatory fish and other species that compete for resources with juveniles salmonids. The ponds can reconnect during high flows, allowing the movement of invasive species into the main river channel.

Despite the presence of several significant dams in the upper watershed (*e.g.* New Bullards Bar, Spaulding Dam, Jackson Meadows Dam, and Englebright Dam), the lower Yuba River still experiences moderate and major floods capable of inducing natural and significant geomorphic changes. Recent studies have documented the increasing amplitude of the naturally developing meander pattern within the main channel. The significant decreases in height and thickness of the training walls downstream of Daguerre Point Dam is due to erosion and scour on the outside of the meander bends, and the associated increased flood risk to portions of Reclamation District 784 (MBK Engineers 2011, cbec 2013, cbec 2014, AECOM 2015). The high flows in 2017 and 2018 have resulted in some significant changes in the river channel.

Other completed section 7 consultations that have occurred in the area include informal consultation for the ongoing operation and maintenance of Englebright Dam and Reservoir (NMFS 2014b), formal consultation for the operation and maintenance of Daguerre Point Dam (NMFS 2014c), formal consultation for the Hallwood Side Channel and Floodplain Restoration Project (NMFS 2017a), and formal consultation for the Yuba Canyon Salmon Habitat Restoration Project (NMFS 2017b). These consultations determined that the proposed actions will not result in jeopardy to listed species or adverse modification of their critical habitats.

2.4.2 Mercury Contamination

During historical gold mining within the Yuba River watershed, more than 8 million pounds of mercury were lost to the environment (Hunerlach 2004). Much of the mercury left over from the mining era is contained in sediment held behind Englebright Dam and Daguerre Point Dam.

Methylmercury is the form of mercury that is toxic to biota and which can bioaccumulate in aquatic organisms. In the environment, methylmercury can be produced from the soluble fraction of the inorganic mercury by naturally occurring anaerobic bacteria. However, it is likely that only a very small fraction of the total mercury associated with gold mining sediments in the Yuba River is actually ‘reactive’ and available to bacteria for methylation (Singer et al. 2016).

Although most of the mercury is not biologically available, enough has methylized in Englebright Lake that it is bioaccumulating in the larger predatory fish (USACE 2014).

Methylmercury can be also be removed from shallow surface waters through photodegradation, a process by which methylmercury is converted to less toxic inorganic mercury by the sun's ultraviolet light (USGS 2014). However, because mercury in aquatic environments preferentially partitions to soil, sediment, and suspended matter (i.e., the dissolved mercury concentration is typically far lower than the concentration in soil, sediment, and suspended matter), most of the mercury in the water column is removed not by reduction to the elemental species, but by sedimentation of the particles to which divalent mercury and methylmercury are bound. As a result of this sedimentation process, sediment in the Yuba River exhibits high levels of mercury (Cramer Fish Sciences 2016).

2.4.3 Existing Conditions

The Yuba River watershed is approximately 1,340 square miles covering Sierra, Placer, Yuba, and Nevada counties. The water flows west from the Sierra Nevada Mountains carrying melted snow run-off and water from the three upper Yuba Rivers all the way down to the confluence with the Feather River. While the location of the project is in the lower Yuba River, the overall watershed quality plays a large role in water quality and quanitity in the project area. Multiple factors affect the water quality of the lower Yuba River including: hydroelectric power generation, diversion for water supply, dams and reservoirs, mining activities, urbanization, and timber harvesting.

Major dams in the Yuba River watershed include Spaulding, Bowman, Fordyce, Englebright, Jackson Meadows, and New Bullards Bar. Many of the dams in the Yuba River watershed were originally built for gold mining, but later on the use of dams shifted for emphasis on flood control, waters supply, and hydropower. The flows in the lower Yuba River are based on the Lower Yuba River Accord, which is an agreement between the Yuba County Water Agency and stakeholders in the area to balance interests of irrigation, conservation, water supply, and fisheries concerns. The physical, thermal, and chemical changes that occur from water being retained behind dams can greatly affect the downstream water quality and the temperature of the river.

The lower Yuba River experiences water temperature fluctuation due to variation in snow pack, storage and releases from upper watershed dams, inflows from Deer Creek (RM 22.7), irrigation diversions at Daguerre Point Dam (RM 11.6), and operational releases from Englebright Dam (RM 24). Furthermore, the general width to flow ratio in conjunction with low riparian cover provide opportunity for solar heating of the water. The water within the lower Yuba River can increase up to 7°C from the release at Englebright Dam to the City of Marysville (LYRA 2010), but this is seasonally dependent and influenced by amount of water released from Englebright Dam, solar input, and air temperature. Data taken near Marysville, showed that dissolved oxygen concentrations, total dissolved solids, pH, alkalinity, and turbidity are well within acceptable or preferred ranges for salmonids and other key freshwater organisms (USACE 2012). In 2007, instream flow requirements were established by the Lower Yuba River Accord (YCWA 2007) to maintain suitable habitat in the lower Yuba River for fish and wildlife.

Due to mining, mining sediment deposition, and relocation of the lower Yuba River, the lower Yuba River has been largely converted from a multi-channel system to a single constricted channel, and features such as functional floodplains and other off-channel salmonid rearing habitat are reduced. Most of the floodplain habitat and side channels that are present only inundate at extreme high flows, with a few deep backwater pools created by dredge mining that connect perennially at the downstream end of remnant side channels via subsurface flow. Instream habitats within the lower Yuba River have been modified or converted for uses such as agriculture, gravel and gold mining, water impoundments, water diversions, and levees. These major actions and other events have led to the deterioration of riparian and aquatic habitat conditions. The lower Yuba River is largely disconnected from historic floodplains, providing little opportunity for seasonally inundated terrestrial vegetation and off-channel areas that are important for juvenile salmonids. Rearing habitat is generally considered a limiting factor in the Yuba River and in the action area (Yoshiyama et al. 1996, Lindley et al. 2009). In some reaches of the lower Yuba River, instream cover is very limited.

2.4.4 CV Spring-run Chinook Salmon and CCV Steelhead and their Critical Habitat in the Action Area

The Yuba River within the action area is used as a migration corridor for adult and juvenile CV spring-run Chinook salmon and CCV steelhead. Adult CV spring-run Chinook salmon have been documented to hold for an extended period of time in the pool below Daguerre Point Dam (Yuba RMT 2013). Riffles and glides used by salmonids for spawning occur throughout the Yuba River main channel within the action area, and CV spring-run Chinook salmon and CCV steelhead have been documented spawning in the Yuba River within the action area (Campos and Massa 2010, 2012, USFWS 2010, Yuba RMT 2013). The Yuba River within the action area is also used by rearing juvenile CV spring-run Chinook salmon and CCV steelhead.

The PBFs of critical habitat features for CV Spring-run Chinook and CCV Steelhead within the action area include freshwater rearing, migration and spawning.

2.4.5 North American Green Sturgeon and their Critical Habitat in the Action Area

Daguerre Point Dam is impassible to adult green sturgeon and blocks access to historical upstream sDPS green sturgeon spawning habitat (Mora et al. 2009). SDPS green sturgeon have been observed in the pool downstream of Daguerre Point Dam and were apparently exhibiting spawning behavior in 2011(Bergman 2011). Adult sDPS green sturgeon have been observed in the pool downstream of Daguerre Point Dam in several years. Eggs were collected in 2018, however the DNA analysis results have not yet been reported. The pool below Daguerre Point Dam may be the only currently accessible location in lower Yuba River where depth, substrate type and size, and water flow may be conducive to green sturgeon spawning. The rest of the lower Yuba River has been highly modified by anthropogenic activities and likely only serves as a migratory corridor with water flow, and water quality, sufficient for green sturgeon migration.

The PBFs of critical habitat features for sDPS North American green sturgeon within the action area include food resources, migratory corridor, water quality, depth, substrate type or size, sediment quality, and water flow.

2.4.6 Global Climate Change

By contrast to the conditions for other Central Valley floor rivers, climate change may not have as much of an impact on salmonids in the lower Yuba River downstream of Englebright Reservoir (YCWA 2010a). Presently, the lower Yuba River is one of the few Central Valley tributaries that consistently has suitable water temperatures for salmonids throughout the year. Lower Yuba River water temperatures generally remain below 58°F year-round at the Smartsville Gage (downstream of Englebright Dam), and below 60°F year-round at Daguerre Point Dam (YCWA et al. 2007). At Marysville, water temperatures generally remain below 60°F from October through May, and below 65°F from June through September (YCWA et al. 2007). However, in dry years temperatures may become warmer than the optimum range for salmonids.

According to YCWA(2010b), because of specific physical and hydrologic factors, the lower Yuba River is expected to continue to provide the most suitable water temperature conditions for anadromous salmonids of all Central Valley floor rivers, even if there are long-term climate changes. This is because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample cold water pool reserves. Throughout the period of operations of New Bullards Bar Reservoir (1969 through present), which encompasses the most extreme critically dry year on record (1977), the cold water pool in New Bullards Bar Reservoir never was depleted. Since 1993, cold water pool availability in New Bullards Bar Reservoir has been sufficient to accommodate year-round utilization of the reservoir’s lower level outlets to provide cold water to the lower Yuba River. Even if climate conditions change, New Bullards Bar Reservoir still will have a very substantial cold water pool each year that will continue to be available to provide sustained, relatively cold flows of water into the lower Yuba River during the late spring, summer and fall of each year (YCWA 2010b).

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.

NMFS identified that adverse effects may occur due to:

- Fish Relocation,
- Instream Construction,
- Elevated Levels of Mercury,
- Noise,
- Monitoring, and

- In addition, there may be effects (adverse and beneficial) due to modification of designated critical habitat. The action area includes designated critical habitat for CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon (only downstream of Daguerre Point Dam). Adverse effects may occur through spills, loss of riparian vegetation, and reduced food production. These potential adverse effects could reduce the PBFs of migration, rearing, and spawning for salmonid and sDPS green sturgeon critical habitat, and substrate size for sDPS green sturgeon critical habitat.

Timing of construction will be limited to April 1 to November 30, with the in-water construction occurring between June 15 and October 31. The in-water work period is when flows are low and avoids the primary migration and spawning periods of adult CCV steelhead and adult sDPS green sturgeon. The in-water work period also avoids the primary downstream migration period for juvenile CV spring-run Chinook salmon and CCV steelhead. However, rearing juvenile CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon may be present during the in-water construction window, and may be impacted by the proposed action. Additionally, CV spring-run Chinook salmon begin spawning in September and could be adversely affected by the proposed action. However, the Yuba River Management Team (2013) identified that CV spring-run Chinook salmon spawn primarily upstream of Highway 20 bridge, outside the action area.

2.5.1 Potential Effects of Fish Relocation on Individuals

To minimize direct and indirect mortality of fishes from construction activities, fish will be relocated, if necessary, away from areas where instream work occurs. A full description of fish relocation procedures are described above in the *Proposed Federal Action* section. Fish relocation will first be attempted using herding since this method is expected to have the lowest impact on the species, as fish will not be handled and will not be subject to holding and transport stress.

If fish cannot be herded, they will be collected using seining or electrofishing. Fish relocation activities pose a risk of injury or mortality to rearing juvenile CCV steelhead, juvenile CV spring-run Chinook salmon, and juvenile sDPS green sturgeon, since any fish relocation or collection gear has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish relocation varies widely depending on the method used, ambient conditions, and the experience of the field crew. Since fish relocation activities will be conducted by qualified fisheries biologists following NMFS guidelines, direct effects to and mortality of juvenile CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon during relocation activities is expected to be minimal.

Sites selected for relocating fish will have similar water temperature and provide suitable habitat as the as the capture site. However, relocated fish may endure short term stress from crowding at the relocation site. Relocated fish may also have to compete with resident fish for available resources such as food and habitat. Some of the fish released at the relocation site will likely move upstream or downstream to areas that have more habitat and a lower density of fish. As each fish disperses, competition diminishes and remains localized in a small area. The number of fish affected by competition cannot be accurately estimated but it is unlikely that this impact will affect the survival chances of individuals or cascade through the population within the watershed based on the small area that will be affected and the small number of CCV steelhead, CV spring-run Chinook, and sDPS green sturgeon that will need to be relocated.

Juvenile CCV steelhead, CV spring-run Chinook and sDPS green sturgeon may be present during and subject to relocation, and thus subject to the above effects, resulting in capture, and potentially injury and death. Adult CV spring-run Chinook salmon, CCV steelhead, and sDPS green sturgeon are not expected to be present in the shallow isolated areas of the proposed action, where relocation activities will occur. They may be present in deeper flowing water, and not likely to be subject to relocation activities. Thus, impacts to this life stage of these species is considered improbable.

SDPS green sturgeon may be present in the Yuba River, but lack of available information makes it is difficult to accurately quantify the number of sturgeon that will be handled during relocation. Adult sDPS green sturgeon do not pass upstream of Daguerre Point Dam, so no sDPS green sturgeon will be present in that portion of the action area. Adult sDPS green sturgeon are only expected to be located in deep pools, and will not likely be subject to relocation. Juvenile sDPS green sturgeon may be present and subject to herding or capture for relocation.

The existing side channel areas in which construction activities will occur are the areas most likely to be occupied by juvenile salmonids and juvenile sDPS green sturgeon that will require relocation. Based on May 2017 Google Earth photographs, the length of the existing side channels that will be affected by the proposed action is 4,497 meters. For the Hallwood Floodplain Restoration Project, Cramer Fish Sciences conducted preconstruction snorkel surveys (Cramer Fish Sciences 2016). The Hallwood Floodplain Restoration Project is located just downstream of Daguerre Point Dam on the Yuba River. The preconstruction surveys were conducted in February through May. The surveys found between 0 and 5 CCV juvenile steelhead in each 50 meter transect, and no juvenile CV spring-run Chinook salmon or sDPS green sturgeon. In-water construction for the proposed action will occur from June 1 through October 31, each year. Juvenile CV spring-run Chinook salmon migrate out of the Yuba River November through June (Yuba RMT 2013). Juvenile CCV steelhead migrate out of the Yuba River from April through September (Yuba RMT 2013). Therefore, the density of juvenile salmonids after June 1 is expected to be less than observed in the preconstruction surveys for the Hallwood Floodplain Restoration Project.

Based on this information, the following method was used to estimate the number of fish that would be subject to capture and fish relocation. NMFS assumed that 5 juvenile CCV steelhead and 1 CV spring-run Chinook salmon are present in every 50 meters of side channel habitat. The side channel habitat length totals 4,497 meters. Therefore, approximately 450 juvenile CCV steelhead (4,497/50 x 5), and 90 CV spring-run Chinook salmon (4,497/50 x 1) will be subject to relocation. NMFS anticipates that less than 1% of juvenile salmonids will die during relocation (approximately 5 juvenile CCV steelhead and 1 juvenile CV spring-run Chinook).

Juvenile southern DPS green sturgeon may be present in the Yuba River, downstream of Daguerre Point Dam, and in areas subject to relocation, but lack of available information makes it difficult to accurately quantify the number of sturgeon that will be handled during relocation. It is presumed that up to 3 juvenile sDPS green sturgeon will be present and subject to relocation, and none will die during relocation.

2.5.2 Potential Effects of Instream Construction on Individuals

In areas where fish relocation does not occur, juvenile CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon may be impacted by instream construction activities. Fish are expected to migrate downstream in response the noise and disturbance caused by these activities. Fish that migrate downstream in response to instream construction activities may endure short term stress from being forced to migrate away from their rearing area and needing to locate a new rearing area downstream. Fish may endure some short term stress from crowding and competition with resident fish for food and habitat. Fish may be subject to increased predation risk while they are locating a new rearing area. However, displaced fish will likely locate to areas downstream that have suitable habitat and low competition. It is not expected that the temporary displacement of fish or the competition they endure will affect the survival chances of individual fish or cascade through the population based on the size of the area that will likely be affected and the small number of CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon likely to be displaced. Fish that are displaced will be able to access the newly created habitat after construction has progressed past the area through upstream migration.

Instream construction may directly injure or kill ESA listed anadromous fish if construction equipment comes in contact with individuals. ESA listed anadromous fish are expect to move from the vicinity of construction equipment due to the noise of the approaching equipment. However, a few may seek cover within the construction area and be injured or killed by coming into direct or indirect contact with heavy equipment.

Instream construction activities are expected to cause mortality or abundance reduction of benthic aquatic macroinvertebrates within the immediate sediment placement areas when they are covered with coarse sediment. However, not all invertebrates will be smothered and many will move up through the material to colonize the new surface layer (Merz and Chan 2005). Furthermore, effects to aquatic macroinvertebrates from coarse sediment smothering will be temporary because construction activities will be relatively short in duration and rapid recolonization (about two weeks to two months) of the new sediment is expected (Merz and Chan 2005). Furthermore, downstream drift is expected to temporarily benefit any downstream, drift-feeding organisms, including juvenile salmonids. The benthic macroinvertebrate production within the site is expected to increase when the project is complete as there will be an increase in area of perennial riffle habitat. The amount of food available for juvenile salmonids and other native fishes is therefore expected to increase relative to pre-project conditions.

Juvenile CCV steelhead, juvenile CV spring-run Chinook salmon and juvenile sDPS green sturgeon may be present during instream construction activities, and thus subject to the above effects. These fish include those that are present in areas that will not be dewatered and fish that allude capture in dewatered areas. Because juveniles will be able to retreat to suitable habitat and food resources will only be temporarily impacted, effects of instream construction activities will be minor and are unlikely to result in injury or death. Adult CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon are not expected to be present in shallow areas of the action area during instream construction activities. Adults of these species will occur in deeper waters and are likely to avoid the areas adjacent to construction activities. Thus impacts to this life stage of these species is considered improbable.

Based on May 2017 Google Earth photographs, the length of the project in which fish may interact with heavy equipment, excluding side channels from which fish will be relocated is 9,842 meters. For the Hallwood Floodplain Restoration Project, Cramer Fish Sciences conducted preconstruction snorkel surveys (Cramer Fish Sciences 2016). The Hallwood Floodplain Restoration Project is located just downstream of Daguerre Point Dam on the Yuba River. The preconstruction surveys were conducted in February through May. The surveys found between 0 and 5 CCV juvenile steelhead in each 50 meter transect, and no juvenile CV spring-run Chinook salmon or sDPS green sturgeon. In-water construction for the proposed action will occur from June 1 through October 31, each year. Juvenile CV spring-run Chinook salmon migrate out of the Yuba River November through June (Yuba RMT 2013). Juvenile CCV steelhead migrate out of the Yuba River from April through September (Yuba RMT 2013). Therefore, the density of juvenile salmonids after June 1 is expected to be less than observed in the preconstruction surveys for the Hallwood Floodplain Restoration Project.

Based on this information, the following method was used to estimate the number of fish that would be subject to interaction with heavy equipment. NMFS assumed that 5 juvenile CCV steelhead and 1 CV spring-run Chinook salmon are present in every 50 meters of the non-side channel habitat. The stream length affected by the proposed action without side channels totals 9,842 meters. Therefore, approximately 984 juvenile CCV steelhead (9,842/50 x 5), and 196 CV spring-run Chinook salmon (9,842/50 x 1) may be subject to interactions with heavy equipment. Because these fish will have the ability to move out of the area as heavy equipment approaches, and the equipment used for planting is not likely to enter the water, NMFS expects mortalities to be lower than with relocation of fish. NMFS anticipates that less than 0.5% of juvenile salmonids will die during interactions with heavy equipment (approximately 5 juvenile CCV steelhead and 1 juvenile CV spring-run Chinook).

Southern DPS green sturgeon may be present in the Yuba River, downstream of Daguerre Point Dam, but lack of available information makes it is difficult to accurately quantify the number of sturgeon that will be handled during relocation. It is presumed that up to 5 juvenile sDPS green sturgeon may interact with heavy equipment, and none will die during relocation.

2.5.3 Potential Effects of Sediment and Turbidity on Individuals

Construction activities related to restoration actions will temporarily disturb soil and riverbed sediments, resulting in the potential for temporary increases in turbidity and suspended sediments in the action area. Turbidity plumes are expected to affect a portion of the channel width and extend up to 1,000 feet downstream of the site. Construction-related increases in sedimentation and siltation above the background level could potentially affect fish species and their habitat by reducing egg and juvenile survival, interfering with feeding activities, causing breakdown of social organization, and reducing primary and secondary productivity. The magnitude of potential effects on fish depends on the timing and extent of sediment loading and flow in the river before, during, and immediately following construction.

High concentrations of suspended sediment can have both direct and indirect effects on salmonids. The severity of these effects depends on the sediment concentration, duration of exposure, and sensitivity of the affected life stage. Based on the types and duration of proposed in-water construction methods, short-term increases in turbidity and suspended sediment may disrupt feeding activities or result in avoidance or displacement of fish from preferred habitat. Juvenile salmonids have been observed to avoid streams that are chronically turbid (Lloyd 1987) or move laterally or downstream to avoid turbidity plumes (Sigler *et al.*, 1994). Sigler et al. (1984) found that prolonged exposure to turbidities between 25 and 50 NTUs resulted in reduced growth and increased emigration rates of juvenile coho salmon and steelhead compared to controls. These findings are generally attributed to reductions in the ability of salmon to see and capture prey in turbid water (Waters 1995). Chronic exposure to high turbidity and suspended sediment may also affect growth and survival by impairing respiratory function, reducing tolerance to disease and contaminants, and causing physiological stress (Waters 1995). Berg and Northcote (1985) observed changes in social and foraging behavior and increased gill flaring (an indicator of stress) in juvenile coho salmon at moderate turbidity (30-60 NTUs). In this study, behavior returned to normal quickly after turbidity was reduced to lower levels (0-20 NTU).

Sedimentation is known to have lethal and sublethal effects to incubating salmonids eggs by decreasing dissolved oxygen transport between spawning gravel. Sediment also blocks micropores on the surface of incubating eggs, inhibiting oxygen transport and creates an additional oxygen demand through the chemical and biological oxidation of organic material (Kemp *et al*. 2011, Greig *et al*. 2005, Suttle *et al*. 2004). However, due to the location and timing of construction, sDPS green sturgeon, CV spring-run Chinook, and CCV steelhead eggs are not expected to be present, and thus adverse impacts to incubating eggs are not expected to occur.

Any increase in turbidity associated with instream work is likely to be brief and occur only in the vicinity of the site, attenuating downstream as suspended sediment settles out of the water column. Temporary spikes in suspended sediment may result in behavioral avoidance of the site by fish; several studies have documented active avoidance of turbid areas by juvenile and adult salmonids (Bisson and Bilby 1982, Lloyd 1987, Servizi and Martens 1992, Sigler et al. 1984). Individual fish that encounter increased turbidity or sediment concentrations will likely move away from affected areas into suitable surrounding habitat. Water quality monitoring, including measurements of turbidity will be performed on a regular basis during construction to track the response of water quality to construction activities. The proposed action includes monitoring of settable solids and turbidity, as required by the Regional Water Quality Control Board (RWQCB). Sediment plumes will occur intermittently only during daylight hours, resulting in daily periods (at least 12 hours) in which water quality will return to background levels. The proposed action includes measures to minimize the potential for impacts to water quality. These measures include use of erosion control actions, minimizing operation of heavy equipment in the flowing portion of the stream channel, erosion control fencing, and screening of material being placed in the river. Construction activities will be slowed or stopped if turbidity exceeds criteria established by the RWQCB. The amount of sediment generated by construction will be minimized by mitigation measures that are designed to minimize erosion and sediment entering the channel.

Juvenile CCV steelhead, CV spring-run Chinook and sDPS green sturgeon may be present during instream construction activities, and thus subject to the above effects. However, with the above measures in place, the effects of increased turbidity will be minor and are unlikely to result in injury or death. Adult CCV steelhead, CV spring-run Chinook, and sDPS green sturgeon may be present during activities that may increase turbidity. However, with measures to minimize turbidity, the ability of adults of these species to move to areas with no turbidity, and no construction occurring at night, impacts to this life stage of these species are considered improbable.

2.5.4 Potential Effects of Elevated Levels of Mercury on Individuals

The proposed action has the potential to result in an increase in mercury methylation and subsequent downstream transport through (1) potential short term increases due to construction related activities, and (2) potential long term increases in rates of methylation of mercury due to changes in duration and frequency of inundation.

The construction of the proposed action has the potential to expose clay and silt sized particles which have elevated mercury levels. These finer sized sediments with elevated mercury could then be transported into the wetted channel of the Yuba River during high flow events. A fraction of the mercury may then methylate and become toxic to fishes and other biota in the Yuba River. The inundation of floodplains plays an important role in the methylation, mobilization, and transport of mercury. Methylmercury has a range of toxic effects to fish including; behavioral, neurochemical, hormonal, and reproductive changes. In one study of Atlantic salmon (*Salmo salar*), methylmercury caused altered behavior and pathological damage in Atlantic Salmon (Berntssen *et al.* 2003).

The proposed action includes preconstruction surveys, to identify locations of high risk for mercury contamination and the proposed plan will be adjusted accordingly to minimize or avoid potential actions that could result in unacceptable impacts to water quality. To minimize the risk of mercury contamination in the water, the proposed action includes regular monitoring and testing of fine-grained sediment for mercury concentration. If fines are determined to contain mercury above acceptable background levels, they may be buried and capped with coarser materials, or hauled off-site for proper disposal, based upon resource agency direction.

Methylation of mercury only occurs from reactive mercury within very fine sediment (<63 μm) which is not a significant portion of the sediment in the channel (Singer 2016). Therefore, an elevated potential for mercury methylation is primarily related to floodplain areas. Given the location of the proposed features within the channel (generally occurring within the limits of 5,000 cfs discharge) and the low percentage of fine sediments within the channel, the proposed action is not be expected to significantly increase the potential for mercury methylation in the lower Yuba River. With implementation of monitoring, measures identified to deal with elevated mercury levels, adverse effects related to mercury contamination are expected to be minimized such that impacts are not expected to reach a level that causes adverse effects to ESA listed anadromous fish.

2.5.5 Potential Effects of Contaminants on Individuals

Construction equipment has the potential to leak toxic substances such as gasoline and diesel, lubricants, and other petroleum-based projects. As a result of spills or leaks in storage containers, the substances could enter waterways within and adjacent to the project site, causing mortality or physiological impairment of fish or disrupt other behavioral patterns. Development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) and other conservation measures described in the biological assessment (Corps 2018) will reduce potential impacts from leaks.

During construction, the potential exists for spills or leakage of toxic substances that could enter the Yuba River. Refueling, operation, and storage of construction equipment and materials could result in accidental spills of pollutants (e.g., fuels, lubricants, concrete, sealants, and oil).
High concentrations of contaminants can cause direct (sublethal to lethal) and indirect effects on fish. Direct effects include mortality from exposure or increased susceptibility to disease that reduces the overall health and survival of the exposed fish. The severity of these effects depends on the contaminant, the concentration, duration of exposure, and sensitivity of the affected life stage. A potential indirect effect of contamination is reduced prey availability; invertebrate prey survival could be reduced following exposure, therefore making food less available for fish. Fish consuming infected prey may also absorb toxins. The proposed action includes development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) and measures such as fueling vehicles in designated areas outside the stream channel, daily inspections of equipment for potential leaks, and using vegetable based oils for hydraulic fluid. These measures will minimize the potential exposure of ESA listed anadromous fish species to hazardous materials.

With these best management practices in place, impacts from contaminants are expected to be improbable for all life stages of CCV steelhead, CV spring-run Chinook, and sDPS green sturgeon.

2.5.6 Potential Effects of Noise on Individuals

Noise generated by heavy equipment and personnel during construction activities could adversely affect fish and other aquatic organisms. The potential direct effects of underwater noise on fish and other organisms depend on a number of biological characteristics (e.g., fish size, hearing sensitivity, behavior) and the physical characteristics of the sound (e.g., frequency, intensity, duration) to which fish and invertebrates are exposed. Potential direct effects include behavioral effects, physiological stress, physical injury (including hearing loss), and mortality. Diesel engines are the loudest noise expected at the site. Measures included in the project description that will minimize the effects of noise to ESA listed anadromous fish species include:

- In-water construction will occur between June 1 and October 31,
- Heavy equipment operation will be limited to the hours of 7 a.m. to 7 p.m.,
- Prior to starting work surveys will be made for adult salmonids. If adult salmonids are observed, work will cease until the fish have left the area, and
- Project personnel will be instructed in the protection of ESA listed species, including when to stop work.

With implementation of these measures, ESA listed anadromous fish are not expected to be exposed to sounds that may cause physical injury. Any fish disturbed by the limited aquatic noise generated by construction are expected to move away to suitable habitat. Therefore, the effects of increased noise will be minor and are unlikely to result in injury or death to adult or juvenile CCV steelhead, adult or juvenile CV spring-run Chinook, or adult or juvenile sDPS green sturgeon.

2.5.7 Potential Effects of Monitoring on Individuals

Monitoring will focus on ecosystem function and not on ESA listed fish species utilization of the action area. Monitoring will include staff wading into the Yuba River to take measurements and samples. Information collected will include depth, velocity, wetted area, and inundation duration. No ESA listed fish will be handled. Disturbance of ESA listed anadromous fish from monitoring activities is expected to be brief, and fish would capable of moving away from the people in the water. Therefore, adverse effects to ESA listed anadromous fish species from monitoring are not expected to occur.

2.5.8 Potential Effects to Critical Habitat

The proposed action is expected to have direct short- and long-term effects on the designated critical habitat of CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon. The impacts that could occur and affect PBFs of salmon, steelhead, and green sturgeon are water quality impacts, including temporary increases to turbidity and suspended sediment and release of contaminants. These impacts are expected to be localized, minor, short term. The applicant will also utilize best management practices, including the implementation of a SWPPP and associated Spill Prevention and Response Plan. The applicant will use vegetable oil as a lubricant for construction machinery, and locate the equipment staging area in an upland area well away from the Yuba River. A contaminant spill is not likely and if one does occur then it will be cleaned up and remediated rapidly such that its effects are expected to be localized, minor, and short term.

The purpose of the proposed action is to improve the ecosystem in the Yuba River. The proposed action will result in the creation and enhancement of high quality juvenile salmonid rearing habitat and is expected to have measureable benefits to the PBFs of freshwater rearing for salmonids. The suitability of aquatic habitat for juvenile salmonids and other fishes depends on the presence of nearshore areas with shallow water, instream woody material, and aquatic and riparian vegetation. These attributes provide juvenile salmonids and other fishes with valuable feeding and resting habitat, concealment from predators, and refuge during high flows (Jeffres et al. 2008, McCormick and Harrison 2011). Creation of floodplains, side channels, and other off-channel areas that increase habitat complexity and inundate more frequently will function as high quality juvenile salmonid rearing habitat.

The instream construction is expected to have short term adverse effects on the critical habitat salmonid PBFs of freshwater rearing habitat through construction disturbance and modification as well as the removal of some riparian trees and shrubs. However, the removal of riparian trees and shrubs will be localized and short term. The proposed action includes plantings that will increase the amount of riparian vegetation. To the maximum extent practicable, existing riparian habitat will be retained and disturbance will be minimized. Following construction, all disturbed or exposed soils will be stabilized and/or planted with native woody and herbaceous vegetation to control erosion and offset any unavoidable losses of vegetation. Some short term losses of mature riparian vegetation may occur during construction however, plantings and natural riparian vegetation recruitment will establish and mature following construction thereby resulting in an increase in the amount and extent of riparian habitat within the site. This increase in riparian habitat is expected to provide increased rearing habitat, complexity, and cover for CV spring-run Chinook salmon, CCV steelhead, and other native fishes in the action area, thereby improving rearing and migratory PBFs.

Large woody material and engineered log jams will be placed in strategic locations to provide a variety of geomorphic functions including scour protection and enhancement, sediment deposition and sorting, as well as habitat functions including structural coverage and velocity refuge for juvenile salmonids. Large woody material added as part of the proposed action will increase instream habitat diversity and complexity within the site.

The proposed action is expected to have little to no adverse effect on the salmonid critical habitat PBFs of spawning habitat. Much of the proposed action will occur in areas that are not currently inundated during the time when ESA listed anadromous fish are spawning in the Yuba River. With lowering of the elevation in some areas and creation of side channels, the PBFs of spawning habitat are expected to be improved.

Short term impacts to the benthic macroinvertebrate (BMI) community may occur from construction activities. Disturbance to substrate from in water excavation, sedimentation, or grading activities could result in the mortality to BMIs through the removal or burying of their habitat. BMIs are an essential part of habitat for juvenile rearing fish. However, given the minimization of in water work, continuity of adjacent BMI communities, and rapid recovery of disturbed BMI communities in disturbed areas, the potential indirect effects to salmonids and sDPS green sturgeon related to disturbance of BMI communities is not likely to result in adverse effects. Lowering of areas will increase the total area inundate at lower flows. This is expected to increase the production of BMIs, and thereby improve the PBFs of rearing for salmonids, and PBFs of rearing and food resources for sDPS sturgeon.

With minimization and mitigation measures in place, impacts to the critical habitat of CCV steelhead, CV spring-run Chinook, and sDPS green sturgeon are expected to be localized, minor, and short term. The proposed action will result in beneficial effects to designated critical habitat through increasing complexity of habitat available to ESA listed anadromous fish, through making more habitat available during low flows, increasing LWM, and increasing riparian vegetation. These habitat modifications are expected to improve the PBFs of spawning habitat, rearing habitat, and migration for salmonids, and PBFs of food resources and migratory corridor for sDPS green sturgeon.

2.6 Cumulative Effects

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

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

Few future non-Federal actions that may affect the action area are expected to occur. Non-Federal actions that may affect the action area include angling and State angling regulation changes, agricultural practices that may change water diversions, private water contracts, water withdrawals and diversions, and increased population growth resulting in urbanization and changes in water diversions.

Operation of dams and diversions in the Yuba River watershed outside the action area will continue to affect flows in the action area. During the flood season, peak flows will be decreased from natural flows, in the spring flows will be less than natural flows due to storage of water, and in the dry season flows will be higher than natural flows due to releases to deliver water to diversions primarily for irrigation. Flows downstream of Daguerre Point Dam are affected by three diversions at, and upstream of Daguerre Point Dam during the irrigation season.

2.7 Integration and Synthesis

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

CCV steelhead, CV spring-run Chinook, and sDPS of green sturgeon have experienced significant declines in abundance and available habitat in the California Central Valley relative to historical conditions.

2.7.1 Rangewide Status

Population viability is determined by four parameters: spatial structure, diversity, abundance, and productivity (growth rate). Both population spatial structure and diversity (behavioral and genetic) provide the foundation for populations to achieve abundance levels at or near potential carrying capacity and to achieve stable or increasing growth rates. Spatial structure on a watershed scale is determined by the availability, diversity, and utilization of properly functioning habitats and the connections between such habitats.

Climate change poses a high threat to CCV steelhead, CV spring-run Chinook salmon, sDPS green sturgeon throughout their range. Temperatures in California's Central Valley are predicted to increase between 2°C and 7°C by 2100 (Dettinger *et al.* 2004, Hayhoe *et al.* 2004, Van Rheenen *et al.* 2004), with a drier hydrology predominated by precipitation rather than snowfall. The cold snowmelt that furnishes the late spring and early summer runoff will be replaced by warmer precipitation runoff. Altered river runoff patterns will transform the tributaries that feed the Central Valley. This is expected to truncate the period of time that suitable cold-water conditions persist below existing reservoirs and dams due to the warmer inflow temperatures to reservoirs from rain runoff. Summer temperatures and flow levels in some areas of the Central Valley will become unsuitable for salmonid survival.

2.7.1.1 CCV Steelhead

O. mykiss have long been recognized as having one of the most complex and diverse life histories among all the salmonids. Populations may be entirely anadromous, partly anadromous, or entirely resident, and levels of anadromy can vary by age and sex. One of the difficulties in assessing any steelhead data in the Central Valley is the possibility that some individuals may actually be resident fish, as it is nearly impossible to visually distinguish the two life history forms when they are juveniles.

Indications are that natural CCV steelhead have continued to decrease in abundance throughout the California Central Valley. The proportion of natural fish has also decreased over the past 25 years (Good *et al.* 2005, NMFS 2016b). Most wild CCV steelhead populations are very small and may lack the resiliency to persist for protracted periods if subjected to additional stressors, particularly widespread stressors such as climate change. The genetic diversity of CCV steelhead has likely been impacted by low population sizes and high numbers of hatchery fish relative to wild fish. NMFS identified that the DPS is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (NMFS 2016b).

2.7.1.2 CV Spring-run Chinook Salmon

The extinction risk for the CV spring-run Chinook salmon ESU remains at moderate risk of extinction (NMFS 2016a). Based on the severity of the drought and the low escapements as well as increased pre-spawn mortality in Butte, Mill, and Deer creeks in 2015, there is concern that these CV spring-run Chinook salmon strongholds will deteriorate into high extinction risk in the coming years based on the population size or rate of decline criteria (NMFS 2016a).

2.7.1.3 SDPS Green Sturgeon

Many of the principle factors considered when listing sDPS green sturgeon as threatened are relatively unchanged (NMFS 2015). Recent studies confirm that the spawning area utilized by sDPS green sturgeon is small. Confirmation of Feather River spawning is encouraging and the decommissioning of Red Bluff Diversion Dam and breach of Shanghai Bench makes spawning conditions more favorable, although sDPS green sturgeon still encounter impassible barriers in the Sacramento, Feather and other rivers that limit their spawning range. The relationship between altered flows and temperatures in spawning and rearing habitat and sDPS green sturgeon population productivity is uncertain. Entrainment as well as stranding in flood diversions during high water events also negatively impact sDPS green sturgeon. The prohibition of retention in commercial and recreational fisheries has eliminated a known threat and likely had a very positive effect on the overall population, although recruitment indices are not presently available.

2.7.2 Environmental Baseline

2.7.2.1 CCV Steelhead

In the Yuba River, analysis by the Yuba River Management Team (YRMT 2013) identified for the years 2003/2004 through 2011/2012 the range of adult CCV steelhead migrating upstream of Daguerre Point Dam ranged from 24 to 457, with 3 years exceeding 100 individuals. These counts are incomplete due to equipment outages, and high flows. Hatchery fish are part of these counts.

2.7.2.2 CV Spring-run Chinook Salmon

In the Yuba River, the adult returns of CV spring-run Chinook salmon are highly variable in number (372-3,592) (YRMT 2013). These numbers are based on counts in the fish ladders at Daguerre Point Dam. The number of adult CV spring-run Chinook salmon can be heavily influenced (3-61 percent) by hatchery CV spring-run Chinook salmon. Englebright Dam is the upstream migration barrier. Due to Englebright Dam and other dams upstream, CV spring-run Chinook salmon cannot access historic spawning habitat. This has also forced CV spring-run Chinook salmon and fall-run Chinook salmon to utilized the same spawning habitat. This has resulted in interbreeding between these two populations, and has resulted in the loss of CV spring-run Chinook salmon eggs due to superimposition by spawning fall-run Chinook salmon.

2.7.2.3 SDPS Green Sturgeon

Adult sDPS green sturgeon have been observed in the Yuba River immediately downstream of Daguerre Point Dam. They have not been observed every year. Daguerre Point Dam is an upstream migration barrier for sDPS green sturgeon. Little is known about green sturgeon utilization of the Yuba River.

2.7.3 Effects of the Proposed Action to Listed Species

The proposed action has the potential to affect various life stages of CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon. Adults and juveniles of all of these species may be present during construction of the proposed action. Adults of these species are expected to be in deeper water away from construction areas and avoid areas with construction due to noise from heavy equipment and not be subject to capture and relocation. Juveniles of these species may be captured, injured, or killed during relocation, and juvenile fish that cannot be relocated may be injured or killed by construction equipment.

Adverse effects to CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon adults and juveniles due to sediment in the water, elevated mercury, noise, hazardous substances, and monitoring are expected to be improbable or minor, due to the measures included in the proposed action.

2.7.4 Effects of the Proposed Action to Critical Habitat

Critical habitat in the Yuba River has been adversely affected by changes in the timing and magnitude of flows, due to dams and diversions. Historic mining in the upper watershed has changed the Yuba River in the action area through deposits of sediments up to 40 feet deep. Historic mining in the lower Yuba River has drastically altered river, including moving the river, and decreases in the amount of riparian vegetation due to the river banks in many places being steep tailings from dredge mining.

Critical habitat has been designated for CCV steelhead, and CV spring-run Chinook salmon in the action area. PBFs contained within the action area are for salmonids are: 1) freshwater spawning habitat 2) freshwater rearing habitat and 3) a migration corridor. Spawning and rearing habitat PBFs have the potential to be adversely affected by sedimentation and loss of riparian vegetation through a variety of physical and biological mechanisms. The migration corridor PBF also has the potential to be adversely effected in the course of the proposed construction operations. The adverse effects are expected to PBFs are expected to be temporary. Increased sediment and turbidity may temporarily affect rearing habitat, but the affects will diminish within a week or two of the in-water work being completed. Noise may disrupt migration, but construction work will not occur at night, allowing unimpeded migration at night. The proposed action will result in more spawning and rearing habitat being available to salmonids, especially at lower flows. The results of the proposed action will ultimately enhance all three PBFs contained in the action area for salmonids. Critical habitat has also been designated in the action area for sDPS green sturgeon. The PBFs within the action area for sDPS green sturgeon are: (1) food resources, (2) adequate flow regime for all life stages, (3) water quality, (4) migratory corridors, (5) adequate water depth for all life stages, and (6) adequate sediment quality. As with salmonid critical habitat, adverse effects to sDPS green sturgeon designated habitat is expected to be temporary. For example, increased sediment could reduce food resources in a small area downstream of construction work. However, benthic organisms would recolonized the area within a couple of weeks. The proposed action is expected to enhance PBFs for sDPS green sturgeon designated critical habitat.

2.7.5 Survival and Recovery

The CV spring-run Chinook salmon ESU is currently limited to independent populations in Mill, Deer, Butte creeks, and the Feather River, with the Yuba River being a dependent population. This ESU continues to be threatened by habitat loss, degradation and modification, hydropower dams and water diversions that reduce or eliminate instream flows during migration, unscreened or inadequately screened water diversions, excessively high water temperatures, and predation by non-native species. In the lower Yuba River, CV spring-run Chinook salmon spawning may occur a few weeks earlier than fall-run spawning, but currently there is no clear distinction between the two because of the disruption of spatial segregation by Englebright Dam. Thus, CV spring-run and fall-run Chinook salmon spawning overlap temporally and spatially (NMFS 2014) . Restoration goals outlined in the proposed action are consistent with specific recommended recovery actions for the Yuba River outlined in the NMFS Recovery Plan for CV spring-run Chinook. These include increasing floodplain habitat, improving the quality of side channel habitat, and increasing instream cover (NMFS 2014a). Implementation of the proposed action is expected to benefit these fish and their critical habitat by improving growth, survival, and production, ultimately aiding in the range-wide recovery of these ESUs.

Existing CCV steelhead populations in the Sacramento River basin occur in the upper Sacramento River and its tributaries, including the Yuba River. NMFS Recovery Plan for CCV steelhead lists the Yuba River steelhead as an independent population with an uncertain population extinction risk. Englebright Dam is currently impassable to steelhead, and thus represents the upstream extend of their range in the Yuba River. Restoration goals outlined in the proposed action are consistent with specific recommended recovery actions for the Yuba River outlined in the NMFS Recovery Plan for CCV steelhead. These include increasing floodplain habitat, improving the quality of side channel habitat, and increasing instream cover (NMFS 2014a). Implementation of the proposed action is expected to aid in the range-wide recovery of this DPS. The proposed action addresses the loss and degradation of salmonid spawning and rearing habitat, and implements the following measures of the NMFS Recovery Plan for (NMFS 2014a) ESA listed salmonids in the Yuba River:

- YUR-1.3 Develop programs and implement projects that promote natural river processes, including jprojects that add riparian habitat and instream cover.
- YUR-2.2 Increase floodplain habitat availability in the lower Yuba River,
- YUR-2.4 Create and restore side channel habitats to increase the quantity and quality of off channel rearing and spawning areas in the Yuba River.
- YUR-2.5 Develop and implement programs and projects that focus on retaining, restoring and creating river riparian corridors.

Recent population estimates for the southern DPS of North American green sturgeon indicate that there are few fish relative to historic conditions, and that loss of habitat has affected population size and distribution. However, the southern DPS of North American green sturgeon remain widely distributed along the Pacific coast from California to Washington, and recent findings of fish in the Feather River and the Yuba River indicate that their distribution in the

Central Valley may be broader than previously thought. This suggests that the DPS probably meets several viable species population criteria for distribution and diversity, and indicates that the southern DPS of North American green sturgeon faces a low to moderate risk of extinction. The proposed action is not expected to impede the survival or recovery of sDPS green sturgeon, and may improve survival by restoring natural ecosystem process to the lower Yuba River and reducing stranding risk caused by the current configuration of the channel.

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' opinion that the proposed action is not likely to jeopardize the continued existence of CV spring-run Chinook salmon, CCV steelhead, or sDPS green sturgeon, or destroy or adversely modify their designated critical habitat.

2.9 Incidental Take Statement

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

2.9.1 Amount or Extent of Take

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

- Relocation of ESA listed anadromous fish, and
- Interaction with heavy equipment.

The take will most likely be of juvenile ESA listed anadromous fish. NMFS anticipates that juvenile CCV steelhead, juvenile CV spring-run Chinook salmon, and juvenile sDPS green sturgeon may be captured, injured, or killed as a result of the proposed action, as they will likely be present in the action area during the scheduled work period each year. Adult CCV steelhead, adult CCV spring-run Chinook, and adult green sturgeon are not expected to be captured, injured or killed as a result of the proposed action.

Take of juvenile CCV steelhead, juvenile CV spring-run Chinook salmon, and juvenile sDPS green sturgeon may occur during fish relocations, which may utilize herding, seining, dip netting, or electrofishing to relocate fish. Netting and electrofishing require handling fish, and thus will only be used when herding is not successful. Any fish relocation or collection gear has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish relocation varies widely depending on the method used, ambient conditions, and the experience of the field crew. Since fish relocation activities will be conducted by qualified fisheries biologists following NMFS guidelines, direct effects to and mortality of juvenile CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon during relocation activities is expected to be minimal. However, some fish may still be killed or injured during relocation. Take in the form of collection, injury, or death is summarized below in Table 7.

Table 7. Expected take of juvenile CCV steelhead, CCV spring-run Chinook salmon, and sDPS green sturgeon due to fish relocation activities during construction of the proposed action.

Species	Life Stage	Expected Collection	Potential Mortality
CCV Steelhead	Juvenile	450	5
CV Spring-run Chinook Salmon	Juvenile	90	1
sDPS Green Sturgeon	Juvenile	3	0

Similarly, take of CCV steelhead, CV spring-run Chinook salmon, and sDPS green sturgeon associated with interactions with heavy equipment may occur during the construction of the proposed action. Using heavy equipment in water creates the risk that fish may be injured or killed. The potential for mortality is less than with relocating fish, due to the opportunity for fish to flee from the noise of the equipment. The amount of unintentional injury and mortality attributable to fish interactions with heavy equipment varies widely depending on the activity of the equipment, the season, and fish presence. Take in the form of fish interaction with heavy equipment, injury, or death is summarized below in Table 8.

Table 8. Expected take of juvenile CCV steelhead, CCV spring-run Chinook salmon, and sDPS green sturgeon due to fish interaction with heavy equipment during construction of the proposed action.

Species	Life Stage	Expected Interaction	Potential Mortality
CCV Steelhead	Juvenile	984	5
CV Spring-run Chinook Salmon	Juvenile	196	1
sDPS Green Sturgeon	Juvenile	5	0

If the number of fish collected, observed interacting with heavy equipment, or die, exceed the numbers in Table 7 and 8, the take limit will have been exceeded.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

1. The Corps shall seek NMFS review and input regarding the design of the proposed action, including timing of in-water activities.

2. The Corps shall take measures to minimize take associated with heavy equipment.

3. The Corps shall prepare and provide NMFS with a yearly report detailing the amount of take that has occurred.

2.9.4 Terms and Conditions

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

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

   a. When the design for each Habitat Increment has reached 50 percent and 80 percent (or sooner), the Corps shall solicit input from NMFS regarding the design. The Corps shall allow NMFS at least 30 days to provide comments.

   b. The Corps shall provide NMFS with the opportunity to review and comments on a draft of the monitoring plan. The Corps shall allow NMFS at least 30 days to provide comments.

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

   a. Equipment used for the project shall be thoroughly cleaned off-site to remove any invasive plant material or invasive aquatic biota prior to use in the action area.

   b. Environmentally sensitive areas, sensitive plant species and wetland areas shall be avoided during project activities to the maximum extent practicable. High visibility fencing shall be placed around these areas to minimize disturbance.

c. Soil and excavated material and/or fill material shall be stockpiled in existing clearings when possible.

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

a. Once construction of the proposed action begins, the Corps shall prepare and provide NMFS with a yearly report detailing the annual amount of acres affected by the proposed action, the types of activities that occurred, numbers and species of fish relocated, and any injuries or death of ESA listed anadromous fish. The report should be submitted to the following address:

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

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 Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead (Recovery Plan, NMFS 2014a) identified two primary objectives for recovering California Central Valley ESA listed salmonid populations. These primary objectives are:

a. Secure existing populations by addressing stressors, and

b. Reintroduce populations into historically occupied or other suitable areas.

The Recovery Plan (NMFS 2014a) states that these objectives are considered equal in importance and both should be pursued simultaneously. The Recovery Plan classifies the North Yuba River and Middle Yuba River (both upstream of Englebright Dam) as the only Primary Rivers in the Northern Sierra Nevada Diversity Group for CV spring-run Chinook salmon reintroduction. The Recovery Plan also identifies that reintroduction of CV spring-run Chinook salmon and CCV steelhead to historic habitats upstream of Englebright Dam as an ACTION PRIORITY 1. Modification of Daguerre Point Dam to provide volitional upstream passage of salmonids and sturgeon and to minimize predation of juvenile fish moving downstream is also identified in the Recovery Plan as an ACTION PRIORITY 1 activity. Additional information is available in NMFS' comment letter to the Corps regarding the Yuba River Ecosystem Restoration Feasibility Study (December 4, 2015).

For these reasons, and to meet purposes the ESA, the Corps should include in the proposed action measures to improve fish passage at the Corps' Daguerre Point Dam, and to provide upstream and downstream passage associated with the Corps' Englebright Dam.

1. Where practical, the Corps should install signs to inform the public of the activities associated with the proposed action. The signs should include information about ESA listed anadromous fish species present in the action area.

2.11 Reinitiation of Consultation

This concludes formal consultation for Yuba River Ecosystem Feasibility Study.

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

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

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

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

3.1 Essential Fish Habitat Affected by the Project

EFH designated under the Pacific Coast Salmon FMP may be affected by the proposed action. Species that utilize EFH designated under this FMP within the action area include spring-run Chinook salmon fall-run Chinook salmon, and 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 and **(3)** spawning habitat.

3.2 Adverse Effects on Essential Fish Habitat

Effects to the HAPCs listed in section 3.1 above are discussed in context of effects to critical habitat PFBs as designated under the ESA in section 2.5.8 Potential Effects to Critical Jabitat and EFH HAPCs are appreciably similar, therefore no additional discussion is included. A list of 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:

<u>Sedimentation and turbidity</u>

- Reduced habitat complexity **(1)**
- Reduced quality and availability of spawning substrate **(3)**
- Reduced delivery of oxygenated water to incubating eggs **(3)**
- Reduced size and connectivity of spawning patches **(1, 3)**
- Increased scouring **(1, 3)**
- Reduced riffle habitat **(1, 3)**

<u>Removal of riparian vegetation</u>

- Degraded water quality **(1, 3)**
- Reduced shading **(2)**

- Reduction in large woody material recruitment **(1)**
- Reduced shelter from predators **(1)**
- Reduction in aquatic macroinvertebrate production **(1)**

3.3 Essential Fish Habitat Conservation Recommendations

- The Worker Environmental Awareness Training should be provided by a NMFS approved fish biologist. The program should provide workers with information on their responsibilities with regard to ESA listed anadromous fish, their critical habitat, an overview of the life-history of all the species, information on take prohibitions, protections under the ESA, and an explanation of terms and conditions identified in this opinion. Written documentation of the training must be submitted to NMFS within 30 days of the completion of training. HAPCs that would benefit from implementation of this training include (1) complex channels and floodplain habitats, (2) thermal refugia and (3) spawning habitat.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 179 acres of designated EFH for Pacific Coast salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Corps must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

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

3.5 Supplemental Consultation

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

4. FISH AND WILDLIFE COORDINATION ACT

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

The following recommendations apply to the proposed action:

At any project site within the action area that experiences foot traffic, the Corps should post interpretive signs describing the presence of listed fish and/or critical habitat as well as highlighting their ecological and cultural value.

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

This concludes the FWCA portion of this consultation.

5. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

5.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the Corps. Other interested users could include Yuba Water Agency, the South Yuba River Citizen League and Friends of the River. Individual copies of this opinion were provided to the Corps. This opinion will be posted on the NMFS Public Consultation Tracking System Web Page. The format and naming adheres to conventional standards for style.

5.2 Integrity

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

5.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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Environmental Appendix D
Attachment 2

Letter of Concurrence ESA Section 7
U.S. Fish and Wildlife Service
Yuba River Ecosystem Restoration Feasibility Study

October 2018

U.S. Army Corps of Engineers

Sacramento District

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AUG 20 2018

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

In Reply Refer to:
08ESMF00-
2018-I-2633

AUG 02 2018

Mr. Mark T. Ziminske
Chief, Environmental Resources Branch
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814-2922

Subject: Informal Consultation on the Yuba River Ecosystem Restoration Feasibility Study, Yuba County, California

Dear Mr. Ziminske:

This letter is in response to the U.S. Army Corps of Engineers' (Corps) January 3, 2018, request for informal consultation with the U.S. Fish and Wildlife Service (Service) on the Yuba River Ecosystem Restoration Feasibility Study (YRERFS) (proposed project) in Yuba County. Your request was received by the Service on January 8, 2018. The proposed project will restore 178.6 acres of the lower Yuba River. Restoration is targeting salmonid species by providing shallow, low velocity rearing habitat and refugia. At issue are the proposed project's potential effects on the federally-threatened valley elderberry longhorn beetle (*Democerus californicus dimorphus*), California red-legged frog (*Rana draytonii*), and western yellow-billed cuckoo (*Coccyzus americanus*). There is no proposed or designated critical habitat in the proposed project area. Our primary concern and mandate is the protection of federally-listed species pursuant to the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)(Act).

We have reviewed the proposed project, including: (1) the January 3, 2018, letter from the Corps requesting informal consultation; (2) the *Biological Assessment for the Yuba River Ecosystem Restoration Feasibility Study* prepared January 2018; (3) the June 4, 2018, memorandum for record written by the Corps; (4) email correspondence between the Corps and the Service; and (5) other information available to the Service.

The Corps and the Yuba County Water Agency (YCWA) propose to restore 178.6 acres of aquatic and riparian habitat along the lower Yuba River in Yuba County, California. The principle features of the proposed project include restoration of 42.5 acres of aquatic habitat including side channels, backwater areas, bank scallops, floodplain lowering, and channel stabilization. These features will provide shallow, low velocity rearing habitat and refugia for juvenile anadromous salmonids and potentially increase benthic macroinvertebrate producing habitat. Engineered log jams (ELJs) and placement of boulders and large woody material have been incorporated in the project area at strategic locations. ELJs and boulders will be placed at actively eroding banks or sites with high velocities and shear stresses. These features will promote bank stabilization, add structural complexity, provide velocity refuge of juvenile fish, and modify local hydraulics and sediment transport. Construction of these sorts of features will remove 13.4 acres of riparian habitat discontinuously over the four reaches where work will occur.

The proposed project also includes about 136 acres of riparian habitat restoration consisting of floodplain lowering and grading, and riparian vegetation plantings, which will increase the quantity and quality of riparian habitat in the river corridor. The proposed project addresses fragmentation of habitat by targeting areas adjacent to existing vegetation that have been unable to initiate revegetation through natural processes due to substrate composition and depth to groundwater. Floodplain lowering reconnects the river to its floodplain and makes planting feasible where it was not previously due to excessive groundwater depths.

Construction of the proposed project will take place over 4 years. The primary work of excavation, grading, and feature placement will be expected to be completed in 3 years. One additional year is assumed to account for schedule slippage and repair/closeout of construction tasks. Planting will also be expected to be completed over 3 years. Planting will be conducted concurrently with the primary excavation and feature installation, beginning the second year and extending to the end of the fourth year. All in-water work is expected to occur downstream of the Highway 20 bridge and will be conducted between June 1 and October 31 each year. Planting is expected to occur between October 1 and November 30 each year. Pending Congressional authorization and funding, the project will be expected to begin in 2021 and be completed by 2024.

The lower Yuba River is the combined flow of the North Fork, Middle Fork, and South Fork of the Yuba River. Elevations range from 158 to 285 feet above mean sea level. The proposed project is includes the channel of the lower Yuba, side channels, riparian areas, and the Yuba Goldfields. Staging areas will be located primarily in agricultural, grassland, and barren areas. Access will occur along previously established roads (both paved and un-paved) located primarily in agricultural areas.

Conservation Measures

- Straw bales, straw wattles, and silt fences will be installed at each work area as appropriate.
- Operation of heavy machinery in the active channel will be minimized to avoid disturbance of substrates.
- Turbidity and solids will be monitored according to water quality permits. If acceptable limits are exceeded, work will be suspended until acceptable measured levels are achieved.
- Equipment used for the project will be thoroughly cleaned off-site to remove any invasive plant material or invasive aquatic biota prior to use in the project area.
- High visibility fencing will be placed around environmentally sensitive areas and will be avoided during project activities to the maximum extent practicable.
- All food related trash items will be disposed of in closed containers.
- A revegetation plan will be developed and all temporary impact areas will be restored to pre-project contour and revegetated.

Valley Elderberry Longhorn Beetle

- The Corps will conduct elderberry shrub surveys prior to construction and keep a 20-foot buffer between the dripline of an elderberry shrub and any project activities.

Western Yellow-Billed Cuckoo

- Riparian vegetation removal or trimming will be conducted during the winter months (January and February).

The Service concurs with your determination that the proposed project may affect, but is not likely to adversely affect the valley elderberry longhorn beetle. We came to the conclusion based on the following reasons: (1) the Corps' conservation measures committing to avoiding elderberry shrubs by at least 20 feet; and (2) best management practices that will avoid project construction from affecting elderberry shrubs.

The Service concurs with your determination that the proposed project may affect, but is not likely to adversely affect the California red-legged frog. We came to this conclusion based on the following reasons: (1) the nearest recorded occurrence is more than 15 miles away from the project area; and (2) the project area lacks a fine sediment substrate and woody material used for thermal regulation and predator avoidance.

The Service concurs with your determination that the proposed project may affect, but is not likely to adversely affect the western yellow-billed cuckoo. We came to this conclusion based on the following reasons: (1) while cuckoos have been observed near the confluence of the Yuba and Feather Rivers, they have not been observed in the Feather River watershed for more than 20 years and (2) the Corps' conservation measure will remove woody vegetation during the winter.

Therefore, unless new information reveals effects of the proposed project that may affect listed species in a manner or to an extent not considered, or a new species or critical habitat is designated that may be affected by the proposed project, no further action pursuant to the Act is necessary.

If you have any questions regarding this letter, please contact Jennifer Hobbs, Senior Fish and Wildlife Biologist, at Jennifer_hobbs@fws.gov or (916) 414-6541, or myself at Douglas_weinrich@fws.gov or (916) 414-6541; or at the letterhead address.

Sincerely,

Doug Weinrich

Doug Weinrich
Assistant Field Supervisor

Environmental Appendix D
Attachment 3

Clean Water Act Section 404(b)(1) Evaluation

Yuba River Ecosystem Restoration Feasibility Study

Prepared By

U.S. Army Corps of Engineers

Sacramento District

October 2018

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Contents

I. Introduction D3-7

I. Project Description D3-7

A. Project Purpose D3-7

B. Location D3-8

C. General Description D3-8

D. Background D3-8

E. Authority D3-9

F. General Description of Dredged or Fill Material D3-9

G. General Characteristics of Material D3-9

(1) Large Woody Material (LWM) & Engineered Log Jams D3-10

(2) Boulders D3-10

(3) Gravel D3-10

(4) Quantity of Material D3-10

(5) Source of Material D3-10

H. Description of Proposed Discharge Site D3-11

(1) Location D3-11

(2) Size D3-11

(3) Type of Site D3-11

(4) Type of Habitat D3-11

I. Timing and Duration of Discharge D3-12

J. Description of Disposal Method D3-12

II. Factual Determinations D3-12

A. Physical Substrate Determinations (Sections 230.11(a) and 230.20) D3-12

(1) Comparison of Existing Substrate and Fill D3-12

(2) Changes to Disposal Area Elevation D3-13

(3) Migration of Fill D3-13

(4) Duration and Extent of Substrate Change D3-13

(5) Changes to Environmental Quality and Value D3-14

(6) Actions to Minimize Impacts D3-14
B. Water Circulation, Fluctuation, and Salinity Determinations D3-14
(1) Alteration of Current Patterns and Water Circulation D3-14
(2) Interference with Water Level Fluctuation D3-14
(3) Salinity Gradients Alteration D3-14
(4) Effects on Water Quality D3-15
(5) Changes to Environmental Quality and Value D3-16
(6) Actions to Minimize Impacts D3-17
C. Suspended Particulates/Turbidity Determinations D3-17
(1) Alteration of Suspended Particulate Type and Concentration D3-17
(2) Particulate Plumes Associated with Discharge D3-17
(3) Changes to Environmental Quality and Value D3-17
(4) Actions to Minimize Impacts D3-17
D. Contaminant Determinations D3-17
E. Aquatic Ecosystem and Organism Determinations D3-18
(1) Effects on Plankton D3-18
(2) Effects on Benthos D3-18
(3) Effects on Nekton D3-18
(4) Effects on Aquatic Food Web D3-19
(5) Effects on Special Aquatic Sites D3-19
(6) Threatened and Endangered Species D3-19
(7) Other Wildlife D3-20
(8) Actions to Minimize Impacts D3-21
F. Proposed Disposal Site Determinations D3-21
(1) Mixing Zone Size Determination D3-21
(2) Determination of Compliance with Applicable Water Quality Standards D3-21
(3) Potential Effects on Human Use Characteristics D3-21
(4) Municipal and Private Water Supplies D3-21
(5) Recreation and Commercial Fisheries D3-22
(6) Water-related recreation D3-22

(7) Aesthetics D3-22

G. Determination of Cumulative Effects on the Aquatic Ecosystem D3-23

H. Determination of Secondary Effects on the Aquatic Ecosystem D3-23

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge D3-23

A. Adaptation of the Section 404(b)(1) Guidelines to this Evaluation D3-23

B. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Impact on the Aquatic Ecosystem D3-23

C. Alternative 1- No action D3-23

D. Alternative 5 (Recommended Plan) D3-24

E. Alternative 6 ..... D3-24

F. Compliance with Applicable State Water Quality Standards, and; Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act D3-24

G. Compliance with Endangered Species Act (ESA) of 1973 ..... D3-25

H. Evaluation of Extent of Degradation of the Waters of the United States D3-25

I. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Sanctuaries Designated by the Marine Protection, Research, & Sanctuaries Act D3-25

J. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem D3-25

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I. Introduction

This appendix evaluates compliance of the Recommended Plan, Alternative 5 with the Guidelines established under the Federal Pollution Control Act (Clean Water Act) Amendments of 1972 (Public Law 92-500), as amended by the Clean Water Act of 1977 (Public Law 95-217), legislation collectively referred to as the Clean Water Act. The Clean Water Act sets national goals and policies to eliminate the discharge of water pollutants into navigable waters. Any discharge of dredged or fill material into waters of the U.S. (WOUS) by the U.S. Army Corps of Engineers (USACE) requires a written evaluation that demonstrates that a proposed action complies with the guidelines published at 40 CFR Part 230. These guidelines, referred to as the Section 404(b)(1) Guidelines or "Guidelines," are the substantive criteria used in evaluating discharges of dredged or fill material under Section 404 of the Clean Water Act.

Fundamental to the Guidelines is the precept that "dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated such a discharge would not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern."

The procedures for documenting compliance with the Guidelines include the following:

- Examining practicable alternatives to the proposed discharge that might have fewer adverse environmental impacts, including not discharging into a water of the U.S. or discharging into an alternative aquatic site.
- Evaluating the potential short- and long-term effects, including cumulative effects, of a proposed discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment.
- Identifying appropriate and practicable measures to mitigate the unavoidable adverse environmental impacts of the proposed discharge.
- Making and documenting the Findings of Compliance required by §230.12 of the Guidelines.

This Clean Water Act, Section 404(b)(1) evaluation of compliance with the Guidelines is not intended to be a "stand alone" document; it relies heavily on information provided in the integrated feasibility report and Environmental Assessment (FR/EA) to which it is attached.

I. Project Description

<u>A. Project Purpose</u>

The Project purpose and objective is to identify problems and opportunities associated with ecosystem degradation in the Yuba River watershed; to formulate, evaluate, and screen potential solutions to these problems; and to recommend a series of actions and projects that have a Federal interest and are supported by a local entity willing to provide the necessary items of local cooperation.

The overall goal of the study is to restore degraded ecosystem structure, function, and dynamic processes of the Yuba River watershed to a less degraded, more natural condition. Based on the problems identified in the area planning study objectives include:

- Improve the quantity, quality, and complexity of aquatic habitats.

- Improve the quantity, quality, complexity, and connectivity of riparian habitats.
- Improve longitudinal river connectivity.
- Improve lateral connectivity of the river to its floodplain

B. Location

The overall project area is located northeast of Marysville, Yuba County, within and adjacent to the lower Yuba River. The overall project is nested within the 3,400 square mile Yuba River Watershed, which is part of the larger Sacramento River basin. The Yuba River Watershed is located on the western slopes of the Sierra Nevada Mountain Range within portions of Sierra, Placer, Yuba, and Nevada Counties. The lower Yuba River is the combined flow of the North Fork, Middle Fork, and South Fork of the Yuba River. The primary components of the Project are located below the ordinary high water mark of the lower Yuba River. Staging areas would be located primarily in previously disturbed locations in agricultural, forested, grassland, and barren areas. Access would occur along previously established roads to the greatest extent possible (both paved and un-paved). In some cases access would require construction or improvements through unimproved areas, including along cobble bars adjacent to the river, to establish suitable conditions for equipment to reach proposed feature construction sites.

C. General Description

The YRERFS is a cooperative effort between the USACE and Yuba County Water Agency (YCWA), the non-federal sponsor. The YRERFS Integrated Feasibility Report/Environmental Assessment (FR/EA) describes the plan formulation process for the study and evaluates the environmental effects of the alternatives. Portions of the FR/EA will be referenced throughout this document to describe the existing conditions near the project site, as well as some potential impacts of the Recommended Plan and other alternatives. The Recommended Plan would require a discharge of fill material into waters of the U.S. under Section 404 of the Clean Water Act. This document describes actions proposed for Alternative 5, the Recommended Plan (Project) and identifies any possible discharge of fill material associated with the Project. Additional information about the proposed actions can be found in Chapter 4 of the FR/EA.

D. Background

The current state of riparian and aquatic ecosystems in the Yuba Watershed was largely shaped by extensive hydraulic mining during the late 1800s. Hydraulic mining was the practice of using high pressure water cannons to dislodge rock material or move sediment. The resulting water-sediment slurry was directed through sluice boxes to remove gold or other desirable minerals. Hydraulic mining resulted in torrents of sediment transported downslope, causing rapid aggradation and exacerbating flooding along the lower Yuba River. Public backlash was significant and prompted lawsuits and government intervention. In 1893, Congress passed the Camenitti Act which established the California Debris Commission (CDC) as a regulatory body charged with restoring and protecting the navigability of rivers.

Much of the waste material dislodged by hydraulic mining settled where the grade of the river flattened. The natural riverbed then became suffocated under millions of cubic yards of cobble. Today, many sections of the Lower Yuba River remain primarily composed of cobble and large gravel. The coarse substrate is unfavorable for the natural recruitment of riparian vegetation. Efforts to control the river have further altered natural hydrologic and sediment transfer regimes. The CDC built Daguerre

Point and Englebright Dams to prevent additional mining debris from washing downstream and into the Feather and Sacramento Rivers. The Water Resources Development Act of 1986 eliminated the CDC and transferred Daguerre Point and Englebright Dams to USACE.

Due to vast anthropogenic modifications along the lower Yuba River, the quality of aquatic habitat has been degraded by reduced water volume; altered depth, velocity, temperature, substrate, and oxygen levels; and introduced heavy metals. Riparian habitats have also been diminished in quantity, degraded in quality, and fragmented by conversion to agricultural fields and reservoirs; accumulation of mining deposits; and reduced fine sediments. River connectivity has been altered and reduced by hydro-periods and sediment transport leading to blockage and impaired passage of migrating fish. In addition to the longitudinal river impairment, the lateral river connectivity has also been reduced due to disconnection of the river from the floodplain.

E. Authority

The authority to study the Sacramento River Basin for flood control and allied purposes, including ecosystem restoration, was granted in the Rivers and Harbors Act of 1962, P.L. 87-874, Section 209, which reads:

> *The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes, including channel and major drainage improvements…in drainage areas of the United States and its territorial possessions, which include the following named localities…Sacramento River Basin and streams in northern California draining into the Pacific Ocean for the purposes of developing, where feasible, multi-purpose water resource projects, particularly those which would be eligible under the provisions of Title III of Public Law 85-500.*

Title III of Public Law 85-500 concerns water supply. On 28 April 2016, a Senate Committee Resolution clarified that ecosystem restoration is to be included in the investigation.

> *Resolved by the Committee on Environment and Public Works of the United States Senate, that the Secretary of the Army, pursuant to the Rivers and Harbors Act of 1962, Pub. L. 87-874 § 209, is requested to investigate ecosystem restoration opportunities in the Sacramento River Basin and streams in northern California draining into the Pacific Ocean, including the Yuba River watershed.*

Further information on authorization for the Yuba River Ecosystem Restoration Study is also discussed in Chapter 1 of the FR/EA.

F. General Description of Dredged or Fill Material

The following sections only pertain to project actions that would directly impact waters of the U.S.

G. General Characteristics of Material

Fill is required below the ordinary high water mark for the purposes of 1) placement of large wood material anchored by cables, boulders, and pins (Engineered Log Jams) 2) deposition of rock/sediment, 3) installation of boulders. Temporary fill below the ordinary high water mark may include the use of construction mats and dewatering equipment. Excavation of sediment (cobbles and soil) within the floodplain would occur for the creation of side channels and lowering the floodplain.

(1) Large Woody Material (LWM) & Engineered Log Jams

Where woody material is described as an addition to bankline, assume woody features are 25 feet in length and 2 feet in diameter. The material will be anchored in the bankline at a 45 degree angle downstream and protrude one third of its total length beyond the bankline into the channel. The floodplain application is where woody material is placed on a floodplain or seasonally inundated area, the woody material will be placed parallel with the flow, anchored with cables boulders and pins.

(2) Boulders

Boulders weighing 5 tons and measuring 1 meter in diameter will be used to slow or modify velocities in certain areas. The quantity and placement of boulders incorporated into the restoration actions will be determined during PED pending site specific design, including refined hydraulic modeling.

(3) Gravel

Gravel (mixed cobble gravel) would be placed in areas to establish temporary stream crossings. A clean gravel/ cobble mix, appropriate for spawning would be used. This material also may be used to facilitate channel constriction to facilitate appropriate hydraulic conditions for long term, self-sustaining hydro geomorphic maintenance of aquatic features (i.e., side channels).

(4) Quantity of Material

Although, the final amount of fill material placed in the lower Yuba River is not known at this time, estimated quantities were developed for the purpose of developing feasibility level costs and designs. The quantities of large woody material, ELJs, boulders, and gravel are summarized in Table 1. For large woody material, ELJs, and boulders, the estimated quantity is in non-specific units representative of the number of anticipated placements. The final quantity of fill will depend on the size of each placement, necessary to ensure stability under high flows and would be determined during site specific design in PED.

Table 1. Feasibility Level Estimates of Proposed Features Qualifying as Fill.

Feature	Quantity
Large Woody Material	13 units
Engineered Log Jams	16 units
Boulders	8 units
Gravel	720 CY

(5) Source of Material

The fill material for project would likely come from licensed facilities within 50 miles of the project site that meet the applicable standards and requirements. Cutting for planting would be sourced from local existing vegetation.

H. Description of Proposed Discharge Site

(1) Location

The location of the discharge sites would be in designated locations within the lower Yuba River. Specifically the Project, would include sites at Increments 2, 3a, 5a, and 5b. At Increment 2, just downstream of the Highway 20 bridge at Upper Gilt Edge Bar, riparian planning would occurring along the river banks and Large Woody Material would be inserted along the areas where bank scalloping was done. Further downstream in Increment 3a, Lower Gilt Edge Bar to Hammon Bar, Engineered Log Jams would be placed to stabilize the channel, Large Woody Material would be inserted in a side channel/backwater areas, and riparian planting would occur at many portions throughout. At Increment 5, below the Teichert Hallwood Restoration project, a historical channel alignment on the north side of Bar C would be restored to inundate at 3,000 cfs and function as swale habitat. The side channel and adjacent floodplain would be lowered and graded. Additionally, riparian vegetation would be planted on each side of the restored swale/side channel. ELJs would be placed in a patchwork configuration at the inflow of the swale, at the upstream end of Bar C. In addition, LWM would be placed in the backwater area at the downstream end of Bar C to increase structural and habitat complexity in the area. A historical channel alignment on the south side of the bar would be restored by lowering and grading a side channel within a stand of riparian vegetation. The side channel would extend into an existing backwater habitat located at the downstream edge of the Yuba Goldfields. The floodplain on the north side of the side channel would be lowered and planted with riparian vegetation. Boulder structures would be placed to provide hydraulic stability at the inflow section of the side channel at the upstream end of Bar C.

(2) Size

An aquatic resource delineation has not been conducted, but waters within the study area are assumed to be jurisdictional under Section 404 of the Clean Water Act. Restoration actions would occur along approximately 12.6 miles of the lower Yuba River, but the discharge sites would not exceed 178.6 acres.

(3) Type of Site

The type of disposal site is within the river bed and adjacent to the lower Yuba River.

(4) Type of Habitat

The following habitat types were identified at and adjacent to the study area:

Riverine: The lower Yuba River is located within the study area and would be impacted by the placement of fill into waters of the U.S. The lower Yuba River is a perennial river subject to section 404 of the Clean Water Act, it is not a navigable waterway under Section 10 of the Rivers and Harbors Appropriation Act of 1899. The riverbed is generally composed of gravel/cobble, minimal bedrock, and sediment. Vegetation is largely absent from the riverbed, except on areas where sediment accumulations, depth, and water flow allow for the establishment of plants such as sand/gravel bars or shallow banks.

Barren: This habitat type is defined by the absence of vegetation, any habitat with less than 2% total vegetation cover of herbaceous, desert, or non-wildland species and less than 10% cover by tree or shrub species qualifies. Much of the barren nature of the lower Yuba River is due to anthropogenic mining input.

Valley Foothill Riparian Habitat: The valley foothill riparian habitat is transitional and present between aquatic and upland zones that develops along flood plains of low-gradient rivers and streams. Dominant species present include Cottonwood (*Populus* spp.), California (western) sycamore (*Platanus racemosa*), and valley oak (*Quercus lobata*). Subcanopy trees include white alder (*Alnus rhombifolia*), box elder (*Acer negundo* var. *californica*), and Oregon ash (*Fraxinus latifolia*). Typical understory shrub layer plants include wild grape (*Vitis californica*), wild rose (*Rosa californica*), California blackberry (*Rubus ursinus*), blue elderberry (*Sambucus mexicana*), poison oak (*Toxicodendron diversilobum*), buttonbush (*Cephalanthus occidentalis*), and willows (*Salix* spp.).

Other Land Cover types: Irrigated Row and Field Crops; Deciduous Orchards; Un-vegetated, Vacant, or Developed areas; and Barren (mining refuse) occur directly adjacent to, and in some cases partially within, the study area and are associated with human activities: The types of Irrigated Row and Field Crops is unknown, but commonly known types in the region are tomatoes, lettuce, and beets.

I. Timing and Duration of Discharge

If the project is authorized in 2019, construction activities could start as early as 2022. The following is a schedule showing the approval and construction phases of the project, assuming optimal funding.

• Division Commander's Notice	FEB 2019
• Chief of Engineers Report	JUL 2019
• Potential Authorization	OCT 2019
• USACE and Sponsor sign Design Agreement	NOV 2019
• Initiate PED	2019
• Initiate Construction	2022
• Complete Physical Construction	2025
• Complete Plant Establishment Period	2030
• Complete Monitoring	2035

Timing of construction would correspond to low water levels and species migratory patterns, when feasible, to minimize impacts to water quality and species. Physical construction would begin in 2022 and be completed by end of 2025.

J. Description of Disposal Method

Construction of the project may be performed using typical construction equipment such as motor graders, backhoes, bulldozers, track and wheel loaders, dump trucks, pavers, rollers, and similar equipment.

II. Factual Determinations

A. Physical Substrate Determinations (Sections 230.11(a) and 230.20)

(1) Comparison of Existing Substrate and Fill

The substrate currently within the project area primarily consists of gravel/cobble, minimal bedrock, and sediment. Vegetation is largely absent from the riverbed, except on areas where sediment accumulations, depth, and water flow allow for the establishment of plants such as sand/gravel bars or shallow banks. Sediment size within the project area varies, consisting of silt, sand, gravel, cobble, and boulders. According to the NRCS' Soil Survey Geographic database, Soils present onsite include: Riverwash, dumps, Auburn-Sobrante, Sobrante-Timbuctoo, Redding-Corning, Tujunga, Holillipah, and Shanghai. The large majority of soils are categorized as Riverwash. Dumps, and Tujunga (SoilWeb 2017). No vegetation is expected to be removed from the project site.

The material that will be discharged at the project site consists of organic substrate as in boulders, large woody material, and riparian plantings. No soil material will be discharged at the project site within waters of the U.S., but cobble material may be used in creation of side channels. The cobble for side channel creation would be harvested from the project location.

(2) Changes to Disposal Area Elevation

On average, the elevations within the Project area range from 158 to 285 feet above mean sea level. The change in elevation at the disposal sites within the project area due to the discharge of fill material would be minimal. The discharge of large woody material, boulders, and tree cuttings would not significantly change the base elevation. The elevation at other locations, outside of the direct disposal site, are not expected to occur as a result of erosion, slumpage, or other movement of the discharged fill material. It's possible that the riparian plantings and the large wood material may accumulate sediment over time, but this would increase the amount of organic sediment within the river channel and provide suitable material for riparian grown, which is currently absent within the river system. This sort of sediment accumulation is difficult to quantify, but is expected to be small and within the natural amount for the river system. While not a discharge of fill material, as the fill will be hauled off site, the greater elevation change would occur from excavation of riverbed material.

(3) Migration of Fill

The discharge of fill material associated with this Project is not expected to migrate over time. The large woody material which would be placed below within the floodplain is placed parallel with the flow and anchored with cables, boulders, and pins (known as an Engineered Log Jam). The riparian plantings have the potential to move in high flow events before they're well established. Once established, the plants are expected to stay in place as well as help avoid erosion or scouring. In the event of a high flow situation, there is the possibility that the discharged fill material associated with this project may washed down stream. Due to the small volume and locations of the fill material in this project, the effect they would have on the river and riparian system if migrated downstream would be minimal.

A temporary increase in sedimentation and turbidity could occur within the river during earth moving activities. These indirect effects would be reduced to less than significant with the implementation of BMPs discussed in Water Quality (Chapter 4 of the FR/EA).

(4) Duration and Extent of Substrate Change

There would be a permanent discharge of fill material into waters of the U.S. associated with the implementation of the Project. The fill material would be placed in specific locations, as described in Chapter 3 of the FR/EA, within the river channel and floodplain to emulate a natural system and help restore the degraded quality of the system. While not a discharge of fill material, there would be a large amount of native substrate within the project area removed.

(5) Changes to Environmental Quality and Value

The current riverine and riparian systems within the Project area are highly degraded, and the Project would increase the quality and quantity of the environment. Riparian plantings would provide needed woody structure and create species and structural diversity. Insertion of the Engineered Log Jams would be to replicate the complexity of the natural system and gather spawning gravels and provide suitable habit for invertebrates and fish. Both the riparian plantings and Engineered Log Jams would reduce bank erosion while at the same time add stream habitat. In addition, they would also help control the morphology and grade of the river system. An overall increase in quality and value would occur from implementation of the Project.

Additional information on vegetation and wildlife, fisheries resources, special status species and impacts to those resources can be found in Chapter 4 of the FR/EA.

(6) Actions to Minimize Impacts

Construction activities would have short-term and minor impacts. In-water project work would occur during low flow period and standard erosion prevention practices would be employed. With the implementation of BMPs and avoidance, minimization, and mitigation measures discussed in Chapter 4 of the FR/EA the impacts to erosion and transport of soils and substrate would be minimized.

B. Water Circulation, Fluctuation, and Salinity Determinations

(1) Alteration of Current Patterns and Water Circulation

The Project would alter the current flow of the river as well, as alter the floodplain. Boulders and ELJs would be placed in conjunction with created aquatic habitat features (i.e. secondary channels) and would serve as hydraulic control features to maintain hydraulic conditions that support the stability and sustainability of these features. Boulders, large woody material, and ELJs may also be placed within a feature to further modify flows. The final quantity and placement of these features would be determined during site specific design in PED

Furthermore, the creation of side channels and lowering the flood plain would also alter the pattern of changing the direction water to go into the historic floodplain. This may affect the velocity of water in certain Increments, would help restore a more natural flow and create habitat diversity. These changes are not expected to negatively alter up or downstream functions.

(2) Interference with Water Level Fluctuation

The Yuba River system is regulated by upstream dams which allow a specific amount of water to be released. Major dams in the Yuba River watershed completed in dates from 1913 to 1969 include Spaulding, Bowman, Fordyce, Englebright, Jackson Meadows, and New Bullards Bar. Furthermore the lower Yuba River is currently operating under the Lower Yuba River Accord flow regime, which is a joint project between the Yuba County Water Agency and the United States Department of the Interior Bureau of Reclamation to manage the interests of nearly 17 stakeholders in the area to balance interests of irrigation, conservation, water supply, and fisheries concerns. This plan establishes a flow requirement to meet all of the above needs. The Project would not change the water level fluctuation patterns.

(3) Salinity Gradients Alteration

Salinity gradients would not be affected.

(4) Effects on Water Quality

Multiple factors affect the water quality of the Lower Yuba River including: hydroelectric power generation, dams and reservoirs, mining activities, urbanization, and timber harvesting. At least 6 dams are located within the Yuba River watershed. The physical, thermal, and chemical changes that occur from water being retained behind dams can greatly affect the downstream quality and temperature of the river.

The lower Yuba River experiences temperature fluctuation from inflows of Deer Creek (RM 22.7), irrigation diversions at Daguerre Point Dam (RM 11.6), and operational releases from Englebright Dam (RM 24). Furthermore, the general width to flow ratio in conjunction with low riparian cover provide opportunity for solar heating of the water. The water within the lower Yuba River can increase up to 7°C from the release at Englebright Dam to the City of Marysville (LYRA 2010), but this is seasonally dependent and influenced by amount of water released from Englebright Dam, solar input, and air temperature. Data taken near Marysville, showed that dissolved oxygen concentrations, total dissolved solids, pH, alkalinity, and turbidity are well within acceptable or preferred ranges for salmonids and other key freshwater organisms (USACE 2012). In 2007, instream flow requirements were memorialized by the Yuba Accord (YCWA 2007) to maintain suitable habitat in the lower Yuba River for fish and wildlife.

Mercury contamination from hydraulic mining in the watershed poses a risk to environmental and human health. Mercury was used in hydraulic gold mining to increase the removal of gold from hard rock, but mercury particles would wash through the sluice before they could settle and be confined. The accumulated mercury in river sediments pose a risk to human health through consumption of contaminated fish, drinking potentially unsafe water, and improper handling of sediments (USGS, 2005). From an environmental standpoint, mercury methylation and biomagnificaiton are a problem, especially when the biomagnificaiton occurs in great geographic distribution. Many environmental factors such as temperature, dissolved organic carbon levels, salinity, oxidation-reduction conditions, acidity (pH), and concentration of sulfur in the water and sediments influence the rates of mercury methylation as well as demethylation (USGS, 2005). In a statewide survey conducted by the SWRCB's Surface Water Ambient Monitoring Program, the fish tested for mercury in the tributaries of the Yuba River were the highest in the state (Yuba County IRWMP, 2015).

a) Water Chemistry

The proposed project has the potential to increase turbidity during in-water work. The use of construction equipment such as motor graders, backhoes, bulldozers, track and wheel loaders, dump trucks, pavers, rollers, and similar equipment would likely disturb sediment within the river channel and back areas. These activities also have the potential to mobilize mercury, but these affects are addressed in the Effects on Water Quality section above. Approved BMPs and water quality monitoring would be conducted in compliance with the Section 401 Water Quality Certification. Stormwater runoff has the potential to impact turbidity and pH of the reservoir. Stormwater discharges would be permitted under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction Activities. All storm water discharges and activities would be monitored under the project Storm Water Pollution Prevention Plan (SWPPP). With appropriate BMPs and an approved SWPPP, impacts to turbidity and pH from stormwater runoff is anticipated to be minimal.

Appropriate measures implemented during the restoration activities such as BMPs and a Spill Prevention, Control and Countermeasures Plan (SPCCP), would reduce temporary water chemistry impacts to less than significant.

Salinity. The project would not change salinity levels.

Clarity. Total suspended solids may temporarily impact the clarity of water column during construction. This is expected to be contained within the immediate project area. However, the reduction of clarity caused by construction activities would be short in duration and would return to pre-construction levels upon project completion.

Color. Dredging and placement of fill materials would temporarily induce a color change due to an increase in turbidity. However, conditions would return to pre-construction levels upon completion of the project.

Odor. The project would not affect odor.

Taste. The project would not affect taste.

Dissolved Gas Levels. Dissolved gas levels within the project vicinity would be temporarily affected during the project. Significant negative effects would be avoided through the implementation of an approved SWPPP.

Temperature. Temperature would be affected temporarily and permanently. Construction activities have the potential to increase localized turbidity which could affect the amount of light that can enter the water therefore affecting temperature. With Best Management Practices and mitigation measures the effects to temperature during construction would be minimized. Long term beneficial effects to temperature are expected to occur once the project is established. The riparian plantings would provide shade to help moderate stream temperatures and light penetration; and providing root structure and woody material that would help stabilize stream banks, moderate stream velocities, reduce channelization, and reduce erosion and suspended sediments. Excavating side channels and lowering the flood plain to emulate a natural riverine system would provide more consistent temperatures.

Nutrients. Project activities would likely cause the release of sediments and affect the turbidity within the immediate project area. Turbidity would be controlled inside and outside of the working area by using a combination of BMPS. High levels of Mercury and other heavy metals are embedded within the lower Yuba River and may be released from earth moving construction activities associated with the project. Implementation of an approved SWPPP would also prevent and mitigate the temporary and permanent release of excess nutrients.

Eutrophication. With the implementation of BMPs and an approved SWPPP, the project is not intended to contribute excess nutrients into the lower Yuba River or promote excess plant growth.

(5) Changes to Environmental Quality and Value

Implementation of the ecosystem restoration project would not result in long term adverse changes to the current quality or aquatic resource functions and values. Long term changes to the environmental quality and value would increase from the project. Under the Project, 173.5 acres of riverine, riparian, and related habitats would be restored.

Conducting the proposed project has the potential to temporarily adversely impact aquatic resource functions and values. As seen in section B(4) of this document, water quality could be impacted through sedimentation, turbidity, and temperature. The project may also temporarily impact dissolved oxygen levels and nutrient cycling. Integrating BMPs, mitigation and monitoring, and required measures from the SWPPP for the Project would reduce project impacts to less than significant.

(6) Actions to Minimize Impacts

To minimize impacts that may occur from project construction, standard BMPs, avoidance, minimization, and mitigation measures would be implemented. If possible, the project would be conducted when water levels are at their lowest and erosion prevention measures would be employed to prevent run off.

C. Suspended Particulates/Turbidity Determinations

(1) Alteration of Suspended Particulate Type and Concentration

The materials that would be discharged from implementation of the Project likely would not alternate suspended particles type. The excavation of river material associated with the project may cause a temporary concentration of sediment in the project area. By implementing avoidance and minimization measures, discussed in Chapter 4 of the FR/EA, impacts could be reduced to less than significant.

(2) Particulate Plumes Associated with Discharge

Excavation for creation of side channels and other in water work have the potential to agitate river sediment creating turbidity and sediment plumes within the construction area and downstream. The plumes would be temporary and dissipate after in water construction work is complete. By implementing avoidance and minimization measures, discussed in Chapter 4 of the FR/EA, impacts could be reduced to less than significant.

(3) Changes to Environmental Quality and Value

During implementation of the Project, suspended particles and plumes associated with discharge would be temporary and subside after the project construction is over. There is also the potential for mercury and other heavy metals to be concentrated and present in the water due to construction activities.

(4) Actions to Minimize Impacts

In order to minimize the impacts that suspended particles and plumes may have, in water work would be conducted in low water level periods if possible. Certification from the Central Valley RWQCB would be obtained prior to in water work. BMPs to avoid, minimize, and mitigate adverse impacts would be implemented and impacts would be less than significant.

D. Contaminant Determinations

Construction related activities involve the use of hazardous materials such as fuels and lubricants to operate construction equipment. The fill material that will be discharged onsite would be clean organic matter that is free from contaminants. The soil that is excavated on site is likely contaminated with mercury and other heavy metals; this material will be hauled off site and disposed in a commercial upland disposal site. Earth moving activities could result in the release of mercury that already exist in the soil into the environment. This has the potential to affect the direct and indirect project area. In order to ensure that the effects of contaminants on the environment are less than significant, BMPs listed in the Water Quality Section 4.2.7 (Chapter 4) of the FR/EA will be implemented.

E. Aquatic Ecosystem and Organism Determinations

(1) Effects on Plankton

Plankton are the floating organisms that occupy the pelagic zone of oceans, seas, or fresh bodies of water. Construction impacts would be temporary and localized. With the implementation of BMPs and an approved SWPPP, the effects to plankton would not be significant.

(2) Effects on Benthos

Benthic organisms are located in the ecological zone that is the lowest level of a water body such as the ocean, river, or lake. This includes the sediment surface and sub-surface layers. This layer typically hosts invertebrates, but it is also important to fish species and their reproduction. The discharge of fill material is not expected to affect the native benthic species due to the location of the disposal points and general depth of the lower Yuba River. The lowering and excavating of the river bed and floodplain have the potential to remove benthic species within the river channel. The Project would also temporarily affect the benthic zone though turbidity and sedimentation. With the implementation of BMPs and an approved SWPPP, the effects to benthic organisms would not be significant.

(3) Effects on Nekton

Nekton consists of actively swimming aquatic organisms and can be further broken down into three categories: invertebrates, mollusks, and crustaceans. Historic and current conditions are host to native and non-native fish, some anadromous species and some resident species. Anadromous fish species in the Lower Yuba River include: Central Valley fall-run, Central Valley late fall–run, and Central Valley spring-run Chinook salmon (*Onchorhynchus tshawytscha*) and Central Valley steelhead (*O. mykiss*), native green sturgeon (*Acipenser medirostris*) and Pacific lamprey (*Lampetra tridentatus*), and nonnative striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*). The Lower Yuba River is also home to many non-anadromous native fish species including the resident rainbow trout (*O. mykiss*), Sacramento sucker (*Catostomus occidentalis*), hardhead (*Mylopharodon conocephalus*), Sacramento pikeminnow (*Ptychocheilus grandis*), western roach (*Lavinia symmetricus*), prickly sculpin (*Cottus asper*), riffle sculpin (*Cottus gulosus*), speckled dace (*Rhinichthys osculus*), and tule perch (*Hysterocarpus traski*). Nonnative fish species include smallmouth bass (*Micropterus dolomieui*), bluegill (*Lepomis macrchirus*), green sunfish (*L. cyanellus*), redear sunfish (*L. microlophus*), and mosquitofish (*Gambusia affinis*).

The Project would have direct and indirect effects to the nekton community. Direct effects may include injury or mortality due to movement of large equipment, placement/movement of fill, or construction noise. Indirect effects may include impacts to habitat conditions during construction such as sedimentation, turbidity, or slight temperature change, but an overall increase in habitat quality is expected to occur from project implementation.

Nekton organisms may temporarily be displaced during construction activities. Impacts to nekton are expected to be less than significant with the implementation of BMPs.

(4) Effects on Aquatic Food Web

Implementing the Project would have direct and indirect effects on the aquatic food web. The proposed in channel work, such as lowering and excavating the floodplain to facilitate more frequent inundation or for the placement of Engineered Log Jams, will temporarily disturb soil and sediments therefore causing an increase in turbidity and sedimentation which can reduce light penetration and disrupt photosynthesis. Furthermore, these effects could potentially interfere with feeding, social organization, spawning, rearing, and juvenile survival in fish species and other nekton species; however, these effects would be short term and localized to the project area. Mitigation measures will be implemented to minimize effects of sedimentation and turbidity to special status species and habitat.

Construction equipment has the potential to leak toxic substances such as gasoline and diesel, lubricants, and other petroleum-based projects. As a result of spills or leaks in storage containers, the substances could enter waterways within and adjacent to the project site, causing mortality or physiological impairment or disrupt other behavioral patterns of all types of species.

Implementation of BMP's and other mitigation measures (Chapter 4 of FR/EA) would result in minimal impacts on the aquatic food web outside and within the immediate work area.

(5) Effects on Special Aquatic Sites

Sanctuaries and Refuges. No sanctuaries and refuges are within the project area.

Wetlands. The proposed project is not expected to result in the loss of wetlands or the conversion of one type of a wetland to another. The proposed removal of vegetation would only take place to facilitate the construction of additional and or enhancement of existing riverine/riparian habitat. The proposed project would also result in the planting of additional riparian vegetation. The proposed project would result in a net enhancement of riparian and riverine habitat form and function.

Mud Flats. No mud flats are within the project area.

Vegetated Shallows. No vegetated shallows are within the project area.

Coral Reefs. No coral reefs are within the project area.

Riffle and Pool Complexes. The lower Yuba River has a fairly low gradient, which does not lend itself to have riffle and pool complexes, but in high flow with the cobble sediment certain portions of the lower Yuba River may contain riffle and pool complexes. The coarse substrate of the lower Yuba River can result in rough turbulent flow and high dissolved oxygen levels. Pools typically occur downstream of the riffle complexes and have slower stream velocities and finer substrate. The Project would not result in the discharge of fill material into riffle and pool complexes. Gradual sedimentation from the discharge of fill material is not expected to affect the riffle and pool complexes any more than natural stream movement might.

(6) Threatened and Endangered Species

Implementation of the Project has the potential to impact 6 species that are listed as Threatened or Endangered under the Federal Endangered Species Act (16 U.S.C. 1531-1544). Detailed accounts of special status species can be found in Chapter 4 of the FR/EA. There is a possibility that the following species could be located within the project area: California Red-legged Frog (*Rana draytonii),* Western Yellow-billed Cuckoo (*Coccyzus americanus),* and Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*). If these species are located within the project area, they have the potential to be indirectly impacted. The following species are known to occur within the project area and would likely be directly impacted: Southern DPS Green Sturgeon (*Acipenser medirostris),* Central Valley Spring-run Chinook salmon (*Oncorhynchus tshawytscha),* and California Central Valley Steelhead DPS (*Oncorhynchus mykiss).*

The presence of VELB within the project area is unknown, but if the species is located within the Action Area, there is the potential to cause temporary disturbance which may adversely affect the VELB. If possible a 100 foot buffers would be used, which is considered complete avoidance (USFWS 1999). With the proposed avoidance and mitigation measures implemented during construction, the impact to VELB would be insignificant.

Based on the necessary habitat requirements for the Western Yellow Billed Cuckoo and nearest known recorded occurrence of the species, there is a low possibility for the species within the project area. Furthermore, much of the riparian habitat within and along the lower Yuba River is patchy and not large enough to be considered suitable habitat. Pre-project surveys would be conducted by a qualified biologist. The effects of fill on the Yellow Billed Cuckoo, if present, would be insignificant with the implementation of BMPs.

The Project would directly impact the Southern DPS Green Sturgeon (*Acipenser medirostris*), Central Valley Spring-run Chinook salmon (*Oncorhynchus tshawytscha*), and California Central Valley Steelhead DPS (*Oncorhynchus mykiss*). The proposed in channel work, such as lowering and excavating the floodplain to facilitate more frequent inundation or for the placement of Engineered Log Jams, will temporarily disturb soil and sediments therefore causing an increase in turbidity and sedimentation. These effects could potentially interfere with feeding, social organization, spawning, rearing, and juvenile survival in fish species; however, these effects would be expected to be short term and localized to the project area. Mitigation measures will be implemented to minimize effects of sedimentation and turbidity to special status species and habitat. As a result of spills or leaks in storage containers or from project equipment, substances could enter waterways within and adjacent to the project site, causing mortality or physiological impairment of fish or disrupt other behavioral patterns. Improvements to aquatic and riparian habitat would result in long term benefits for special status species.

(7) Other Wildlife

Project implementation has the potential to impact non-special status species within the project area. Species that may occur in the area include: Species of birds may include the Northern harrier (*Circus cyaneus*), Swainson's hawk (*Buteo swainsoni*), Tricolored blackbird (*Agelaius tricolor*), Loggerhead shrike (*Lanius ludovicianus*), Song sparrow, (*Ammodramus sacannarum*). Reptile and amphibians may include: pond turtle (*Actinemys marmorta*), green racer (Coluber constrictor), and Gilbert's skink (Eumeces gilbertii). Bats such as the Western red bat (*Lasiurus blossevillii*) or Yuma myotis (Myotis yumanensis), may also utilize the riparian area. Other common mammal species known to occur in the area include: mule deer, cougar (*Felis concolor*), and opossum (*Didelphus virginiana*). Aquatic species present in the project area are: non-native bullfrogs (*Lithobates catesbeianus*) and non-native crayfish (*Procambarus clarkii*; *Pacifastacus leniusculus*), Pacific lamprey (*Lampetra tridentatus*), and nonnative striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*), resident rainbow trout (*O. mykiss*), Sacramento sucker (*Catostomus occidentalis*), hardhead

(*Mylopharodon conocephalus*), Sacramento pikeminnow (*Ptychocheilus grandis*), western roach (*Lavinia symmetricus*), prickly sculpin (*Cottus asper*), riffle sculpin (*Cottus gulosus*), speckled dace (*Rhinichthys osculus*), and tule perch (*Hysterocarpus traski*), smallmouth bass (*Micropterus dolomieui*), bluegill (*Lepomis macrchirus*), green sunfish (*L. cyanellus*), redear sunfish (*L. microlophus*), and mosquitofish (*Gambusia affinis*).

Wildlife species could be directly or indirectly affected. Direct effects may include injury or mortality due to movement of large equipment, placement/movement of fill, or construction noise. Indirect effects may include impacts to habitat conditions during construction, but an overall increase in habitat quality is expected to increase from project implementation.

To ensure that there would be no effect to migratory birds, preconstruction surveys would be conducted, if needed, in and around the project area. If any migratory birds are found, a protective buffer would be delineated, and USFWS and CDFG would be consulted for further actions. Recommendations proposed by the USFWS in their Fish and Wildlife Coordination Act Report.

(8) Actions to Minimize Impacts

To minimize impacts to the aquatic ecosystem and organisms, mitigation measures have been developed and can be found in Chapter 4 of the FR/EA. With the implementation of a SWPPP and special conditions from federal consultations, the impact to special status species and wildlife will be minimized to a less than significant level.

F. Proposed Disposal Site Determinations

(1) Mixing Zone Size Determination

Not applicable

(2) Determination of Compliance with Applicable Water Quality Standards

Water quality within the project area and downstream may be affected as a result of project implementation. Construction activities, such as grading, excavating, structure placement, and rock placement have the potential to degrade water quality through material release of sediment and contaminants. The discharge of fill material into waters of the U.S. would not violate state or Federal water quality standards or primary drinking water standards of the Safe Drinking Water Act (42 USC 300f – 300j). Certifications would be obtained from the Central Valley RWQCB prior to construction to comply with the California Water Code. Project design, certification from the RWQCB, and project BMPs would ensure that fill material would not have an adverse impact on water quality and would adhere to applicable water quality control standards.

(3) Potential Effects on Human Use Characteristics

(4) Municipal and Private Water Supplies

Currently Yuba County Water Agency obtains the water service agreements to provide its member units surface water from the lower Yuba River. Ground water, which is deemed good quality, within the Yuba basin is typically used for domestic and agricultural uses. The project will not violate an Environmental Protection Agency or State water quality standards or violate the primary drinking water standards of the Safe Drinking Water Act (42 USC 300f – 300j).

(5) Recreation and Commercial Fisheries

The lower Yuba River offers excellent American shad, Chinook salmon, and steelhead, smallmouth bass, and striped bass fishing. While recreation opportunities in the lower Yuba River are limited by poor access, informal public river access in the 24-mile long lower Yuba River is available at Parks Bar approximately 5 miles northwest of Smartsville and the Hallwood Avenue Access approximately five miles northeast of Marysville. Formal recreation areas along the Yuba River that are operated by Yuba County include Sycamore Ranch and Hammon Grove Parks near the Dry Creek and lower Yuba River confluence. These parks are located just downstream of the proposed Increment 3a restoration area.

Project activities would temporarily and indirectly disrupt informal recreational fishing activities. Access points and parts of the river would be temporarily disturbed during construction. Construction activities, such as the placement of temporary bridges and construction equipment would temporarily impair the visual aesthetics of informal fishing. It would also temporarily block access from river points used for informal fishing access. Because these are informal recreation uses in the area, and there would still be land permanently available for these activities, this impact would be considered less than significant. No formal commercial fishing activities would be affected by project implementation.

(6) Water-related recreation

In addition to fishing activities, the lower Yuba River offers boating, recreational exercise, and wildlife viewing. Other activities may include hunting, swimming, and gold panning. Similar to fishing, hiking and boating opportunities in the lower Yuba River are limited by poor access. Where access is available, fishing, picnicking, rafting, kayaking, tubing, and swimming are the dominant recreational uses. There are proposed staging areas located in the vicinity of both the Hallwood and Parks Bar river access points. The proposed staging areas would not restrict access at these locations, but they would cause the area to have a degraded recreation experience due to the presence of heavy construction equipment, increased dust, and noise. These impacts would be significant, but with implementation of the proposed mitigation measures they would be reduced to less than significant.

(7) Aesthetics

Temporary impacts to the aesthetics would likely occur from project implementation. Heavy construction equipment, increased dust, and noise would be present that could disrupt natural visual conditions. While no vegetation is expected to be removed during the project, there is the potential that it would be necessary to remove vegetation which could also disturb the existing visual conditions. If necessary vegetation would be replanted in-kind and no temporal loss of vegetation is expected. Long term aesthetics would benefit from the project design, as there would be more riparian plantings and restoration modeled after natural riverine conditions. Furthermore, an increase in the quality and quantity of habitat would promote the use of the land to more wildlife.

Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves

Formal recreational parks owned and operated by Yuba County are situated along the lower Yuba River. These include Sycamore Ranch and Hammon Grove Parks near the Dry Creek and lower Yuba River confluence. Operation, use, and quality of the parks within and adjacent to the project areas would not be significantly affected.

G. Determination of Cumulative Effects on the Aquatic Ecosystem

Construction activities have the potential to temporarily degrade water quality through the direct release of soil and construction materials into water bodies or the indirect release of contaminants into water bodies through excavation activities. Projects being conducted concurrently with the proposed YRERS may including Hallwood Side Channel and Floodplain Restoration Project, the Yuba River Canyon Salmon Habitat Restoration Project, ongoing voluntary conservation measures related to Daguerre Point Dam and continuing operations and maintenance, as well as continuous sand and gravel mining in the lower Yuba River area. Adding in the impacts of the YRERS to other past, present, and reasonably foreseeable future actions could experience a cumulative effect on the environment.

All projects within the lower Yuba River would be required to coordinate with the Central Valley RWQCB to obtain certification. Degradation of water quality from the project would be short term and limited to the construction period. The proposed restoration activities associated with the study would result in less-than-significant effects to water quality and would not contribute to cumulative long-term adverse effects.

H. Determination of Secondary Effects on the Aquatic Ecosystem

No secondary effects to the aquatic ecosystem are anticipated to occur as a result of the discharge of fill material associated with the Project.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

Under the Recommended Plan, the proposed disposal sites for the discharge of fill material is specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.

A. Adaptation of the Section 404(b)(1) Guidelines to this Evaluation

No significant adaptations of the guidelines were made relative to this evaluation.

B. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Impact on the Aquatic Ecosystem

Three alternatives were evaluated in detail: Alternative 1 -No action alternative, Alternative 5 (Recommended Plan), and Alternative 6. Chapter 4 of the FR/EA also discusses several other alternatives that were previously considered, but have since been screened from consideration. While Alternative 6 would restore more habitat (197.8 acres) than Alternative 5 (178.6 acres), it is more than three times the cost per Average Annual Habitat Unit (unit of beneficial ecosystem output) of other Alternatives. Alternative 5 maximizes benefits relative to costs and is therefore the NER Plan and the Recommended Plan. Alternative 5, restores significant ecosystem function, structure, and dynamic processes on 178.6 acres of riverine, riparian, and related habitats in the highly degraded Yuba River System. Discussion of the alternatives is below:

C. Alternative 1- No action

If no Federal action is taken, the Yuba River ecosystem-related problems existing today are expected to continue, and stressors will persist and potentially become exacerbated. Populations of Chinook salmon, steelhead, and water-birds will continue to be significantly reduced from historic conditions. Connectivity of the riverine aquatic habitat will continue to be curtailed by the presence of large dams in the watershed. Regeneration of riparian habitat will continue to be impeded by coarse substrate conditions. Incremental improvements to currently accessible habitat may be made by other entities. However, the cost of large scale excavation is likely a barrier to other entities and the sites requiring minimal excavation have already been addressed, leaving the most problematic and expensive sites in the current state of degradation.

Although the No Action Alternative would not impact waters of the U.S., it does not meet the project purpose since it does not address ecosystem restoration in the study area, and is, therefore, not considered to be one of the least environmentally damaging practicable alternatives (LEDPA).

D. Alternative 5 (Recommended Plan)

Alternative 5 consists of ecosystem restoration in Habitat Increments 2, 3a, 5a, and 5b, at Upper Gilt Edge Bar, Unnamed Bar, Narrow Bar, River Mile 6.5, Bar E, Island B, Bar C, Lower Gild Edge Bar, Hidden Island, First Island, Silica Bar, and North Silica Bar, which would result in approximately 178.6 acres of restored habitat by lowering the floodplain to facilitate inundation and riparian vegetation planting. A full description of Alternative 5 can be found in Chapter 4 of the FR/EA. The Implementation of Alternative 5 or Alternative 6 would result in short-term construction related impacts to the natural environment; however, both alternatives would result in long-term significant improvements to the aquatic ecosystem. Alternative 6 includes additional habitat features compared to Alternative 5 and has incrementally higher impacts associated with the additional construction efforts. Alternative 5 was found to be the most efficient Alternative and reasonably maximizes benefits relative to costs. For the purpose of this analysis, the same logic is applied in identifying the LEDPA. While Alternative 5 provides and Alternative 6 would both result in significant long-term ecosystem benefits, Alternative 5 provides benefits in a more efficient manner, requiring less construction and fewer short-term construction related impacts, therefore, Alternative 5 is the LEDPA.

E. Alternative 6

Alternative 6 includes increments 2, 5b, 5a, 3a, and 1 at Upper Gilt Edge Bar, Unnamed Bar, Narrow Bar, River Mile 6.5, Bar E, Island B, Bar C, Lower Gilt Edge Bar, Hidden Island, First Island, Silica Bar, North Silica Bar, and Upstream of Highway 20, which would result in 197.8 acres of restored habitat by lowering the floodplain to facilitate inundation and planting riparian vegetation. A full description of Alternative 6 can be found in Chapter 4 of the FR/EA. As discussed above, although Alternative 6 would result in significant long-term ecosystem benefits, implementation of this alternative would require more construction and incrementally greater short-term construction related impacts compared to Alternative 5; therefore, Alternative 6 is not the LEDPA.

F. Compliance with Applicable State Water Quality Standards, and; Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act

Construction and subsequent removal of the project related discharge would not cause or contribute to violation of any applicable State water quality standards. The discharge operations would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

G. Compliance with Endangered Species Act (ESA) of 1973

Placement of fill materials in the project area(s) will not jeopardize the continued existence of any species listed as threatened or endangered or result in the likelihood of destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973. Consultations would occur with the National Marine Fisheries Service and the U.S. Fish and Wildlife service under Section 7 of the Endangered Species Act.

H. Evaluation of Extent of Degradation of the Waters of the United States

Long-term significant effects on the aquatic ecosystem diversity, productivity, and stability would not occur, nor would long-term effects to recreational, aesthetic, and economic values of the affected WOUS occur as a result of the discharge of fill material.

I. Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Sanctuaries Designated by the Marine Protection, Research, & Sanctuaries Act.

Not applicable.

J. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem

With the implementation of BMPs; avoidance, minimization and mitigation measures; and input from other federal agencies the project would not result in significant adverse effects on the environment.

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Environmental Appendix D
Attachment 4

Final Coordination Act Report
U.S. Fish and Wildlife Service
Yuba River Ecosystem Restoration Feasibility Study

Prepared By:

US Fish and Wildlife Service

August 2018

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Suite W-2605
Sacramento, California 95825-1846

In Reply Refer to:
08ESMF00-
2018-CPA-0006-2

AUG 2 1 2018

Mark Ziminski
Chief, Environmental Resources Branch
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814

Dear Mr. Ziminski:

Enclosed is the U.S. Fish and Wildlife Service's Fish and Wildlife Coordination Act (FWCA) report for the U.S. Army Corps of Engineer's Yuba River Ecosystem Restoration Project. The proposed restoration activities would occur along the lower Yuba River in Yuba County, California. This report has been prepared under the authority of, and in accordance with, the provisions of section 2(b) of the FWCA (48 stat. 401, as amended; 16 U.S.C. 661 et seq.).

On December 22, 2017, this report was circulated to the agencies and offices listed below for review and comment. We did not receive any comments on the draft FWCA report.

If you have any questions or comments regarding this report, please contact Jennifer Hobbs at (916) 414-6541.

Sincerely,

Doug Weinrich

Doug Weinrich
Assistant Field Supervisor

Enclosure

cc:
Michael Fong, Corps, Sacramento, California
Gary Sprague, NMFS, Sacramento, California
Tina Bartlett, CDFW, Rancho Cordova, California

UNITED STATES DEPARTMENT OF THE INTERIOR FISH

AND WILDLIFE SERVICE

FISH AND WILDLIFE COORDINATION ACT REPORT FOR THE

YUBA RIVER ECOSYSTEM RESTORATION PROJECT YUBA COUNTY

PREPARED FOR:
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

PREPARED BY:
U.S. FISH AND WILDLIFE SERVICE
SACRAMENTO FIELD OFFICE
SACRAMENTO, CALIFORNIA

AUGUST 2018

INTRODUCTION

The U.S. Fish and Wildlife Service (Service) is preparing this Fish and Wildlife Coordination Act (FWCA) report for the U.S. Army Corps of Engineers' (Corps) Yuba River Ecosystem Restoration Project, Yuba County, California. This report is prepared under the authority of, and in accordance with the FWCA, as amended. Funding to initiate this study was provided by the Corps. The Corps is the federal lead agency and the Yuba County Water Agency (YCWA) is the local sponsor.

The information presented is based primarily upon project planning information made available by the Corps and various reports pertinent to the project area. This report presents the current views of the Service on this project. Our analysis is based on engineering and other project information provided by the Corps. Our appraisal of resources is based on literature reviews; personal communications with other recognized experts; best professional judgment of Service biologists; and a projection of future conditions using current land-use information. Our analyses will not remain valid if the project, the resource base, or anticipated future conditions change significantly.

Hydraulic mining that occurred in the mid to late 1800s has shaped the Yuba River watershed resulting in large amounts of sediment being transported downstream and causing aggradation of the Yuba River channel. Gravel berms were created in the lower Yuba River to promote scouring and create a stable river channel and two debris dams were constructed to prevent further movement of fine sediments from flowing into the Feather and Sacramento Rivers. The influx of sediment into the Yuba River watershed caused loss of riparian habitat and fish rearing habitat while the placement of dams blocked fish migration.

AREA DESCRIPTION

The Yuba River watershed encompasses 1,340 square miles on the western slopes of the Sierra Nevada Mountain Range. The river flows east to west through forest, foothill chaparral, and agricultural lands to the confluence of the Feather River. The watershed is located in portions of Sierra, Placer, Yuba, and Nevada counties. There are a total of 32 dams and 11 powerhouses in the watershed. For most of its course, levees are absent from the river, except for near the confluence with the Feather River. At that point, the Yuba River is confined by levees for 6 miles.

The Yuba River Ecosystem Restoration Project is focusing on the lower Yuba River downstream of Englebright Dam to the confluence of the Feather River. The Corps has divided this length of river into eight reaches with a portion of the Yuba Goldfields, an area of active gravel mining, removed from the project because there is a separate restoration action being planned for that reach through the Department of the Interior's Anadromous Fish Restoration Program (AFRP).

PROJECT DESCRIPTION

A no action alternative and two restoration alternatives are being evaluated. A description of each alternative is provided below.

No Action

Under the No Action Alternative there would be no restoration activities along the Yuba River. Existing problems with fish rearing and habitat would not be resolved and would likely continue on and likely worsen with climate change.

Alternative 5

Alternative 5 is made up of four reaches. They are described below according to reach. Overall, 91.9 acres of riparian habitat would be restored and 104.7 acres of fish habitat would be created through the construction of side channels, lowering of floodplains, creation of backwater habitat, bank scalloping, and gravel placement.

Reach 2 – Just downstream of the Highway 20 Bridge at Upper Gilt Edge Bar, the floodplain would be lowered to facilitate inundation at 3,000 cubic feet per second (cfs) and riparian vegetation would be planted along the channel edge.

On the southern bank of Upper Guilt Edge Bar, where the bank is 8 – 15 feet high, and the edge of the channel is relatively homogeneous with little habitat complexity, small scallops would be excavated into the tall and steep banks to increase local topographic diversity and wetted edge. These scallops are designed to create an inundated alcove at all discharges with the steep slopes surrounding the alcoves feathered to at least a 10:1 slope, providing additional shallow inundated areas with desirable depth/velocity combinations. Initially, these scallops would provide year round rearing habitat to juvenile salmonids. Over time, it is expected that fine sediment may deposit in the scallops creating nursery sites where natural woody vegetation recruitment could occur. The scallops would further facilitate natural recruitment of riparian vegetation, due to shallow access to the water table, and the fine texture of deposited sediments.

Large woody material (LWM) would be placed within and protruding from the scallops. An existing backwater area would be restored allowing for inundation in a typical 1 – 2 year recurrence interval flood. Riparian vegetation would be planted to increase the structural diversity and extent of existing riparian vegetation. Additional fine material would be introduced to the upper 3 feet of the soil column in excavated areas to increase soil absorption and the amount of soil moisture available to riparian vegetation. LWM would be placed within the backwater to provide aquatic structure.

On unnamed bar on the north side of the river near River Mile (RM) 17, riparian vegetation would be planted. The site would be restored by lowering areas to increase lateral floodplain connectivity and provide additional opportunity to plant riparian vegetation.

Reach 3a – At Lower Gilt Edge Bar, an existing swale feature (at the upstream end of Lower Guilt Edge Bar) would be lowered and connected to the channel to become inundated at 3,000 cfs. A patchwork floodplain network of LWM surrounding the restored groundwater-fed swale would be constructed to encourage fine sediment deposition and riparian recruitment, as well as provide edgewater refugia at flows above baseflow.

Downstream of Lower Gilt Edge Bar, on the alluvial bar on the north side of the river, riparian vegetation would be planted.

First Island has large expanses of floodplain and high floodplain, and a side channel on river left which provides spawning and rearing habitat. This area may provide immediate benefit to emerging salmonid fry if they are allowed access to larger expanses of shallow habitat with riparian cover. To encourage sediment deposition and riparian vegetation recruitment, engineered log jams (ELJs) would be installed in a patchwork configuration, particularly along the apex of First Island just above bankfull elevation.

Rock and sediment would be deposited along the left bank of Silica Bar, and ELJs would be placed to aid constriction at this location. LWM would be placed along the margins of the downstream terminus of the existing side channels/backwater that is surrounded by an existing stand of diverse, mature, native riparian vegetation, in areas that would not disrupt existing riparian vegetation along the banks of the side channel/backwater area. Floodplain areas would be lowered to facilitate inundation and riparian vegetation would be planted.

On the river downstream of First Island, floodplain surfaces would be lowered and riparian vegetation would be planted to facilitate more frequent inundation between 2,000 and 5,000 cfs. Lowering would avoid prolonged inundation and potential to induce mortality of riparian vegetation cuttings. Rock and sediment would be deposited along the left bank of Silica Bar, coupled with placement of ELJs to aid river constriction at this location.

A side channel would be created that activates above 3,000 cfs and connects to the low lying area downstream, providing beneficial off-channel habitat with established riparian vegetation. This would create an anabranching side channel (stable multiple-thread channels) in an existing swale within a stand of relatively dense vegetation that includes willows and cottonwoods.

Actions in this reach will increase habitat connectivity between two other separate restoration projects on the Yuba River and work along Reach 2.

Reach 5a – Immediately downstream of the (AFRP) Teichert Hallwood Restoration Project, a historical channel alignment on the north side of Bar C would be restored to inundate at 3,000 cfs and function as swale habitat. The side channel and adjacent floodplain would be lowered and graded. Additionally, riparian vegetation would be planted on each side of the restored swale/side channel. ELJs would be placed in a patchwork configuration near the inflow of the swale at the upstream end of Bar C. In addition, LWM would be placed in the backwater area at the downstream end of Bar C to increase habitat structure and complexity in the area.

A historical channel alignment on the south side of the bar would be restored by lowering and grading a side channel within a stand of riparian vegetation. The side channel would extend into an existing backwater habitat located at the downstream edge of the Yuba Goldfields. The floodplain on the north side of the side channel would be lowered and planted with riparian vegetation. Boulder structures would be placed to provide hydraulic stability at the inflow section of the side channel at the upstream end of Bar C.

Reach 5b – A side channel would be constructed at Narrow Bar that would connect to an existing swale at the downstream end of the bar. Existing riparian vegetation would border the created side channel. Another side channel would be created, splitting off from the other side channel through the middle of the bar in the southwest direction. Boulders would be placed to maintain stable hydraulic conditions at the inflow. There is a large expanse of shallow depth to groundwater on Narrow Bar, with some areas of high floodplain. The high floodplain areas would be graded and planted with riparian vegetation. Additionally, floodplain along the main channel would be graded to increase inundation duration and frequency at 2,000 cfs. ELJs would be placed in a patchwork configuration to facilitate riparian recruitment and to restore swale habitat. At the terminus of the anabranching side channel, a backwater area would be created. A backwater area would be created on the right bank at RM 6.5 to provide shallow water refugia for salmonids.

Riparian vegetation would be planted in the downstream portion of Bar E surrounding a historical channel alignment to restore species and structural diversity. LWM would be placed in the swale/backwater downstream from the existing diversion channel.

Riparian vegetation would be planted along the upstream portion of Island B to create species and structural diversity. ELJs would be placed in a patchwork configuration to encourage native plant recruitment and improve survivability of plantings. Table 1 includes the acres of habitat created per reach.

<u>Alternative 6</u>

Alternative 6 includes measures in the four reaches described in Alternative 5 with the addition of Reach 1. Therefore, we will only describe Reach 1 here and the reader can refer to Alternative 5 for the remaining alternative description. Work in Reach 1 would include the creation of a side channel in the Timbuctoo Bend area. The side channel would be constructed with native cobble

Table 1. Alternative 5 Restoration Acreages

Reach	Feature Type	Acres
2	Floodplain Lowering	14.0
	Riparian Planting	8.7
	Bank Scalloping	0.3
	Backwater Area	0.3
3a	Floodplain Lowering	13.0
	Riparian Planting	28.7
	Side Channel	11.3
	Gravel Placement	3.5
5a	Floodplain Lowering	13.0
	Riparian Planting	21.3
	Side Channel	15.1
5b	Side Channel	11.1
	Floodplain Lowering	7.7
	Riparian Planting	33.2
	Backwater Area	2.9
	Floodplain Terracing	12.5

or armored stone. Along the southern bank of the side channel, the floodplain would be lowered and planted with riparian vegetation extending across the existing bar to the lower Yuba River. This action would reconnect the river to its floodplain and increase aquatic and riparian habitat. East of Parks Bar, near Big Ravine, the near-shore area and adjacent floodplain on the south bank of the Lower Yuba River would be lowered and planted with riparian vegetation adjacent to the Yuba River. Near the confluence of Big Ravine Creek, a large backwater area would be created for use by waterfowl, amphibians, and other wildlife species. Table 2 includes the acres of habitat created per reach.

EXISTING BIOLOGICAL RESOURCES

Vegetation

Historically, the lower Yuba River had dense wide swaths of riparian vegetation with multiple layers of vegetation varying in height due to the age of the stand. Mining activities in the 1800s drastically changed the Yuba River channel and negatively affected the adjacent riparian habitat. In the *Riparian Vegetation Analysis* (Watershed Science 2012) an analysis of LiDAR data determined that 264.3 acres of riparian vegetation exists in the study area of the project. This habitat is patchy along the roughly 14 miles of river. Riparian vegetation found along the lower Yuba River include elderberry shrubs, willow species, white alder, Oregon ash, California black walnut, western sycamore, button bush, and Fremont cottonwood. Smaller willow species combined with Fremont cottonwood are the most common species in the floodplain. Agriculture and urban cover-types make up the majority of the area with patches of annual grassland, areas of rock or gravel, and small amounts of oak woodland.

Table 2. Alternative 6 Restoration Acreages

Reach	Feature Type	Acres
1	Riparian Planting	7.4
	Side Channel	5.8
	Backwater Area	6.1
2	Floodplain Lowering	14.0
	Riparian Planting	8.7
	Bank Scalloping	0.3
	Backwater Area	0.3
3a	Floodplain Lowering	13.0
	Riparian Planting	28.7
	Side Channel	11.3
	Gravel Placement	3.5
5a	Floodplain Lowering	13.0
	Riparian Planting	21.3
	Side Channel	15.1
5b	Side Channel	11.1
	Floodplain Lowering	7.7
	Riparian Planting	33.2
	Backwater Area	2.9
	Floodplain Terracing	12.5

Wildlife

Riparian habitat is especially valuable for wildlife. The terrestrial and aquatic interface created in the riparian zone supports a numerous number of diverse species and provides a food source for these species. Riparian trees provide nesting habitat for many birds, notably cavity-nesting species and a large assemblage of raptors, including the State-listed Swainson's hawk. Birds which glean insects off of bark, leaves, and leaf tangles such as bushtits, woodpeckers, and nuthatches, also use riparian habitats. Typical mammal species that can be found in riparian areas include deer, raccoons, beavers, coyotes, and red foxes. The multilayered vegetation provides an abundance of insects that feed on fresh foliage and stems during the growing season and serve as prey for birds, mammals, and reptiles.

Grassland areas provide habitat for granivorous birds such as western meadowlarks, California quail, sparrows, and finches, for mammals such as voles, mice, and pocket gophers and reptiles such as western fence lizards, gopher snakes and western rattlesnakes. The reptile species in particular can also be found using the open rock areas for thermoregulation or cover.

Fisheries

Forty-five fish species reside within the lower Yuba River. Federally listed species will be described in the following section. Twenty-three of the species are not native to California and include species such as inland silversides, various sunfish species, various bass species, minnows, shad, and catfish.

Native species include Sacramento sucker, sculpin, Sacramento splittail, and lampreys. Only 18 of the 45 species have been observed upstream of Daguerre Point Dam.

Endangered Species

A query of the Service's Information for Planning and Consultation resulted in the following nine Service federally listed species: the endangered conservancy fairy shrimp, vernal pool tadpole shrimp, Hartweg's golden sunburst; and the threatened valley elderberry longhorn beetle, vernal pool fairy shrimp, delta smelt, California red-legged frog, giant garter snake, and yellow-billed cuckoo.

A review of the California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNDDB) found the following state listed species have occurrences within a half mile of the lower Yuba River: Harwtig's golden sunburst, spring run chinook salmon, tricolored blackbird, yellow-billed cuckoo, and Swainson's hawk.

California's State Wildlife Action Plan (SWAP) is a plan developed to guide the state in its long-term goals of conserving the state's fish and wildlife and their natural habitats. It includes Species of Greatest Conservation Need (SGCN) which consists of species determined to be rare, imperiled, and/or in need of conservation. For purposes of this project, the Central Valley spring-run chinook salmon and Central Valley fall/late fall-run chinook salmon are SGCN species. Additionally, one of the six cores principles for anadromous fish in the SWAP is habitat restoration.

Federally listed species under the jurisdiction of the National Marine Fisheries Service (NMFS) that occur in the lower Yuba River include green sturgeon, Central Valley steelhead, and Central Valley spring-run chinook salmon. The Corps has been coordinating with NMFS on the restoration project.

FUTURE CONDITIONS WITHOUT THE PROJECT

Vegetation

Land use in the study area is expected to maintain the current mix. Habitat along the lower Yuba River is likely to continue to degrade in the project footprint. Other restoration projects are slated to be constructed outside of the project footprint and those would continue as planned, providing benefits to fish and wildlife and their habitat in those areas. Climate change and hydrologic models are estimating that with increasing temperatures the northern and central Sierra mountain range will have increasing snow level elevations resulting in more rain falling and flowing into the east side tributaries such as the Yuba River (DWR 2017). When looking at flood magnitudes for various flood flows, all flows increased with climate change factored in versus existing climate conditions. Projections for the Yuba River estimate the largest increase in flows in the 10-year flood magnitude. Climate change would likely cause an increase in the flows coming down the Yuba River during the winter months and a lessening of flows in the spring as a result of less water being stored in snow pack. However, warmer temperatures would also affect how frequently the Yuba River would have wet years. Climate change modeling of effects on vegetation indicate a loss of riparian habitat along the Yuba River under all potential climate scenarios (Thorne *et al.* 2016). Therefore, climate change is likely to result in a decrease the amount of riparian vegetation along the lower Yuba River in the future.

Wildlife

Since little is expected to change in the project footprint to the various habitats, little change is expected to occur for wildlife species. Restoration outside of the project footprint is expected to focus on fish, but could still benefit wildlife species if native riparian vegetation is planted. This may cause expansion of wildlife species into the project area though given the lack of habitat, it is unlikely to support a robust population of wildlife. Long-term, climate change would likely to shift habitat types from riparian to more general grassland/upland species and therefore shift the species from riparian wildlife to more general grassland or upland wildlife species.

Fisheries

Aquatic resources would not benefit within the project footprint without the project. Aquatic restoration done adjacent to the project would benefit and fishes, but existing habitat conditions would not be improved.

FUTURE CONDITIONS WITH THE PROJECT

Alternative 5

Vegetation

Lowering of floodplain and creating side channels and backwater would remove vegetation from the project footprint. For this alternative an estimated 13.4 acres of riparian vegetation would be removed and 136 acres would be planted. There would be a temporal loss between removal of existing vegetation and the time it will take for the newly planted woody vegetation to grow. The Corps would attempt to minimize vegetation lost when the project moves into the preconstruction engineering and design (PED) making the loss of 13.4 acres a worst case scenario.

As with most regulated rivers in the Sacramento Valley, there are fewer riparian pioneer communities due to lower rates of seedling establishment. Lowering floodplains and planting woody vegetation will begin to establish early successional riparian habitat along the lower Yuba River, a habitat stage that is not abundant in the Sacramento Valley.

Wildlife

Wildlife species in the lower Yuba River would be disturbed from construction activities and killed or displaced due to the loss of habitat. If woody vegetation is removed during the winter months, then effects to bird species would be lessened as birds would find other habitat for nesting and foraging during construction. Given that the 13.4 acres are spread out over 4 reaches, the individual habitat patches lost would be small which lessens effects to wildlife species.

In the long-term there will be benefits to wildlife species that use the lower Yuba River. About 10 times the amount of habitat that is lost will be created through the project. This will allow various wildlife species to expand into the new riparian habitat. As the vegetation matures bird, mammal, and reptile species would be able to use the riparian for breeding, feeding, and sheltering.

Fisheries

Construction activities would have small temporary affects to fisheries. The Corps and their contractors would work in the dry as much as possible. Invariably there would be some work which would affect fish species through increasing turbidity, temporary loss of benthic macroinvertebrates, disturbance from construction equipment including noise and potential spills of toxic substances, and changes to dissolved oxygen. However, these effects are expected to be short-term, minimal, and in the long-term would result in improved habitat for fish.

Over the long-term, there will be many beneficial effects to fisheries and riverine habitat. The project would create 38.8 acres of side channels and backwater and 47.6 acres of lowered floodplain for a total of 86.4 acres of enhanced aquatic habitat. Large woody material and EJBs creates hydraulic diversity as well as providing structural cover for fish species. All of the aquatic features would provide additional diverse rearing habitat for many fish species, particularly salmonids, and will be available at varying river stages.

Alternative 6

Vegetation

Alternative 6 is the same as Alternative 5 but with an additional reach of restoration. Lowering of floodplain and creating side channels and backwater would remove vegetation from the project footprint. For this alternative an estimated 14.8 acres of riparian vegetation would be removed and 143 acres would be planted. There would be a temporal loss between removal of existing vegetation and the time it takes for the newly planted woody vegetation to grow. The Corps would attempt to minimize vegetation lost when the project moves into PED making the loss of 14.8 acres a worst case scenario.

Again most regulated rivers in the Sacramento Valley have fewer riparian pioneer communities due to lower rates of seedling establishment. Lowering floodplain habitat and planting woody vegetation will begin to establish early successional riparian habitat along the lower Yuba River, a habitat stage that is not abundant in the Sacramento Valley.

Wildlife

Wildlife species in the lower Yuba River would be disturbed from construction activities and killed or displaced due to the loss of habitat. If woody vegetation is removed during the winter months, then effects to bird species would be lessened as birds would find other habitat for nesting and foraging during construction. Given that the 14.8 acres are spread out over 5 reaches, the individual habitat patches lost would be small which lessens effects to wildlife species.

In the long-term there would be benefits to wildlife species that use the lower Yuba River. About 10 times the amount of habitat that is lost will be created through the project. This would allow various wildlife species to expand into the new riparian habitat. As the vegetation matures bird, mammal, and reptile species will be able to use the riparian for breeding, feeding, and sheltering.

Fisheries

Construction activities would have small temporary affects to fisheries. The Corps and their contractors would work in the dry as much as possible. Invariably there would be some work which would affect fish species through increasing turbidity, temporary loss of benthic macroinvertebrates, disturbance from construction equipment including noise and potential spills of toxic substances, and changes to dissolved oxygen. However, these effects should be short-term, minimal, and are expected to return back to baseline and even better.

Over the long-term, there would be many beneficial effects to fisheries and riverine habitat. The project would create 50.6 acres of side channels and backwater and 47.6 acres of lowered floodplain for a total of 98.2 acres of enhanced aquatic habitat. Large woody material and EJBs would create hydraulic diversity as well as providing structural cover for fish species. All of the aquatic features would provide additional diverse rearing habitat for many fish species, particularly salmonids, and would be available at varying river stages.

DISCUSSION

The Service recommends the Corps move forward with the proposed Yuba River Ecosystem Restoration Project. Either alternative would create much needed fish habitat along the Lower Yuba River, with Alternative 6 creating more habitat due to the inclusion of an additional reach for restoration. Planting of riparian vegetation will increase habitat for riparian wildlife species.

The Corps uses ecological benefits and the Cost Effectiveness and Incremental Cost Analysis to inform environmental investment decision making in the Corps planning process. Any model that is certified by the Corps and ideally measures quality and quantity of ecosystem benefits (such as the Habitat Evaluation Procedures (HEP)) is used to evaluate alternatives. HEP was used for this project. Typically, the Service has been responsible for leading a multi-agency team through the selection of HEP models, coordinating the data collection, and running the HEP model to create outputs in coordination with the HEP team. The Sacramento District chose for this project to run the HEP with very little opportunity for the Service to participate in the process. The Corps has transmitted the HEP report to the Service and provided a briefing on their data collection and running of the selected HEP models. However, because of our lack of opportunity to participate in the HEP process we are not including the Corps' HEP data in our FWCA report. The Service should be integrally involved in the HEP process even in ecosystem restoration projects.

RECOMMENDATIONS

When the planning process moves into PED, the Service should be involved in the process and an updated FWCA report should be prepared to provide project level recommendations for the benefit of fish, wildlife, and their habitat. The Service recommends the following for based on the current broad alternative descriptions:

1. Avoid impacts to woody vegetation to the maximum extent possible by removing the least amount of vegetation and choosing to trim trees and shrubs to allow access for equipment and construction in the footprint.

2. Incorporate climate-smart principles into the planning process of this project. Point Blue has developed a set of five guiding principles which can be found at http://www.pointblue.org/our-science-and-services/conservation-science/habitat-restoration/climate-smart-restoration-principles. Currently the Corps has a rather small planting palette for the proposed project. We recommend that you expand the number of species to maximize the number of months that food resources are available to wildlife species. We also recommend planting a wide range of plant species to that could be successful in a range of future climate scenarios.
3. When scheduling construction, ensure that the Migratory Bird Treaty Act is complied with. In particular, any vegetation removal should be done during the non-nesting season. Work occurring during the nesting season that could adversely affect avoided vegetation should have a pre-construction nesting bird survey to identify any nesting migratory birds. Appropriate buffers should be designed and maintained in the event nesting migratory birds are found.
4. Given the planned refinement of the project in PED the Corps should continue to coordinate with the Service under the FWCA as the project description is refined. The Service will work with the NMFS and CDFW in developing recommendations to any proposed changes beyond those included in this report. The Service, NMFS, and CDFW should be included in the development of planting and long term monitoring plans.
5. Include within the planting contract a provision for the contractor to plant understory species after some of the woody canopy has established. Studies have shown that planting late successional understory species after woody canopy has become established increases success of understory plants. This will provide a more diverse and climate resilient habitat for wildlife species over the project life (Johnston 2009).
6. Incorporate native pollinator habitat within the planting plan. Pollinator habitat has decreased resulting in a loss of pollinators. In addition to benefiting the habitat complexity there are benefits to creating pollinator habitat near agricultural areas.
7. The Service should be included in the development of a long-term operation and maintenance plan for the created habitat.

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Environmental Appendix D
Attachment 5

Letter of Support from the Central Valley Regional Water Quality Control Board

Yuba River Ecosystem Restoration Feasibility Study

Prepared By:

Central Valley Regional Water Quality Control Board

October 2018

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2 October 2018

Mark T. Ziminske
United States Army Corps of Engineers
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CERTIFIED MAIL
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LETTER OF SUPPORT: YUBA RIVER ECOSYSTEM RESTORATION FEASIBILITY STUDY PROJECT

This letter is in response to your request for a letter supporting the Yuba River Ecosystem Restoration (YRER) Feasibility Study (Project), which proposes to improve approximately 180 acres of riverine and riparian form, function, and dynamic processes along the lower Yuba River. The Project proposes enhancement to riverine and riparian habitat through contouring of the river bank and creation of secondary channels and backwater features. These contouring actions will be further enhanced by improvements to riparian structure including planting of riparian vegetation and installation of complex structural elements including woody material and boulders. Overall, I am supportive of the Project as it will work to improve ecological health of the Yuba River and look forward to working with you on addressing potential water quality concerns during the process of issuing a Water Quality Certification.

Water Quality Certification pursuant to Section 401 of the federal Clean Water Act will be required to authorize construction of the Project. The Central Valley Regional Water Quality Control Board (Central Valley Water Board) usually reviews applications for Certification during the detailed, final design process that occurs near the completion of a final environmental document. We plan to consider issuing Certification for the Project following completion of Project review in compliance with the requirements of the California Environmental Quality Act (CEQA) and after review of near-final Project designs. Water quality concerns for this project include the potential for temporary construction related impacts associated with river bank contouring and creation of additional channels and the potential for significant short-term impacts on water quality conditions during mobilization of streambed sediments.

The Yuba River is listed under the Clean Water Act Section 303(d) as impaired by mercury due to excessive levels of mercury in fish that are eaten by humans and wildlife species. The primary sources of mercury in the region's waterways are erosion of mercury-contaminated sediments from legacy gold mines and native soils with naturally-elevated concentrations of mercury. When environmental conditions are suitable for mercury to form methylmercury, aquatic organisms build up, or bioaccumulate, methylmercury. The bioaccumulation process can result in high concentrations of methylmercury in fish tissue that can, in turn, threaten the health of humans and wildlife that consume these fish. The State Water Resources Control Board's Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California includes water quality objectives to control the amounts of mercury throughout the Yuba River.

Project measures identified in the final environmental document will need to include monitoring and practices that ensure the Project does not cause or contribute to an exceedance of water quality objectives. My staff will work with you in addressing these concerns during the process of issuing a Water Quality Certification.

In summary, I am supportive of the Yuba River Ecosystem Restoration Feasibility Study that will restore ecological health to the Yuba River. I look forward to continuing to work with you to complete the Water Quality Certification process as further design details are provided. If you have questions regarding the Water Quality Certification process, please contact Stephanie Tadlock at (916) 464-4644 or at Stephanie.Tadlock@waterboards.ca.gov.

for Adam Laputz
Assistant Executive Officer

CC: Michael Fong
Environmental Manager Environmental Planning Section
U.S. Army Corps of Engineers
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Environmental Appendix D
Attachment 6

Feasibility-Level Monitoring and
Adaptive Management Plan
Yuba River Ecosystem Restoration Feasibility Study

Prepared By:

U.S. Army Corps of Engineers

Sacramento District

October 2018

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Table of Contents

1.0 Introduction ... D6-5

1.1 Authorization for Adaptive Management in the YRERFS ... D6-5

1.2 Procedure for Drafting a Monitoring and Adaptive Management Plan for the YRERFS ... D6-5

1.3 Adaptive Management Team Structure ... D6-5

2.0 Basis for Monitoring and Adaptive Management ... D6-7

2.1 Project Goals and Objectives ... D6-7

2.2 Management and Restoration Actions ... D6-8

2.3 Conceptual Ecological Model (CEM) for Monitoring and Adaptive Management ... D6-8

2.4 Sources of Uncertainty ... D6-10

3.0 Monitoring and Adaptive Management Plan ... D6-10

3.1 Aquatic Habitat ... D6-12

3.1.1 Objectives and Implementation Strategy ... D6-12

3.1.2 Success Criteria ... D6-12

3.1.3 Monitoring Strategy ... D6-14

3.1.4 Adaptive Management Strategy ... D6-15

3.2 Riparian Habitat ... D6-16

3.2.1 Objectives and Implementation Strategy ... D6-16

3.2.2 Success Criteria ... D6-17

3.2.3 Monitoring Strategy ... D6-19

3.2.4 Adaptive Management Strategy ... D6-20

4.0 Costs for Implementation of Monitoring and Adaptive Management ... D6-20

4.1 Costs for Implementation of Monitoring Program ... D6-21

4.2 Costs for Implementation of Adaptive Management Program ... D6-22

5.0 References ... D6-26

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1.0 Introduction

This document outlines the feasibility level monitoring and adaptive management (M&AM) Plan for the Yuba River Ecosystem Restoration Feasibility Study (YRERFS) in Yuba County, California. The Project Delivery Team (PDT) of Sacramento District (SPK), in ongoing cooperation with the non-Federal study sponsor, the Yuba County Water Agency (YCWA), have developed this plan to describe monitoring and adaptive management activities proposed for the YRERFS, assign costs, and estimate duration. This plan will be further developed with the project sponsor and any partners and in the preconstruction engineering and design (PED) phase of the project.

1.1 Authorization for Adaptive Management in the YRERFS

Section 1161 of WRDA 2016 amends Section 2039 of WRDA 2007 to specify information required to be included in monitoring plans for ecosystem restoration projects, and to direct when non-federal operation and maintenance responsibilities of these projects may cease.

The implementation guidance for Section 1161, in the form of a CECW-P Memo dated October 19, 2017, also requires that an adaptive management plan be developed for all ecosystem restoration projects.

Monitoring and adaptive management addresses sources of uncertainty, steers project implementation and maintenance to maximize results, and documents project effects for communication to participants, stakeholders, HQ, and Congress.

1.2 Procedure for Drafting a Monitoring and Adaptive Management Plan for the YRERFS

The U.S. Army Corps of Engineers, Sacramento District, is collaborating with YCWA to establish a framework for M&AM. The YRERFS adaptive management framework includes both a set-up phase (Figure 1) and an implementation phase (Figure 2).

1.3 Adaptive Management Team Structure

As part of the communication structure for implementation of adaptive management, an Adaptive Management Planning Team will be established. This team will be led by senior staff from the USACE and a counterpart from the project sponsor's office or its appointment. Other resources and expertise will be brought in as needed, and may include representatives from USACE, CDFW, USFWS, or NMFS. This team is responsible for ensuring that monitoring data and assessments are properly used in the adaptive management decision-making process. If this team determines that adaptive management actions are needed, the team will coordinate a path forward with the project delivery. The Adaptive Management Planning Team is also responsible for project documentation, reporting, and external communication.

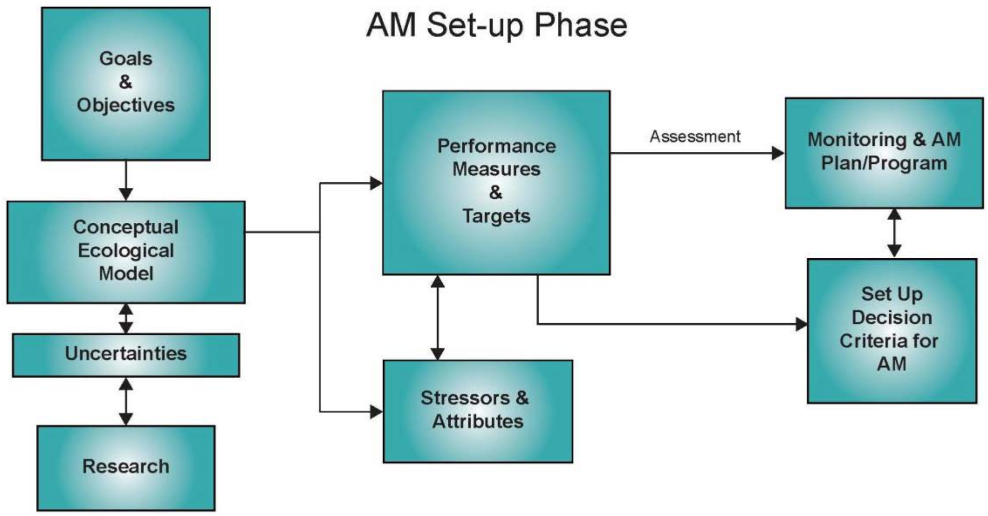

Figure 1. Set-up phase of the adaptive management framework.

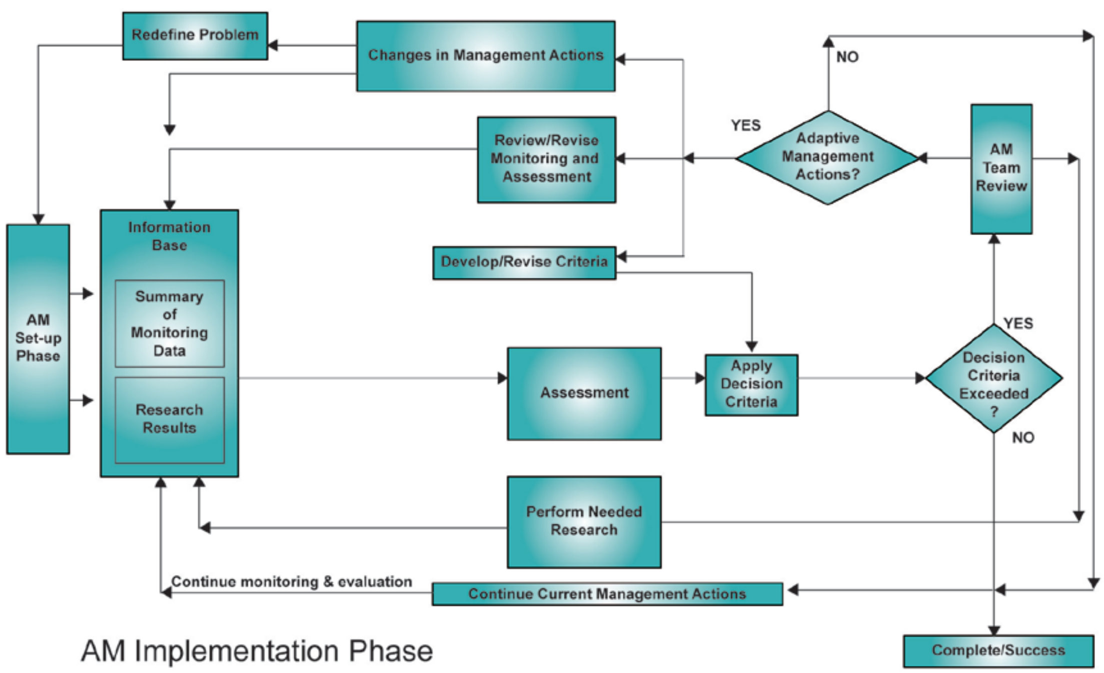

Figure 2. Implementation phase of the adaptive management framework.

2.0 Basis for Monitoring and Adaptive Management

The primary incentive for implementing an adaptive management program is to increase the likelihood of achieving desired project outcomes given the identified uncertainties. All projects face uncertainties with the principal sources of uncertainty including (1) incomplete description and understanding of relevant ecosystem structure and function, (2) imprecise relationships between project management actions and corresponding outcomes, (3) engineering challenges in implementing project alternatives, (4) ambiguous management and decision-making processes, and (5) unpredictable independent variables, such as discharge and climate extremes.

Given these uncertainties, adaptive management provides an organized, coherent, and documented process that suggests and triggers management actions in relation to measured project performance compared to desired project outcomes. The Adaptive Management Plan for this project reflects a level of detail consistent with the project Feasibility Study. The primary intent is to develop monitoring and adaptive management actions appropriate for and specific to the project's restoration goals and objectives. The specified management actions allow estimation of the M&AM costs and duration for the project.

The following section (1) identifies the restoration goals and objectives identified for the YRERFS, (2) outlines management actions that can be undertaken to achieve the project goals and objectives, (3) presents a conceptual ecological model that relates management actions to desired project outcomes, and (4) lists sources of uncertainty that would recommend the use of adaptive management for this project. Subsequent sections describe monitoring, assessment, decision-making, and data management in support of adaptive management.

The level of detail in this plan is based on currently available data and information developed during plan formulation as part of the feasibility study. Uncertainties remain concerning the exact project features, monitoring elements, and adaptive management opportunities. Components of the monitoring and adaptive management plan, including costs, were also estimated using currently available information. Uncertainties will be addressed in the preconstruction, engineering, and design phase, and a detailed monitoring and adaptive management plan, including a detailed cost breakdown, will be drafted as a component of the design document.

2.1 Project Goals and Objectives

The overall goal of the study is to restore degraded ecosystem structure, function, and dynamic processes of the Yuba River watershed to a less degraded, more natural condition. The objectives are statements of the intended steps toward achieving the goals. An objective is developed to address each of the identified problems and opportunities. Objectives represent desired positive changes in the future without-project conditions. Each objective is applicable to the entire Yuba River watershed study area over a 50-year period of analysis. Based upon the problems and opportunity identified in the study area, objectives include the following:

- **Improve the quantity, quality, and complexity of aquatic habitats.** This objective addresses the improvement of aquatic habitats and the functions those habitats provide for all life stages of anadromous fish, water birds, amphibians, and other wildlife within the watershed.

- **Improve the quantity, quality, complexity, and connectivity of riparian habitats.** This objective addresses the improvement of riparian habitats and migratory corridors and the functions those habitats provide for waterfowl, water birds, riparian songbirds, amphibians, and other wildlife within the watershed.
- **Improve longitudinal river connectivity.** This objective addresses the improvement of hydrologic and aquatic habitat connectivity. Critical components of longitudinal connectivity include the downstream movement of anadromous fish, water and sediment, and the upstream movement of anadromous fish and the oceanic nutrients they provide. Connectivity is improved when areas of suitable habitat are joined or gaps between areas of suitable habitat are reduced.
- **Improve lateral connectivity of the river to its floodplain.** This objective addresses the improvement of hydrologic connectivity within and between aquatic and floodplain habitats. Critical components of connectivity include the lateral, or horizontal movement of water within the channel and onto the floodplain, and the vertical, or downward movement of water into the ground.

2.2 Management and Restoration Actions

The PDT performed a plan formulation process to identify potential management measures and restoration actions that address the project objectives. Many alternatives were considered, evaluated, and screened in producing a final array of alternatives. The PDT subsequently identified a tentatively selected plan (TSP). The intent of the TSP is to optimize to maximize restoration outputs while acknowledging sources of risk and uncertainty.

2.3 Conceptual Ecological Model (CEM) for Monitoring and Adaptive Management

As part of the planning process the PDT developed a conceptual ecological model to represent current understanding of ecosystem structure and function in the project area. The CEM was used in this M&AM to support the identification of performance measures and help select parameters for monitoring (Figure 3). The model illustrates the effects of important natural and anthropogenic activities that result in different ecological stressors on the system. The model has helped to identify hypothesized effects of restoration actions on selected performance measures defined for broader physical, chemical, and biological attributes of the system.

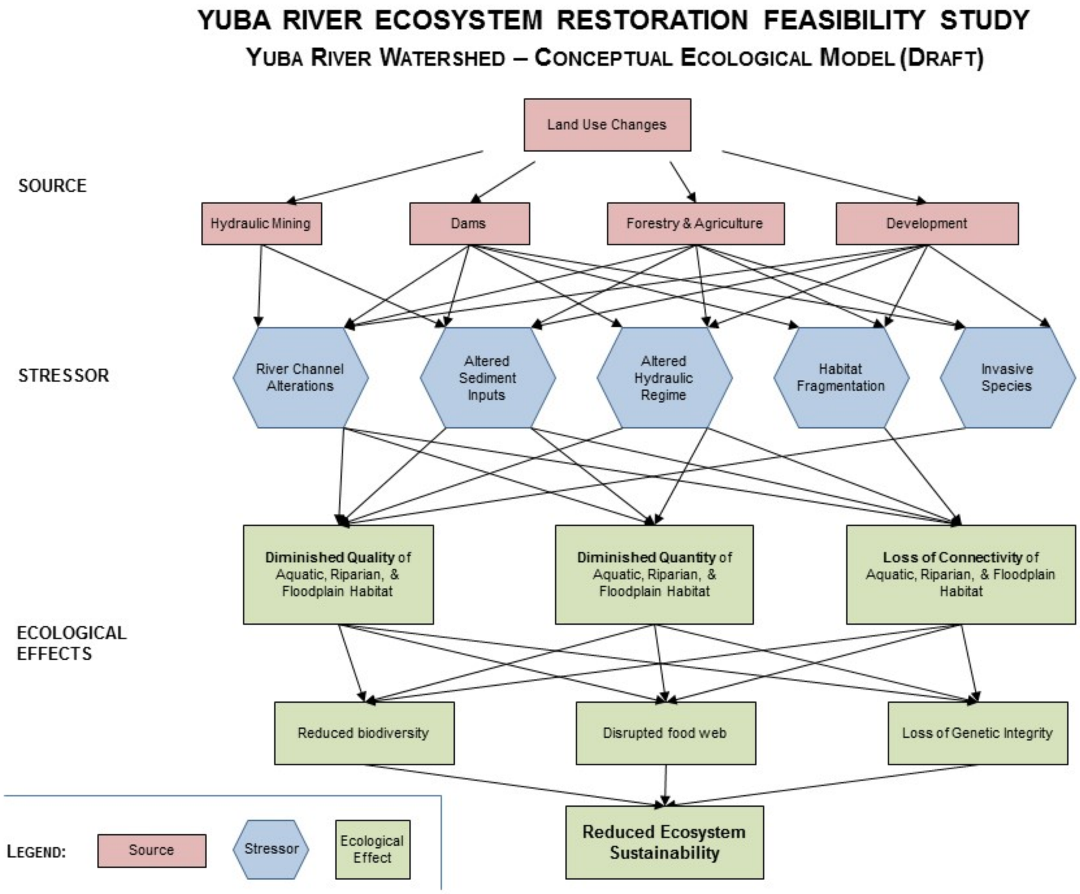

Figure 3. YRERFS Conceptual Ecological Model

2.4 Sources of Uncertainty

Adaptive management provides a coherent process for making decisions in the face of uncertainty. Scientific uncertainties and technological challenges are inherent with any large-scale ecosystem restoration project. Below is a list of uncertainties associated with restoration of the YRERFS.

- Unpredictable climatic conditions and flow extremes
- Ability of ecological and hydrologic models to predict project impacts/benefits
- High level of habitat degradation may render traditional restoration methods ineffective
- Limited ability to predict invasive species impacts
- Reliance on existing information to establish baseline environmental conditions, dynamic river conditions may result in significant differences in existing conditions (on a site specific level) during later phases of project implementation
- Limited ability to predict changes to critical physical habitat variables (i.e., flow and temperature)

3.0 Monitoring and Adaptive Management Plan

This section will described the monitoring, assessment, and decision making processes that form the basis of adaptive management. This section will establish habitat restoration proposals, performance standards, and outline adaptive management measures and costs. Habitat restoration proposals are based on the project goals and objectives described above. Performance criteria includes specific feature(s) to be monitored to determine project performance. Performance standards are established below for each habitat type, and monitoring would be conducted with the intent of meeting those standards. Adaptive management measures are actions identified to address potential mechanisms for failure of project features meeting performance criteria. Triggers for implementation adaptive management and specific adaptive management measures and are established below for each habitat type.

Monitoring must be closely integrated with all other adaptive management components because it is the key to the evaluation, validation, and learning components of adaptive management. Over the 3 to 5 year site establishment period, improvements in field and analytic techniques may lead to changes in the monitoring methodology. Furthermore, unrealistic expectations or inaccurate assumptions can lead to the establishment of inappropriate monitoring objectives. It is possible that a decision to modify success criteria might be reached based on results after several years of monitoring. While the aquatic habitat and riparian habitat monitoring strategies described below build on past experiences, it is likely that other opportunities for improvement will be identified in the future that should be incorporated into the M&AM Plan. In the future, there may be a determination that specific performance standards have been met and that associated monitoring tasks could cease. Similarly, it could be determined that a monitoring task was not returning useful information, and therefore not worth the expense of continuation.

When possible, specific monitoring and large scale information needs should be integrated with existing monitoring efforts that are underway in the Yuba River watershed. During the PED phase the PDT will explore opportunities to collaborate with existing monitoring networks to achieve the monitoring objectives associated with this project. Any changes to an adaptive management plan would be coordinated with HQUSACE Chief of Planning and Policy.

Monitoring for ecological success and adaptive management for the project will be initiated upon completion of individual elements or as baseline data are needed and continue until ecological success is achieved, as defined by the project-specific objectives. This monitoring plan includes the minimum monitoring actions to evaluate success and to determine adaptive management needs. Although the law allows for up to ten years of cost-shared implementation of the monitoring plan, ten years of monitoring may not be required. Once ecological success has been achieved, which may occur in less than ten years post-construction, no further monitoring will be performed. If success cannot be determined within that ten-year period of monitoring, any additional monitoring will be a non-Federal responsibility. This plan estimated monitoring and adaptive management costs for a period of ten years because that is the maximum allowed federal contribution to monitoring. Following successful establishment of project features, the project would be managed following guidelines outlined in the Operations Maintenance, repair, replacement, and rehabilitation (OMRR&R) plan.

The goal of the Corps' Civil Works ecosystem restoration activities is to “restore significant ecosystem function, structure, and dynamic processes that have been lost or degraded” with the intent of partially or fully reestablishing the attributes of a naturalistic, functioning, and self-sustaining system (USACE 1999). Although the goals of the project go beyond the restoration of ecosystem structures, the metrics identified in this M&AM Plan were focused on physical habitat, which facilitates an easily implemented framework for the evaluation and adaptive management of the proposed measures. Reliance on simple habitat metrics provides for a clear path for adaptive management. For example, if the evaluation of the project is based on the establishment of physical features, such as establishing a desired grade along a shoreline, the monitoring of that feature is simple, and in the case that the desired grade is not met, there are clear actions (i.e., regarding) for meeting the objective. In contrast, if the evaluation of the project is based on complex processes, such as improved rearing habitat for juvenile fish, the potential direct adaptive management measures are limited.

This evaluation approach is based on the interactions between ecological form, function, and processes. Ecosystem form, or structure, refers to both the composition of the ecosystem and to its physical and biological organization (NRC 2005). Ecosystem functions are the physical, chemical, and biological processes that create and sustain an ecosystem (Fischenich 2006). Aquatic ecosystem restoration has historically focused on biotic habitat and water quality, but an emergent trend has emphasized the geomorphic structure, function, and evolutionary trajectory of systems (Bennett et al. 2009), coupled with an understanding of the landscape context within which ecohydrologic processes interact. Hydrologic and geomorphic manipulations are the primary management measures employed by USACE for aquatic restoration, and USACE has a long history of dealing with these parameters. Discussion of the link between project features and ecosystem benefits is discussed by habitat type and metric in the “physical indicators of success” sections. Although, this M&AM Plan focuses on simple physical indicators of success, the M&AM Plan is subject to change should additional metrics or adaptive management measures be determined critical to the success of the project.

The following discussion outlines key components of a monitoring plan that will support the YRERFS Adaptive Management Program. The plan identifies performance measures along with desired outcomes and monitoring designs in relation to specific project goals and objectives. Although the study initially included major longitudinal connectivity objectives (i.e. fish passage), proposed measures relating to fish passage were screened from inclusion in the final array of alternatives and therefore no monitoring objectives were developed for those type of connectivity actions. Additional monitoring would be identified as supporting information needs that will help further document project effects. It is important to note that there is a high degree in overlap between anticipated benefits of proposed actions; for the purpose of this M&AM Plan, project success will be evaluated based on two habitat types, aquatic habitat and riparian habitat.

3.1 Aquatic Habitat

3.1.1 Objectives and Implementation Strategy

The primary objectives for restoration of aquatic habitat are to restore the quantity, quality, complexity, and connectivity of these habitats. Although aquatic habitats support a wide range of terrestrial and aquatic wildlife and vegetation, the proposed restoration measures are generally modeled to benefit rearing (fry and juvenile) salmonids. Proposed measures focus on rearing salmonids because they are a keystone species and improvement to these species' habitat are expected to benefit the ecosystem as a whole. Rearing habitat, in general, encompasses a wide variety of microhabitats and physical disturbance (see Section 1.1 of the FR/EA) of the river has reduced the quantity and diversity of those habitats. The proposed actions for the improvement to aquatic habitat include the creation of additional diverse aquatic habitat types such as secondary channels, backwaters, floodplain lowering, and shoreline sculpting as well as installation of complex riparian features. These habitat improvements would be accomplished through excavation of sediment and addition of riparian features (vegetation and structural complexity). Creation of these features is expected to benefit the ecosystem through the creation of additional microhabitat types that support a more diverse range of species and life histories.

3.1.2 Success Criteria

Successful establishment of aquatic habitat would be evaluated through restoration of physical habitat, including depth, velocity, and area. The performance standards used to determine success of habitat restoration are described in Table 1 below. Indicators of biological function will be incorporated into monitoring, however, specific quantitative criteria for biological success would not be considered.

3.1.2.1 Physical indicators of success

Depth and velocity are critical components of aquatic habitat and support a variety of biological and abiotic functions. Depth and velocity serve as important indicators of shallow water refuge for juveniles as well as food and resting areas. By using rearing salmonid habitat requirements as a basis for restoring aquatic habitat, this study is assumes that conditions suitable for juvenile salmonids would provide a benefits to the broader ecosystem. It is also important to acknowledge that a broader range of depths and velocities, considered unsuitable for juvenile salmonids would likely provide value to the ecosystem (other life stages and species); however, the proposed measures are intended to create aquatic habitat with depths and velocities suitable for rearing salmonids and therefore, the success criteria will be based on meeting those design criteria (Engineering Appendix B to the Integrated Feasibility Report/ Environmental Assessment - Design Criteria Attachment). In establishing indicators of success, a distinction was made between project features that were permanently inundated and features that were temporarily inundated.

For permanently inundated features (i.e., secondary channels, backwaters, and shoreline sculpting) the design goal was to create additional perennial aquatic habitat. The suitable range of depths and velocities are based on providing aquatic habitat during the critical summer rearing period (June – September) for steelhead and spring-run chinook. The design goal for depth for these features is to establish 0.5 ft of inundation at base flow discharge (730 cfs above Daguerre Point Dam, 530 cfs below Daguerre Point Dam). A design depth 0.5 ft would provide about 0.5 suitability habitat value for juveniles and optimal suitability (1.0) for fry at base flow. Water depth and velocity suitability ranges were obtained from YRDP Relicensing Participants HSCs (YCWA 2013). To remain consistent with the design criteria the range of suitable depths will be based on a lower limit suitability threshold of 0.5. For the purpose of this M&AM Plan the minimum and maximum depths will be selected for steelhead and chinook rearing lifestages. Given these considerations, the aquatic habitat restoration would be considered successful if the average depth of the created aquatic feature is between 0.3 ft (lower limit based on steelhead fry) to 4.8 (upper limit based on steelhead juvenile).

The same assumptions for determining a range of suitable depths was applied to determining the range of suitable velocities. The upper and lower limits of velocity were based on the greatest range of tolerance for velocities that provide a minimum of 0.5 habitat suitability value. Given these considerations, the aquatic habitat restoration would be considered successful if the average velocity of the created aquatic feature is between 0 ft/sec (lower limit based on all rearing lifestages for steelhead and chinook) to 1.95 ft/sec (upper limit based on steelhead and chinook juvenile). Depths and velocities in restored aquatic features discharge. For the purpose of evaluation the above success criteria would be evaluated under base flow conditions, which is consistent with assumptions used during the development of design criteria.

Area is another important physical indicator of successful site establishment in that it provides a simple measure of quantitative performance. Area will be measured as the two-dimensional wetted area of a feature at base flow. No broadly applied minimum area would be established for determining successful establishment of habitat features because each habitat feature would be created on a site specific basis and would vary in the initial design and construction of wetted area. Successful establishment of area would be based on maintaining a percentage of initial design. For the purpose of this M&AM Plan, permanently inundated features would be considered successfully established if the features maintain a minimum of 80% of the wetted area under base flow conditions of the initial designed and constructed area. The success criteria for area is not directly linked to specific biological functions, rather it represents a target for design and construction. The evaluation of successful establishment of wetted area in conjunction with the evaluation of successful establishment of depth and velocity, would ensure that a feature was providing suitable quantity and quality of habitat.

For seasonally inundated features (i.e., lowered floodplains), the design goal was to create additional inundated salmonid rearing habitat during the spring rearing and growth period. Lowering the floodplain would increase inundation frequency and duration, and support establishment of vegetation, increased production of benthic macroinvertebrates, and increase access to off channel rearing habitat. An inundation duration of 21 days would support these functions. The suitable range of depths and velocities would be the same as those set for perennially inundated aquatic habitat features, however, due to the sloped nature of the floodplain, the target depths and velocities would only be expected to occur near the shoreline. The target depths and velocities would be evaluated between 2,000 cfs (design flow for at which lowered floodplains begin to be inundated) and 5,000 cfs (approximate bankfull flow).

As with permanently inundated features, establishment of temporarily inundated features would be considered successful if 80% of the initially designed and constructed wetted area is maintained. One key difference is that temporarily inundated features are designed to provide habitat between 2,000 and 5,000 cfs, rather than at base flow conditions. During final design and construction of temporarily inundated features, the anticipated inundation area under a range of flows should be established for use during monitoring and adaptive management.

An important component of demonstrating successful establishment of project features is durability. While the project aims to establish features in perpetuity, it is beyond the scope of this M&AM Plan to monitor project performance for an extended period of time. Long term durability is ensured through development and adherence to an OMRR&R Plan. For the purpose of this M&AM Plan, temporal success criteria were established to demonstrate a reasonable level of success. As with the other indicators of success, separate temporal success criteria were established for permanently and temporarily inundated features.

For permanently inundated features, establishment would be considered successful if physical indicators (depth, velocity, and area) meet the established success criteria during and at the end of the 5 year monitoring period. Monitoring would occur for a minimum of 5 years which would provide a reasonable opportunity to evaluate the response of constructed features under to the target range of flow conditions (baseflow to bankfull discharge). For the purpose of this analysis, baseflow conditions would be expected to occur each year and bankfull conditions were defined as a discharge of 5,000 cfs which has an 80% Annual Chance of Exceedance (Wyrick and Pasternack 2012). Given these flow frequencies, bankfull conditions has the potential to occur 4 times during a 5 year monitoring period.

For temporarily inundated features, establishment would be considered successful if physical indicators (depth, velocity, and area) meet the established success criteria during and at the end of the 5 year monitoring period. Monitoring would occur for a minimum of 5 years.

3.1.3 Monitoring Strategy

As described above, the monitoring strategy is focused on successful establishment of critical physical habitat attributes. Monitoring for physical habitat structure would include one survey prior to construction to establish existing conditions. Following construction of each habitat enhancement measure, monitoring would be conducted annually for a minimum of 5 years. If success criteria are not met within 5 years after construction of a specific habitat enhancement measure, monitoring would continue every 2 years thereafter, beginning in the year 6 (i.e, year 6, 8, 10), or until success criteria are met. Monitoring for physical habitat attributes in permanently inundated features would be conducted between June and September each year and in temporarily inundated features February and June each year.

Physical habitat attributes including depth, velocity, and wetted area would be evaluated over the length of the restored areas at transects spaced every 10m. Depth would be sampled with a stadia rod along each transect measured at intervals of 3 ft from the perimeter to the midpoint of the wetted area of the feature. This method would support development of an average depth. Velocity would be sampled with a flow meter at half the depth of the water column at the same sample locations as depth measurements. Area would be recorded by walking the perimeter of the wetted area of the feature using a handheld GPS unit with sub-meter accuracy. Upstream and downstream gage data would be recorded for the dates of the surveys.

Table 1. Performance standards for physical indicators for aquatic habitat restoration: depth and velocity

Feature	Suitable Depth (ft)	Suitable Velocity (ft/sec)	Wetted Area	Inundation Duration	Evaluation Discharge
Secondary Channel, Backwater, and bank sculpting	0.3 – 4.8	0 – 1.95	80% of total area as designed and constructed	June - September	Baseflow (730 cfs upstream of DPD/ 530 cfs downstream of DPD
Lowered floodplain	0.3 – 4.8	0 – 1.95	80% of total area as designed and constructed	21 days minimum (February – June)	2000 cfs – 5000 cfs

Note: DPD = Daguerre Point Dam

In addition to monitoring physical parameters, additional data would be collected to provide a better context for implementing adaptive management including: substrate classification, habitat type classification, gradient, photos, in water structural elements, wildlife use, and site disturbance. Incidental observations of wildlife use would provide a qualitative evaluation of fish use of created and restored aquatic habitat.

Monitoring reports documenting the restoration effort would be prepared following the first monitoring period and would continue annually until the site has met the success criteria. The report would summarize and analyze all monitoring activities with overall evaluation of the performance of the success criteria. Additional results, analysis, proposed adaptive management measures, and associated costs would be incorporated into the monitoring report. Monitoring reports would be provided to resource agencies and project partners.

3.1.4 Adaptive Management Strategy

If the habitat is not meeting the success criteria established above, then adaptive management would be implemented in order to ensure that the habitat establishment is successful. The following subsections identify triggers that would indicate the need to implement adaptive management measures and the measures that would be implemented accordingly.

3.1.4.1 Adaptive Management Triggers

Desired Outcome: Maintain average depth and velocity within suitable ranges at base flow conditions (June – September) in restored secondary channels, backwaters, and shoreline sculpted areas.

Triggers: adaptive management would be triggered if average depth and velocity in these features is not within the suitable range at base flows and the adaptive management team determines that corrective action is necessary.

Desired Outcome: Maintain average depth and velocity within suitable ranges between 2,000 cfs and 5,000 cfs (February – June) in restored floodplain areas.

Triggers: adaptive management would be triggered if average depth and velocity in these features is not within the suitable ranges between 2000 cfs and 5000 cfs (February – June) in restored floodplain areas and the adaptive management team determines that corrective action is necessary.

Desired Outcome: Maintain wetted area within 80% of designed and constructed features. For permanently inundated features, this area would be evaluated under baseflow conditions (June – September). For temporarily inundated features, this area would be evaluated between 2,000 cfs and 5,000 cfs (February – June).

Triggers: adaptive management would be triggered if wetted area is less than 80% of designed and constructed features at target flow conditions and the adaptive management team determines that corrective action is necessary.

3.1.4.2 Adaptive Management Measures

If the triggers established above occur, the following measures would be considered in order to adaptively manage the site for success.

- Regrading or reconfiguration of terrain.
- Addition or reconfiguration of hydraulic control elements (i.e., boulders, large woody material, engineered log jams, and bank armoring).

3.2 Riparian Habitat

3.2.1 Objectives and Implementation Strategy

The primary objectives for restoration of riparian habitat are to restore the quantity, quality, complexity, and connectivity of these habitats. Riparian vegetation is an important component of river ecosystems. Improvements to riparian habitat are expected to increase productivity across multiple trophic levels as well as provide physical structure and complexity that would support a variety of terrestrial and aquatic wildlife. The species composition and distribution of riparian vegetation has been altered through various human related impacts, especially legacy and ongoing mining activities. Natural recruitment and survival of riparian vegetation in the lower Yuba River is generally restricted to areas that provide adequate depth to ground water. Riparian vegetation along the lower Yuba River banks generally occur in narrow bands consistent with a narrow range of suitable hydrologic conditions.

The strategy for improving the quantity, quality, complexity, and connectivity of riparian habitat is to improve topographical conditions through floodplain lowering to support adequate survival of riparian vegetation and also to plant riparian vegetation in suitable areas. Floodplain lowering would occur in areas between 7 -10 ft above the water table. Riparian planting would occur on lowered floodplains and areas of existing suitable depth to water table and would include Fremont cottonwood (*Populus fremontii*), Gooddings black willow (*Salix gooddingii*), red willow (*S. laevigata*), and arroyo willow (*S. lasiolepis*). As native vegetation matures, it helps to stabilize stream banks and shorelines; provides food, shelter, shade, and access to adjacent habitats; creates pathways for movement by resident and nonresident aquatic, semi-aquatic, and terrestrial organisms; and improves and protects water quality by reducing the amount of sediment and other pollutants such as pesticides, organic materials, and nutrients in surface runoff.

3.2.2 Success Criteria

Successful establishment of riparian habitat would be evaluated through restoration of physical habitat, including: (1) the percent survival of planted vegetation; (2) the percent of canopy cover of native plant species; (3) the percent cover of native plant species; and (4) the percent cover of non-native invasive species that out-compete natives. The performance standards used to determine success of habitat restoration are described in Table 2 below. Indicators of biological function will also be incorporated into monitoring, however, specific quantitative criteria for biological success would not be considered.

Percent canopy cover and survival of planted vegetation are important critical components of riparian habitat restoration. The thresholds for successful establishment were based on achievable targets within the initial 5 years of establishment rather than optimal growth or final trajectories. It is anticipated that vegetation would be successfully established within 5 years and would be on a self-sustaining trajectory toward the development of a mature functional riparian habitat. The performance standards used to determine success of habitat restoration are described in Table 2 below.

Table 2. Riparian Habitat Performance Standards.

Performance Standard	**Quantitative Measure**				
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Survival	75%	50%	30%	30%	20%
Canopy Cover %	1.5%	3%	4.5%	6%	7.5%
Native Species Cover %	75%	75%	75%	75%	75%
Non-Native Species Cover %	< 15%	< 15%	< 15%	< 15%	< 15%

3.2.2.1 Survival

The existing and degraded conditions on the lower Yuba River, including coarse substrates and altered hydrologic regimes with high floodplains limit the successful recruitment of native riparian species. To address these challenges, riparian species will be planted via a stinger, which facilitates direct installation of dormant pole cuttings to suitable depths. This planting method has been demonstrated on the lower Yuba River at the Hammon Bar Restoration Site implemented by the South Yuba River Citizens League (SYRCL) and the US Fish and Wildlife Service (USFWS). The overall survival rates for vegetation planted by stinger method is fairly low due, likely driven by the coarse nature of substrate and fluctuations in water table. At the Hammon Bar Restoration Site, 2,000 of 6,300 plants survived from planting in 2011 – 2012 until 2017. The surviving trees withstood a range of environmental conditions, including a large storm event in 2017. After the initial 2-3 years of planting, the year to year survival rates at the Hammon Bar Restoration Site were approximately 80% suggesting successful establishment. The target survival for riparian plantings are based on the demonstrated overall survival rates of the Hammon Bar pilot project (Table 2).

An important component of demonstrating successful establishment of project features is durability. While the project aims to establish features in perpetuity, it is beyond the scope of this M&AM Plan to monitor project performance for an extended period of time. Long term durability is ensured through development and adherence to the OMRR&R Plan. For the purpose of this M&AM Plan, temporal success criteria were established to demonstrate a positive trend toward self-sustainability and long-term success. For the purpose of this M&AM Plan, vegetation indicators will be monitored for a minimum of 5 years. This time period would provide a reasonable period of time to evaluate the development of project features and observe the response of project features to a range of normally occurring and target flow conditions. For riparian habitat features, establishment would be considered successful if vegetative indicators meet the established success criteria for 2 consecutive seasons at the end of the 5 year monitoring period. It is important to note that the initial construction/ planting of riparian vegetation would include contractual based establishment requirements separate from those described in this M&AM Plan. For example, the construction contract could require that 80% of the initial plantings survive at the end of 3 years following initial planting. That requirement would be related to the successful execution of the contract rather than linked to any particular habitat goals. The contractor would be required to replant any plants necessary to meet the contractual goal. After the contractual planting targets have been met, the M&AM Plan success criteria will be applied. It is anticipated that demonstration of successful planting to contract standards would require 2-3 years and therefore the minimum monitoring time associated with establishment of riparian vegetation would likely represent an evaluation of 7-8 years of plant establishment.

3.2.2.1 Percent Canopy Cover

The long term target for canopy cover in the planting area is 50% of the total restored area. Revegetating with patchy stands ensures that existing monotypic vegetation will be replaced with a desirable species composition and structural diversity on some surfaces, while leaving other portions of the constructed surface exposed for natural plant recruitment (Hoopa Valley Tribe *et al.*, 2011). Given the relatively short term scope of monitoring and adaptive management, the overall target of 50% is not suitable to apply to initial years of establishment. The targets for canopy cover in initial years of establishment are intended to provide realistically achievable goals that reflect the challenging environmental conditions in which the proposed riparian plantings would occur. The target canopy cover values for initial years (Table 2) are representative of the percent cover required (as calculated through a linear interpolation) in early years to meet the overall goal of 50% canopy cover by year 50.

Percent cover of native and non-native species are critical components to riparian habitat restoration. Successful establishment of these attributes would ensure that the restored riparian habitat is appropriate for the ecosystem and supports native fauna. Non-native species, especially those species that are invasive have the potential to outcompete native planted vegetation and reduce the overall value of the riparian habitat. The target for native species cover was set at 75% for all years to ensure that although some non-native species may recruit into the restored area, the majority of the restored area would consist of native species. The target maximum for non-native, invasive species was set at 15% for all years to ensure that although some non-native species may recruit into the restored area, the majority of the restored area would consist of native species.

As with survival criteria, success criteria for percent canopy cover and percent native and non-native species cover will be monitored for a minimum of 5 years.

3.2.3 Monitoring Strategy

The following monitoring procedures will provide the information necessary to evaluate the success of riparian habitat restoration. Monitoring for riparian vegetation attributes would include one survey prior to construction to establish existing conditions. Follow construction of each habitat enhancement measure, monitoring would be conducted annually for a minimum of 5 years. If success criteria are not met within 5 years after construction of a specific habitat enhancement measure, monitoring would continue every 2 years thereafter, beginning in year 6 (i.e., year 6, 8, 10), or until success criteria are met. Sampling will occur during spring months, at the peak of growing season, and will consist of permanent field monitoring plots along one or more transects either perpendicular to the river or parallel to the floodplain slope. Plots will be located randomly within each site, and the distance between plots and along transects will be site specific. Woody species with overhead canopy cover that falls along the vegetation monitoring transect, including those that were planted, have recruited naturally to the site, or were existing at the site prior to planting efforts would be recorded. Monitoring will measure the overall cover of riparian vegetation, survival of planted vegetation, and percent cover of native and non-native plant species. Photograph stations are also important for documenting vegetation conditions. All plots and photograph stations will be documented via Global Positioning System (GPS) coordinates to maintain consistency throughout the monitoring period.

In addition to the data collected to determine success, general observations, such as fitness and health of plantings, native plant species recruitment, and signs of drought stress would be noted during the surveys. Additionally, flood damage, vandalism and intrusion, trampling, and pest problems would be qualitatively identified. A general inventory of all wildlife species observed and detected using the mitigation site would be documented. Nesting sites and other signs of wildlife use of the newly created habitat would be recorded and used to qualitatively evaluate biological success.

Monitoring reports documenting the restoration effort would be prepared following the first monitoring period and would continue annually until the site has met the success criteria. Monitoring reports would include photos, the timing of the completion of the restoration, what materials were used in the restoration, and plantings (if specified). Monitoring reports would also include recommendations for additional adaptive management measures, if necessary.

3.2.4 Adaptive Management Strategy

If the habitat is not meeting the success criteria established above, then adaptive management would be implemented in order to ensure that the habitat establishment is successful. The following subsections identify triggers that would indicate the need to implement adaptive management measures and the measures that would be implemented accordingly.

3.2.4.1 Adaptive Management Triggers

Desired Outcome: increase percent cover of riparian vegetation.

Triggers: If the target canopy cover of riparian habitat (Table 2) or target survival of planted vegetation for a target year is not achieved.

Desired Outcome: maintain majority of native species contribution to canopy cover.

Triggers: if percent of native species canopy cover falls below 75% native species or if percent of non-native species cover exceeds 15% within the monitoring period.

3.2.4.2 Adaptive Management Measures

If the triggers established above occur, the following measures would be considered in order to adaptively manage the site for success.

- Replanting may be needed if triggers for vegetative cover, survival, and native species composition are met. Monitoring results should be used to assess the underlying cause of inadequate cover, which may require that additional adaptive management actions be implemented to support successful replanting. Adaptive management actions could include targeted revegetation, such as replanting varieties of species that are exhibiting the greatest growth and survival, or planting at elevations that are exhibiting the greatest growth and survival.
- Nonnative species management such as plant removal may be needed if monitoring results show that the triggers for nonnative species present are met, or if nonnative species are impacting the survival of native species.
- Plant protection may be needed if triggers for vegetative cover and/or survival are being met. If monitoring results show that plantings are failing due to predation or trampling from human use, then adaptive management actions would include plant cages that could be installed to protect plantings.

4.0 Costs for Implementation of Monitoring and Adaptive Management

The costs associated with implementing these monitoring and adaptive management plans were estimated based on currently available data and information developed during plan formulation as part of the feasibility study. Because uncertainties remain as to the exact project features, monitoring elements, adaptive management opportunities, and the costs thereof, the quantities estimated in Tables 3 and 4 (below) will be need to be refined in PED during the development of the detailed monitoring and adaptive management plans. The current total estimated cost for implementing the monitoring and adaptive management programs is $8,777,600. Costs for monitoring and adaptive management would be cost shared with the non-Federal sponsor and must be concurred with by the non-Federal sponsor prior to implementation. It is important to note that the cost estimates in this M&AM Plan do not include consideration of contingency or inflation and therefore may differ from representations of costs associated with the M&AM Plan elsewhere in the FR/EA.

4.1 Costs for Implementation of Monitoring Program

Monitoring under the M&AM Plan begins after construction is completed for any given feature. While construction of aquatic features (excavation and placement of structural complexity features) is anticipated to be completed on an annual basis (1 year duration), the construction of riparian vegetation would include an establishment period (assumed to be 2 years for a total of 3 years construction duration). Therefore, although the project would require 4 years of initial construction, monitoring for the project would require a longer duration. Figure 4 below demonstrates the conceptual sequencing of construction and monitoring for the project.

Costs to be incurred during the PED and construction phases include drafting of the detailed monitoring plan, monitoring site and system establishment, and pre-construction and construction data acquisition to establish baseline conditions. Cost estimates assumed that project features would be successfully established at the end of initial monitoring (5 years for aquatic habitat and 5 years for riparian habitat). It is intended that monitoring will utilize standardized data collection, management, analysis, and reporting processes. Cost estimates include monitoring equipment, monitoring station establishment, data collection, quality assurance/quality control, data analysis, assessment, and reporting, and for the proposed monitoring elements (Table 3). Cost in Table 3 are based on estimates of the efforts required to survey all constructed features. Because monitoring effort varies by year (see Figure 4.), cost estimates were adjusted based the percentage of the total effort that would be monitoring in a given year. For example, in year 2024, construction would be complete for approximately 75% of the aquatic features, therefore, the cost for monitoring of aquatic features in that year was estimated at 75% of the total monitoring cost. For the purpose of developing an estimate, costs were categorized as either related to field labor or as data analysis & reporting. Field labor costs were developed based on an estimate of total anticipated effort for the constructed features. These estimates include consideration of feature area, number of transects, and anticipated labor. For aquatic habitat, a full effort of field labor was estimated as $60,000. For riparian habitat, a full effort of field labor was estimated as $89,600. Costs associated with data analysis and reporting (and equipment) was estimated at a flat rate of $20,000 for each monitoring year. Costs would begin at completion of the construction phase. The low-end estimate for implementing the monitoring and assessment program is $1,257,600. This cost estimate assumes that success criteria are met in the shortest possible timeframe.

If success criteria are not met after the initial minimum monitoring period, the monitoring activities would continue until success criteria are met and would be cost shared for up to ten years following construction. If monitoring is required beyond 10 years, costs would be the sole responsibility of the non-Federal sponsor. Costs associated with the maximum cost-shared amount of monitoring (i.e., up to 10 years) would be $1,906,400 (Table 4). If ecological success criteria are met prior to ten years post-construction, the monitoring program would cease and costs will decrease accordingly.

4.2 Costs for Implementation of Adaptive Management Program

Throughout the feasibility study process, a high degree of public concern has been expressed over the potential for the proposed natural features to be damaged during high flow events. Along with improving designs through thorough site characterization during the PED phase, adaptive management is one of the primary tools to ensure long-term project success. Adaptive Management assumes there are critical uncertainties in restoration approach or methods, there is an opportunity to monitor and learn from monitoring data to reduce uncertainties, and finally that those data can be used to make adjustments to design, approach, implementation, repair or modification methods if damages occur, etc., to improve project success and longevity, and to increase satisfaction of project objectives. Adaptive management measures may be applied in a corrective manner. For example, if monitoring shows vegetation survival is being impacted through herbivory, protective fencing could be installed. This application is different than the direct replacement of features. Public concern has been focused on the potential for a large scale failure of project features, through dramatic erosion, channel migration, or aggradation during high flow events, resulting in a total loss of project features. The only options in those cases, if monitoring reveals a complete loss of any intended project function, and importantly does not suggest that a different approach is warranted if all damage is purely due to an extreme event prior to establishment of the feature and not to location, approach or methods, is replacement of features. The replacement of features are representative of the high end of potential measures during the adaptive management phase. Given the public concern regarding the potential for large scale damage to project features, and in acknowledgement that project features would be exposed to normal dynamic flows that occur in the lower Yuba River, the cost estimates for the implementation of adaptive management measures were based on a cost-risk analysis of a reasonable worst case scenario of events.

The cost-risk approach focused on driving (highest risk/ highest replacement cost) floodplain lowering and riparian planting features, which account for 76% of total restored acreage in the project area, 47.6 acres and 88.5 acres, respectively. Healthy stands of native vegetation represent a significant stabilizing influence on bar and floodplain sediments throughout this reach. Successful installation and establishment of riparian vegetation on designated riparian planting and lowered floodplain areas is a critical driver of overall reach stability, and influences persistence of bar and island features including constructed features such as side channels and backwaters. For this reason, these restoration features are concluded to be the main cost drivers for adaptive management. Side channels, backwaters, ELJs, LWM, boulder and gravel placement are anticipated to be lower risk features, corrected in the establishment period as part of construction or to naturally evolve if monitoring shows the intended functions of these features persists, even if some adjustment occurs throughout the project life. For example, boulders, gravel and LWM in natural riverine environments shift and move over time, though maintain their intended ecological function within the Increment or the LYR as a larger reach.

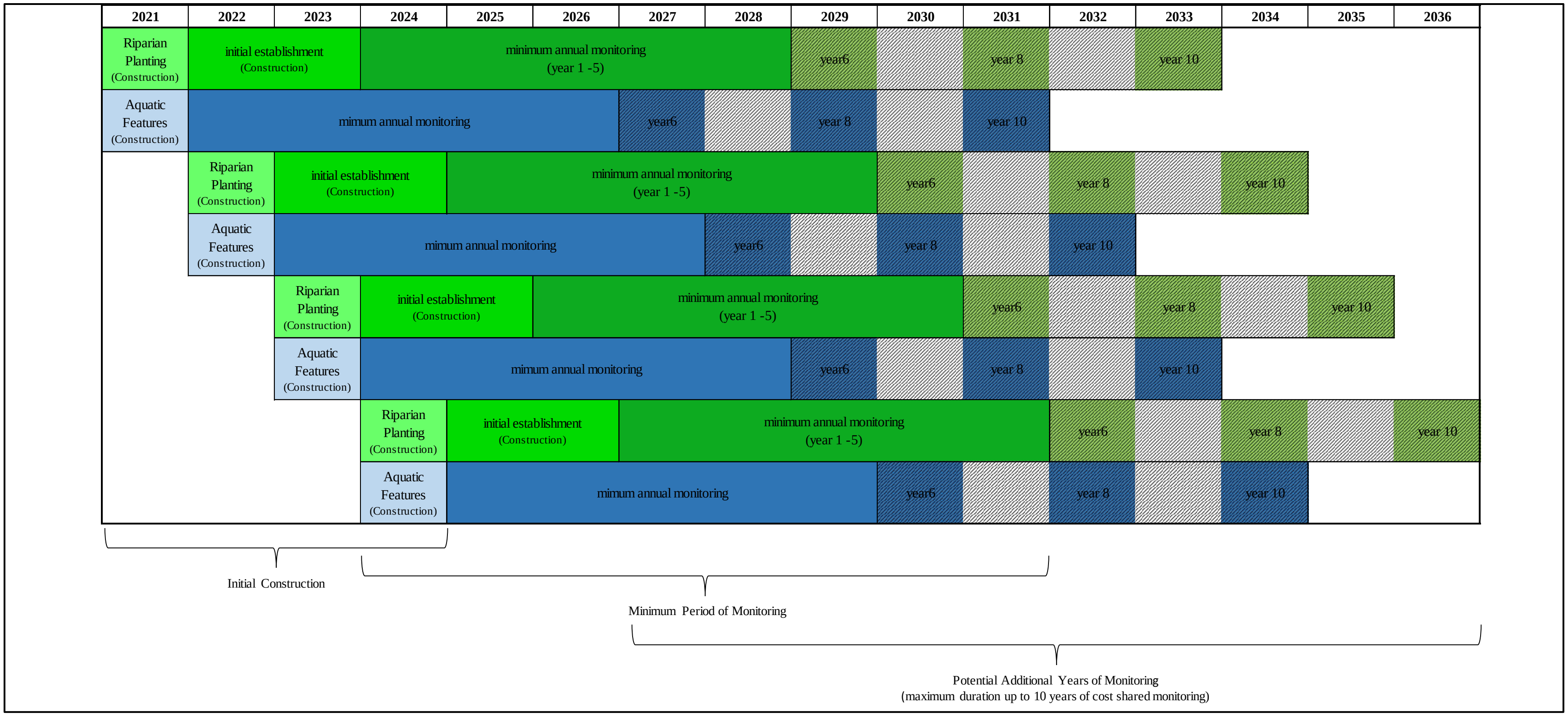

Figure 4. Conceptual Sequencing of Construction and Monitoring

Table 3. Monitoring cost estimates for the YRERFS – Minimum Monitoring Period

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	Total
Riparian Planting	$109,600	$0	$0	$42,400	$64,800	$87,200	$109,600	$109,600	$87,200	$64,800	$42,400	no monitoring	no monitoring	no monitoring	no monitoring	no monitoring	$717,600
Aquatic Features	$80,000	$35,000	$50,000	$65,000	$80,000	$80,000	$65,000	$50,000	$35,000	no monitoring	no monitoring	no monitoring	no monitoring	no monitoring	no monitoring	no monitoring	$540,000
Subtotal	$189,600	$35,000	$50,000	$107,400	$144,800	$167,200	$174,600	$159,600	$122,200	$64,800	$42,400	$0	$0	$0	$0	$0	Total $1,257,600

Table 4. Monitoring cost estimates for the YRERFS – Maximum Cost Shared Monitoring Period

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	Total
Riparian Planting	$109,600	$0	$0	$42,400	$64,800	$87,200	$109,600	$109,600	$109,600	$87,200	$87,200	$64,800	$64,800	$64,800	$42,400	$42,400	$1,086,400
Aquatic Features	$80,000	$35,000	$50,000	$65,000	$80,000	$80,000	$80,000	$65,000	$65,000	$50,000	$50,000	$50,000	$35,000	$35,000	$0	$0	$820,000
Subtotal	$189,600	$35,000	$50,000	$107,400	$144,800	$167,200	$189,600	$174,600	$174,600	$137,200	$137,200	$114,800	$99,800	$99,800	$42,400	$42,400	Total $1,906,400

Monitoring as part of the M&AMP will be targeted at reducing uncertainty in evaluating persistence and ongoing function of these features as they evolve or adjust, and will be used to inform responses to those changes. Specifically, monitoring data will be used to determine the extent to which a change is considered damage or failure, related to whether project objectives are being satisfied, and to whether adjustment in design approach, installation or repair methods, or in application or location can be implemented within the constraints of the project, and if so, to what extent modifications will address deficiencies or uncertainties in design or installation that resulted in negative consequences. Additional monitoring cycles throughout the adaptive management period will be directed at improving implementation of each measure type in each increment accordingly to assess ecological function and adjust responses accordingly, with the explicit goal of improving overall reach function and the implicit goal of improving the success of each measure so as to reduce future costs in OMRR&R stages. The quantitative risk assessment approach considered failure or damages likely to be incurred by project features under a range of five representative flows and the associated probability of those flows to occur within the adaptive management period. A detailed description of the cost-risk analysis is included in the Engineering Appendix C - Attachment CV-C.

An assumed cost of replacement of the total acreage of riparian planting and floodplain lowering activities was made based on initial construction costs and expert judgment, and used in calculation of damages per time period. Estimated damage probability for year ranges (e.g., 0-2, 2-5, 5-10…) is shown in terms of probability of damages in $M in Engineering Appendix C - Attachment CV-C. Annual damages at or above each shear threshold value is shown in $M per exceedance probability. Integrating the area under each of these curves yields a total dollar amount.

The estimate for implementing the adaptive management program is $7,520,000 not including contingency or inflation. This total assumes that total replacement would occur if damages are incurred in the first 2 years. The analysis assumes that 80% replacement could occur in the next 3 years assuming some amount of monitoring-based treatment method and recovery testing would occur that would allow additional methods or approaches to determining or assessing success or progress (i.e., an area damaged by a flood may be revegetated by natural recruitment to some extent, so an additional year of monitoring may be the selected action rather than replanting in that year, to assess the capacity of the site for natural recovery). The analysis assumes the subsequent 5 years might enable a 50% replacement or repair approach, learning from the first 5 years.

It is important to note that actions similar to those included as adaptive management measures are also likely to be included in OMRR&R assumptions, specifically the repair, replacement, and rehabilitation components. Although M&AM and OMRR&R actions may overlap in the type of actions and timing of implementation, M&AM and OMRR&R do not share costs. Unless otherwise noted, M&AM costs will begin at the onset of the PED phase and will be budgeted as construction costs. Upon achievement of success criteria, project features would cease to be evaluated under the M&AM Plan and would maintained according to the O&M manual.

5.0 References

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Environmental Appendix D
Attachment 7

Memorandum of Approval
for the
Juvenile Steelhead Habitat Suitability Index Model
Yuba River Ecosystem Restoration Feasibility Study

Prepared By:
U.S. Army Corps of Engineers
Mississippi Valley Division
October 2017

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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MISSISSIPPI VALLEY DIVISION
P.O. BOX 80
VICKSBURG, MISSISSIPPI 39181-0080

CEMVD-PDP 31 October 2017

MEMORANDUM FOR Commander, Sacramento District, U.S. Army Corps of Engineers (Attn: Alicia Kirchner, CESPK-PD)

SUBJECT: Single Use Approval of the Yuba River Juvenile Steelhead Habitat Suitability Index Model

1. References:
   a. Engineer Circular 1105-2-412: Assuring Quality of Planning Models, 31 March 2011.

   b. Planning Bulletin 2013-02, Assuring Quality of Planning Models (EC 1105-2-412), 31 March 2013.

   c. Memorandum to Directors of National Planning Centers of Expertise – Subject: Modification of the Model Certification Process and Delegation of Model Approval for Use, 04 December 2017.

   d. Memorandum to CECW-SPD - Subject: Recommend Single Use Approval of the Yuba River Juvenile Steelhead Habitat Suitability Index Model, 12 October 2017.

2. An independent review team managed by the National Ecosystem Restoration Planning Center of Expertise evaluated the subject model (Reference 1.d.). A panel convened by the Office of Water Project Review recommended regional use approval of the model in October 2017. Independent technical review of the model is complete and the model meets the criteria in References 1.a. and 1.b for model approval. There are no unresolved issues stemming from the review.

3. The model is approved for use in the Yuba River Ecosystem Restoration Study.

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Gary L. Young
Chief, MVD Planning and Policy and
Director, Ecosystem Restoration
Planning Center of Expertise

CF
CECW-PC (Coleman, Matusiak, Trulick, Bee)
CECW-SPD (McCallister, Wilson)
CESPD-DD-P (Axt)
CESPD-PDS-P (Kennedy)

CESPD-PDP (McCrea)
CESPK-PD (Artho, Kirchner)
CESPK-PD-W (Cowan)
CESPK-PD-R (Ziminske)
CESPK-PM-C (Stewart)
CESPK-PD-RA (Baker)
CESPK-PD-RP (Fong)
CENWS-PM-ER (Scuderi)
CEMVP-PD (Richards, Stefanik, Veninger)
CEMVD-PDP (Mallard, Miller)

Environmental Appendix D
Attachment 8

Habitat Evaluation Assessment Approach

Yuba River Ecosystem Restoration Feasibility Study

Prepared By:

U.S. Army Corps of Engineers

Sacramento District

October 2018

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CONTENTS

1.0 Introduction D8-5

2.0 Background D8-5

3.0 Assessment Approach Framework D8-6

3.1 Key Habitat Types and Representative Species D8-6

3.1.1 Juvenile Steelhead D8-7

3.1.2 Yellow Warbler D8-8

3.1.3 Downy Woodpecker D8-9

3.2 Affected Habitat Evaluation D8-9

3.3 Hydrology D8-10

3.3.1 Hydrologic Data D8-11

3.3.2 Modeled Flow Considerations D8-16

3.4 Hydraulic Modeling D8-19

3.4.1 Topographic Data D8-19

3.4.2 Channel Hydraulics D8-20

3.4.3 Model Refinement D8-27

3.4.1 Model Results D8-27

3.5 Benefits Model Platform D8-28

4.0 Ecosystem Output Calculations D8-28

4.1 Context for the Calculation of Habitat Units for Riverine Key Habitat Type .. D8-32

4.1.1 Habitat Suitability Criteria D8-32

4.1.2 Data Inputs D8-33

4.1.3 Assumptions for the Analysis D8-33

4.2 Context for the Calculation of Habitat Units for Riparian Scrub-Shrub Key Habitat Type D8-38

4.2.1 Habitat Suitability Criteria D8-38

4.2.2 Data Inputs D8-39

4.2.3 Assumptions for the Analysis D8-40

4.3 Context for Calculation of Habitat Units for Riparian Forest Key Habitat Type . D8-41
4.3.1 Habitat Suitability Criteria D8-41
4.3.2 Data Inputs D8-42
4.3.3 Assumptions for the Analysis D8-42
4.4 Annualization of Habitat Units D8-43
5.0 Model Review Requirements D8-43
6.0 Modeling Results D8-44
6.1 Area D8-44
6.2 Average Suitability Index D8-44
6.3 Habitat Units D8-44
6.4 Comparison of Results D8-45
6.6 Uncertainty in Results and Risk to Study Recommendation D8-45
6.5 Average Annual Habitat Units D8-45
7.0 References D8-51

1.0 Introduction

The purpose of this document is to describe the habitat evaluation assessment approach applied in the formulation, evaluation, and comparison of alternatives for the Yuba River Ecosystem Restoration Feasibility Study (YRERFS). The formulation, evaluation, and comparison of alternative plans comprise the third, fourth, and fifth steps of the U.S. Army Corps of Engineers (USACE) planning process. These steps are often referred to collectively as plan formulation. Plan formulation is an iterative process that involves cycling through the formulation, evaluation, and comparison steps several times to develop a reasonable range of alternative plans and then narrow those plans down to a final array of feasible plans from which a single plan can be identified for implementation.

A critical part of plan formulation is the quantitative evaluation and comparison of the potential benefits and costs associated with proposed Alternatives. This comparison of efficiency is conducted utilizing the IWR Planning Suite v2.0.9 (certified) cost effectiveness/incremental cost analysis (CE/ICA) tool. The plan formulation process and CE/ICA are discussed in detail in Chapter 3 and Plan Formulation Appendix A. The CE/ICA is a critical step in plan formulation that can ultimately facilitate the identification of the Recommended Plan. For an ecosystem restoration project, potential benefits are quantified in habitat units. The development of habitat units is the focus of this document.

2.0 Background

The primary consideration in developing an assessment approach was to provide inputs to the CE/ICA in the form of annualized ecosystem outputs for each relevant project action. The CE/ICA will then be used to evaluate project increments, formulate alternatives, and support identification of the NER plan. “Increments” are geographic groupings of inter-related measures into logical and efficient units for the formulation of alternatives. This assessment approach will be applied to changes in habitat quantity and quality, but is not intended to be used to assess changes in fish passage efficiency.

In providing adequate inputs for the CE/ICA, it was determined that the assessment approach would need to: (1) provide an equitable evaluation that adequately distinguishes between all increments, and (2) be based in the U.S. Army Corps of Engineers’ SMART planning principals. The first consideration was satisfied by developing an assessment approach that would produce a broadly applicable output (habitat units) based on a multi-species/multi-habitat evaluation. The second consideration resulted in a number of assumptions and simplifications that streamlined the overall assessment approach and maximized the use of existing information.

The PDT identified the Habitat Evaluation Procedures (HEP) framework as meeting the needs for an assessment approach. The assessment approach would provide an evaluation in terms of acre-based habitat units. The quality component of habitat units would be calculated through the application of habitat suitability relationships of representative species. An integral part of this assessment approach would include hydraulic modeling of increments to evaluate changes to key features of aquatic habitat.

3.0 Assessment Approach Framework

The YRERFS project delivery team (PDT) determined that a HEP framework would provide a suitable multi-habitat/multi-species assessment approach to evaluate and compare increments. The HEP is a process developed by the U.S. Fish and Wildlife Service (1980a and 1980b) to facilitate the identification of impacts from various types of actions on fish and wildlife habitat. The basic premise of HEP is that habitat quantity and quality can be numerically described. HEP can provide a comparison of habitat quality between different sites or between different times at one site (for example, pre-construction versus post-construction). A key assumption in HEP is that an individual species “prefers” (or survives/reproduces better) in habitats with certain physical characteristics that can be measured. For example, if yellow warblers typically nest in deciduous shrubs, then sites with greater deciduous shrub cover are more suitable for yellow warblers than sites which have little or no deciduous shrub cover.

A habitat suitability index (HSI) is the typical format used in HEP which is a mathematical relationship between a physical, chemical, or biological habitat attribute and its suitability for a single species or assemblage of species. In this assessment, the habitat attributes used to indicate suitability for a given species are referred to as Habitat Suitability Criteria (HSC). The Suitability Index (SI) is a unitless number that describes the requirements of a species for certain attributes such as cover, distance to foraging, etc. The relative suitability value of an HSC ranges from 0.0 (indicating unsuitable habitat) to 1.0 (indicating optimal habitat) (YCWA 2013). Each HSC will have a corresponding SI. A set of one or more SIs that represent key habitat requisites for the species during one or more life history stages are combined into an overall HSI by adding or multiplying the individual indices. The mathematical combination of HSCs into an overall HSI, justified through biological relationships is referred to as an HSI model. The attributes are measured in the field or via analysis using geographic information system (GIS) programs and data, and their corresponding index values are inserted into the model to produce a score that describes existing habitat suitability. The overall HSI value is also an index score between 0 and 1. This index value can be multiplied by the area of the site to yield Habitat Units (HUs), or it can be used as an index score for a habitat quality comparison only.

The juvenile steelhead HSI model along with the yellow warbler HSI model and the downy woodpecker HSI model will be used to evaluate habitat response (habitat units) for each key habitat type under Future-Without-Project (FWOP) and Future-With-Project (FWP) conditions. The results from each of the affected key habitat types would be summed to evaluate overall habitat response of each increment. Prior to discussing the step-by-step calculation of ecosystem output, some background is required on a number of concepts that provide a framework for the assessment approach.

3.1 Key Habitat Types and Representative Species

In developing the HEP framework, the PDT identified key habitat types likely to be affected by proposed project actions. Key habitats identified for evaluation include: (1) riverine habitat; (2) riparian scrub-shrub; and (3) riparian forest. Riverine habitat describes the continuous open-water areas that occur within the channel. The physical extent of riverine habitat varies with flow. Riparian scrub-shrub describes dry floodplain habitat with hydrophytic vegetation less than 5 meters (m) in height. Riparian forest describes dry floodplain moving into upland habitat greater than 5 m in height. These key habitat types were selected based on a GIS analysis of existing conditions in the project area. Additional habitat types were identified in the project area, including barren, grassland, and agricultural; however, these habitat types were not included in the assessment approach because either their existing value was considered to be insignificant or they were not likely to be subject to change as the result of any proposed actions. The key habitat types selected for inclusion in this assessment approach are adequate to support evaluation of the full range of actions.

Representative evaluation species were selected for each key habitat type based on several criteria: (1) species known to be sensitive to specific land- and water-use actions; (2) species that play a key role in nutrient cycling or energy flow; (3) species that utilize a common environmental resource; (4) species that are associated with important resource problems, such as anadromous fish and migratory birds; (5) species have existing habitat response models relative to the proposed actions; (6) habitat data available or easily collected to support modeling; (7) species provide relevant evaluation throughout the geographic range of proposed actions and across the broad range of effects of proposed actions. The species and corresponding HSI models selected to evaluate habitat were Central Valley steelhead (*Oncorhynchus mykiss*, juvenile rearing lifestage), yellow warbler (*Dendroica petechial*, Schroeder 1982a), and downy woodpecker (*Dryobates pubescens*, Schroeder 1982b) (Table 1).

3.1.1 Juvenile Steelhead

The juvenile steelhead was selected as a representative species for the riverine key habitat type because it meets the criteria above and provides advantages over similar species.

- Steelhead are known to be sensitive to specific land- and water-use actions and there is a well-documented history on the effect of anthropogenic actions on steelhead in the watershed.
- Steelhead and other anadromous salmonids play a key role in ecosystems by bringing marine-derived nutrients into the system on which a wide variety of plants and wildlife depend.
- Steelhead are dependent on the broadly-used resources of riverine and riparian habitats.
- Steelhead and other anadromous salmonids have been and continue to be the focus of natural resource management in the watershed.
- There are existing habitat response models relative to the proposed actions for steelhead, although the models required review and approval for use under USACE policy.
- There is habitat data available to support ecosystem benefits modeling.
- Various life stages and life histories (resident and anadromous) occur throughout the watershed and all life stages occur within the footprint of the Recommended Plan.

Chinook salmon also meet many of the criteria described above, however, steelhead provide several advantages as a representative species. Steelhead provide a broader context as they exhibit both migratory and non-migratory life histories and are generally tolerant of a wider range of habitat conditions (i.e. temperature). The juvenile rearing life stage was selected for study because juveniles are dependent on the type of habitat features most relevant to the proposed habitat restoration actions (i.e. improvements to shallow water habitat/seasonally inundated floodplain habitat). These species habitat relationships are reflected in the selected juvenile steelhead HSI model. Adult salmonid models are often focused on habitat requirements for spawning. The proposed actions under evaluation are targeted at improving habitat features associated with shallow water habitat (i.e. juvenile habitat features) rather than improvements to habitat features associated with adult habitat (i.e. spawning gravel, water quality).

Although, no suitable (certified) model was available for use on this study, the PDT determined that there was sufficient information available to support the development of a habitat suitability model. The habitat suitability criteria selected for inclusion in the Juvenile Steelhead HSI model were based largely on a similar model developed by the non-Federal sponsor for use on the Yuba River Development Project FERC Relicensing. Those criteria include depth, velocity, and cover which represent critical habitat variables for juvenile steelhead habitat suitability and also are directly related to proposed measures.

3.1.2 Yellow Warbler

The yellow warbler was selected as a representative species for the riparian scrub-shrub key habitat type because it generally meets the criteria above and provides advantages over similar species.

- The yellow warbler nesting life requisites are associated closely with riparian and floodplain vegetation communities (particularly early seral cottonwood and willows).
- The yellow warbler occurs throughout the study area.
- The yellow warbler has an existing habitat response model relative to the proposed actions.
- Existing data for relevant yellow warbler habitat variables are available or easily collected to support modeling.

It is important to note that although the yellow warbler is largely extirpated from the central valley, habitat for the yellow warbler occurs throughout the study area. Yellow Warblers prefer foraging and nesting habitat that are wet, partially covered by willows and alders, and range in height from 1.5 to 4 meters (Schroeder 1982). These cover types are typically associated with deciduous shrubland and deciduous scrub/shrub wetland. For the purpose of this assessment approach it critical that a representative species facilitate the evaluation of response to important habitat elements and therefore facilitate the evaluation of potential improvements to habitat. It is not critical that the species be present in the project area. The Yellow Warbler HSI model is discussed in more detail in Section 4.2 below.

A discussion on the habitat requirements for the Yellow Warbler and how the proposed project would address those habitat needs will also be added to this discussion (within the context of supporting the selection of the yellow warbler as an appropriate representative species).

3.1.3 Downy Woodpecker

The downy woodpecker was selected as a representative species for the riparian forest key habitat type because it generally meets the criteria above and provides advantages over similar species.

- The downy woodpecker food life requisites is associated with riparian forest vegetation communities.
- The downy woodpecker occurs throughout the study area.
- The downy woodpecker has an existing habitat response model relative to the proposed actions.
- Relevant downy woodpecker habitat variables are easily developed from existing data to support modeling.
- The downy woodpecker HSI model was recommended for inclusion in this study by USFWS.

Similar to the selection of the yellow warbler as a representative species, the downy woodpecker was selected primarily based on it association with a key habitat type in the project area and its dependence on habitat features directly associated with the project action. The HSI model for the downy woodpecker considers the suitability of habitat in terms of food and reproductive requirements. These requirements are related to vegetative conditions as measured by basal area and number of snags in a forested area. These criteria are relevant for deciduous forest, evergreen forest, deciduous forested wetland, and evergreen forest wetland. The downy woodpecker HSI model is discussed in more detail in Section 4.3 below.

Table 1. Key Habitat Types, Evaluation Species, and Habitat Suitability Criteria.

Key Habitat Type	Evaluation Species	Habitat Suitability Criteria
Riverine	Steelhead juvenile rearing life stage	• Depth • Velocity • Cover
Riparian Scrub-Shrub	Yellow warbler	• Percent deciduous shrub crown cover <5m • Average height of deciduous shrub canopy • Percent of deciduous shrub canopy comprised of hydrophytic shrubs
Riparian Forest	Downy woodpecker	• Basal area of forest

3.2 Affected Habitat Evaluation

For the purpose of this assessment approach, ecosystem output is defined as the net gain in habitat value as measured by acre-based habitat units for a given action. Because the evaluation of ecosystem output is a measure of change in value rather than a measure of absolute value, the evaluation of each increment was simplified by focusing on the anticipated effects of each increment. This approach will serve to limit the study area to include only the key habitat types identified above as well as guide the evaluation of project effects. For the purpose of this assessment approach, proposed actions were evaluated within an area corresponding 84,000 cfs (84,000 cfs is the upper limit of flow included in the hydraulic modeling and is inclusive of the full width of the floodway of approximately 21,000 cfs) with an upstream/downstream limit of approximately 500 feet beyond the extents of proposed habitat modifications. The upstream/downstream limits were based on a professional judgment estimate of a reasonable limit of hydraulic effects from proposed project actions. This assumption is consistent with the general level of detail included in the modeling. In some instances these evaluation boundaries were reduced to accommodate adjacent evaluation units and/or exclude gaps within an evaluation unit.

3.3 Hydrology

The ecological function and corresponding value of riverine and adjacent habitat types vary depending on seasonal fluctuations in flow. The riverine key habitat type will be evaluated through the application of a juvenile steelhead habitat suitability model; which includes physical habitat indicators of depth, velocity, and cover. The range of optimal depths, velocity, and cover conditions are typically associated with near shore, secondary channel, or temporally inundated areas; these areas will be generally concentrated along the margins of the river, which at any given time are dependent on flow. Riparian scrub-shrub and riparian forest key habitat types will be evaluated through application of yellow warbler and downy woodpecker habitat suitability models respectively, which include vegetation based habitat indicators such as height, cover, and basal area.

One key assumption of the HEP framework applied in this assessment approach is that the maximum potential output is one habitat unit per unit area (acre). For example, habitat units are calculated as the product of quality (habitat suitability) and quantity (habitat area). Quality is evaluated through application of HSI models, resulting in a value from 0 - 1. Quantity is evaluated in terms of acres. Because the maximum value for habitat quality is 1, the maximum habitat units per unit area is 1. For the purpose of this assessment approach, in which ecosystem output will be calculated as the sum of multiple key habitat types, for any single area, only 1 key habitat type will be identified and only 1 HSI model will be used to develop outputs. Given this assumption, as wetted area expands laterally with natural hydrologic patterns, the riverine key habitat type will also expand. The extents of riparian scrub-shrub and riparian forest key habitat types would conversely be reduced.

This dynamic process is key to understanding potential ecosystem function and has been incorporated into the assessment approach in a number of ways. First, as described above, the extent of each key habitat type will be evaluated consistent with the extent of wetted area for a given flow. Second, proposed project increments were evaluated under a range of representative flow conditions. Evaluating a range of flows serves to provide understanding of habitat value as it varies spatially (depths, velocities, cover associated with shallow water habitat) and temporally (as flows fluctuate throughout the year). Under any given flow, inundated area will be evaluated as riverine habitat and the juvenile steelhead HSI model will be applied. Riparian scrub-shrub and riparian forest habitat types will be evaluated under conditions where appropriate vegetation exists above the water surface elevation. The range of flows selected for evaluation are documented below. Habitat units calculated for different flows will be combined into a single weighted average output based on relative frequency of each flow (described in more detail below).

3.3.1 Hydrologic Data

3.3.1.1 Watershed

The Yuba River Watershed (Figure 1) encompasses 1,340 square miles on the western slopes of the Sierra Nevada Mountain Range, and is located in portions of Sierra, Placer, Yuba, and Nevada counties. The Yuba River is a tributary of the Feather River which, in turn, flows into the Sacramento River near the town of Verona, California. The Yuba River flows through forest, foothill chaparral, and agricultural lands. Levees are absent from most of its course except for near the river's confluence with the Feather River. At that point, the Yuba River is contained by levees for approximately six miles. The Final Array of Alternatives and Recommended Plan are located on the Lower Yuba River between Englebright Dam and Marysville.

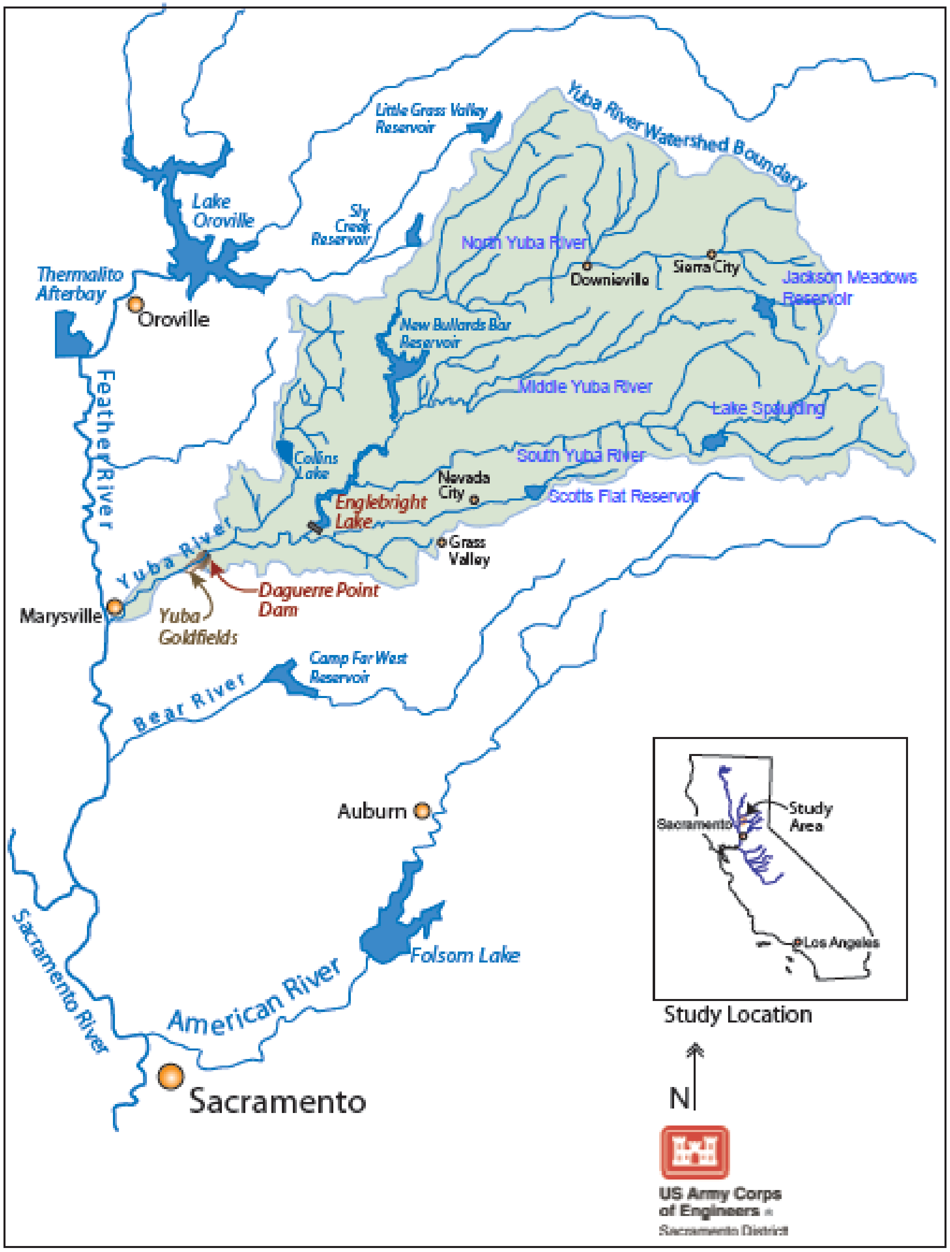

Figure 1. Yuba River Watershed Map (not to scale).

3.3.1.2 Gage Data

The final array of alternatives are located just upstream from the Yuba River near Marysville gage (Gage Number 11421000). There is very little contributing drainage area between the proposed alternatives and the gage. Therefore, this gage reflects the flow conditions at each of the proposed restoration sites. Flows on the Lower Yuba River are highly influenced by upstream reservoir regulation for flood management, hydropower, and water supply purposes. As a result, flows measured at the gage prior to 1972 are not considered representative of the current hydrologic conditions with the reach.

Annual peak flows measured from Water Years 1972 through 2017 (45 years of record) at the Yuba River near Marysville gage have ranged from 673 cfs in water year 1977 to 161,000 cfs in water year 1997. Figure 2 shows the peak annual flow. Table 2 shows the mean monthly flow data. Figure 3 shows daily flow data for a few sample water years (October – September) to help show potential flow durations. The years chosen represent typical low, medium, and high flow events to assist with potential duration expected at given flows.

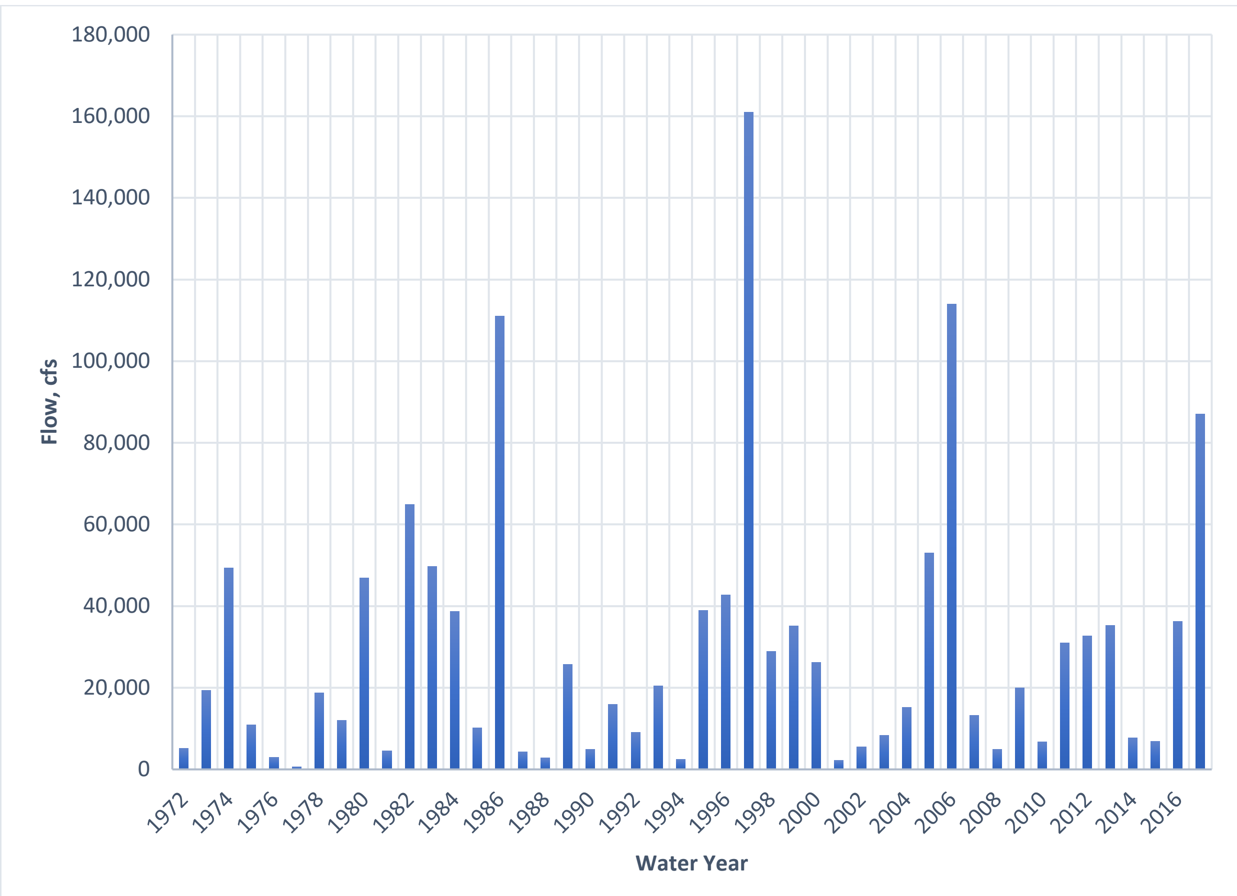

Figure 2. Peak Annual Observed Discharge, Yuba City near Marysville Gage

Table 2. Mean Monthly Discharge (ft^3/s) at the Yuba at Marysville Gage

YEAR	Monthly mean in ft3/s (Calculation Period: 1970-10-01 -> 2017-09-30) Period-of-record for statistical calculation restricted by user											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1970										2,125	2,853	4,352
1971	4,225	3,520	2,395	2,022	1,821	4,045	2,458	2,429	2,197	1,476	1,663	2,455
1972	2,247	1,737	782.3	498.2	461.7	418.2	893.4	1,643	2,196	2,603	2,903	2,901
1973	5,436	5,643	4,944	2,449	716.1	575.3	908.7	1,383	1,671	1,917	4,385	5,485
1974	8,754	4,305	8,346	8,879	3,686	3,725	2,113	2,317	296.0	315.4	1,418	3,529
1975	2,655	2,915	3,870	3,952	1,576	3,377	1,729	2,380	2,664	2,731	2,568	2,004
1976	847.2	556.8	611.8	266.4	211.5	201.1	132.0	135.7	393.0	527.3	476.1	370.6
1977	229.7	211.4	187.6	173.0	166.2	154.8	88.4	71.7	85.8	259.4	270.7	631.4
1978	4,080	4,165	5,232	4,996	3,211	860.6	1,260	2,230	2,488	1,125	849.5	922.2
1979	1,882	2,705	1,992	733.9	1,502	815.3	1,198	1,725	1,768	1,909	1,686	2,224
1980	7,796	9,508	5,559	4,076	2,736	2,462	2,638	2,530	2,900	1,557	952.8	1,293
1981	1,040	925.0	1,435	616.7	354.2	354.6	318.5	263.1	422.0	484.9	2,889	8,336
1982	7,516	10,900	7,290	14,280	7,234	3,483	2,642	2,624	2,629	1,874	2,720	4,382
1983	4,159	7,671	15,100	6,098	7,276	8,633	3,735	2,425	2,209	2,575	4,475	11,430
1984	5,997	4,163	3,504	2,073	1,582	2,106	2,124	2,829	2,852	1,248	1,601	2,145
1985	1,262	1,178	959.6	777.8	559.2	663.3	762.8	391.8	339.7	485.1	519.5	871.3
1986	1,857	20,970	12,480	3,405	1,110	1,087	1,191	833.4	1,593	982.0	597.1	515.9
1987	810.0	1,108	1,086	438.1	366.7	335.2	175.9	1,060	518.1	461.3	496.8	684.2
1988	1,495	1,271	625.5	424.3	308.0	308.8	682.5	894.2	640.9	428.7	932.2	599.0
1989	882.9	929.6	8,825	4,903	1,275	681.4	1,024	1,658	1,708	760.6	751.6	737.5
1990	1,147	887.5	857.4	412.0	871.6	1,249	401.1	431.9	392.2	947.5	894.1	893.2
1991	900.1	757.7	2,392	671.1	348.4	329.3	704.9	1,596	1,970	1,233	695.9	740.6
1992	1,014	2,009	804.3	603.9	553.1	489.0	121.8	140.6	246.7	448.5	423.5	812.7
1993	4,337	4,908	5,808	4,660	3,950	3,850	1,446	1,350	912.7	1,277	1,380	1,277
1994	1,209	1,180	1,046	514.9	418.1	280.0	117.7	427.5	435.6	449.8	532.0	919.5
1995	7,782	5,349	14,080	5,910	9,721	7,029	2,897	1,325	862.0	964.0	903.1	1,986
1996	2,956	11,060	5,375	4,621	8,675	2,244	1,292	1,602	1,000	1,145	1,040	8,036
1997	26,180	6,283	3,522	1,441	768.6	366.8	1,146	2,051	600.5	800.1	960.9	1,315
1998	5,461	10,040	6,398	5,505	5,348	7,331	2,284	2,214	1,453	1,032	1,498	2,732
1999	4,020	7,597	6,025	3,659	2,215	1,941	1,651	2,147	1,161	867.0	720.5	764.1
2000	1,651	5,819	5,774	2,891	1,708	958.9	845.2	1,053	957.9	782.1	641.8	696.0
2001	827.6	1,028	861.2	803.3	302.5	264.3	1,369	1,270	521.8	431.1	443.8	1,039
2002	1,982	1,795	2,767	2,174	1,638	1,293	1,432	1,213	464.6	458.8	482.7	1,769
2003	2,025	2,307	2,426	2,661	5,194	3,201	1,745	1,740	554.5	600.7	568.6	1,450
2004	2,331	3,602	2,984	1,686	1,586	961.9	990.2	939.5	514.1	596.4	542.5	919.1
2005	1,531	1,118	2,218	2,364	8,795	3,174	1,684	939.1	564.8	624.3	856.4	7,844
2006	11,840	5,302	8,061	13,820	10,010	3,059	1,655	761.4	477.9	521.5	532.2	750.7
2007	1,261	2,530	1,819	930.3	1,030	679.7	726.1	749.5	682.0	686.4	685.1	746.3
2008	1,487	1,759	916.4	794.3	955.9	597.2	864.4	882.5	621.9	571.2	557.9	567.0
2009	588.0	1,463	1,731	1,468	3,766	1,756	1,675	1,748	780.5	619.8	557.9	580.8
2010	1,217	1,282	1,399	1,906	2,239	4,031	2,603	1,877	750.9	791.2	668.0	5,984
2011	3,464	3,376	9,022	6,619	6,385	7,884	4,051	2,525	670.2	726.2	573.8	600.1
2012	717.1	700.9	3,492	4,708	2,275	996.1	1,365	1,345	786.4	717.1	925.5	4,963
2013	2,035	1,474	1,396	980.5	1,037	819.8	1,124	977.4	574.8	572.7	595.8	526.3
2014	534.5	1,110	1,018	695.6	598.8	550.6	821.2	818.5	428.8	427.2	538.6	1,424
2015	576.3	956.6	647.1	550.0	459.6	348.3	389.5	382.4	395.9	380.9	415.4	721.8
2016	1,980	1,132	9,534	3,406	2,168	1,528	803.0	672.6	573.7	641.5	780.2	5,951
2017	17,610	27,070	7,702	9,475	7,803	4,045	2,320	1,871	744.8			
Mean of monthly Discharge	3,660	4,220	4,160	3,130	2,700	2,030	1,370	1,380	1,060	961	1,160	2,380

** Incomplete data have been used for statistical calculation

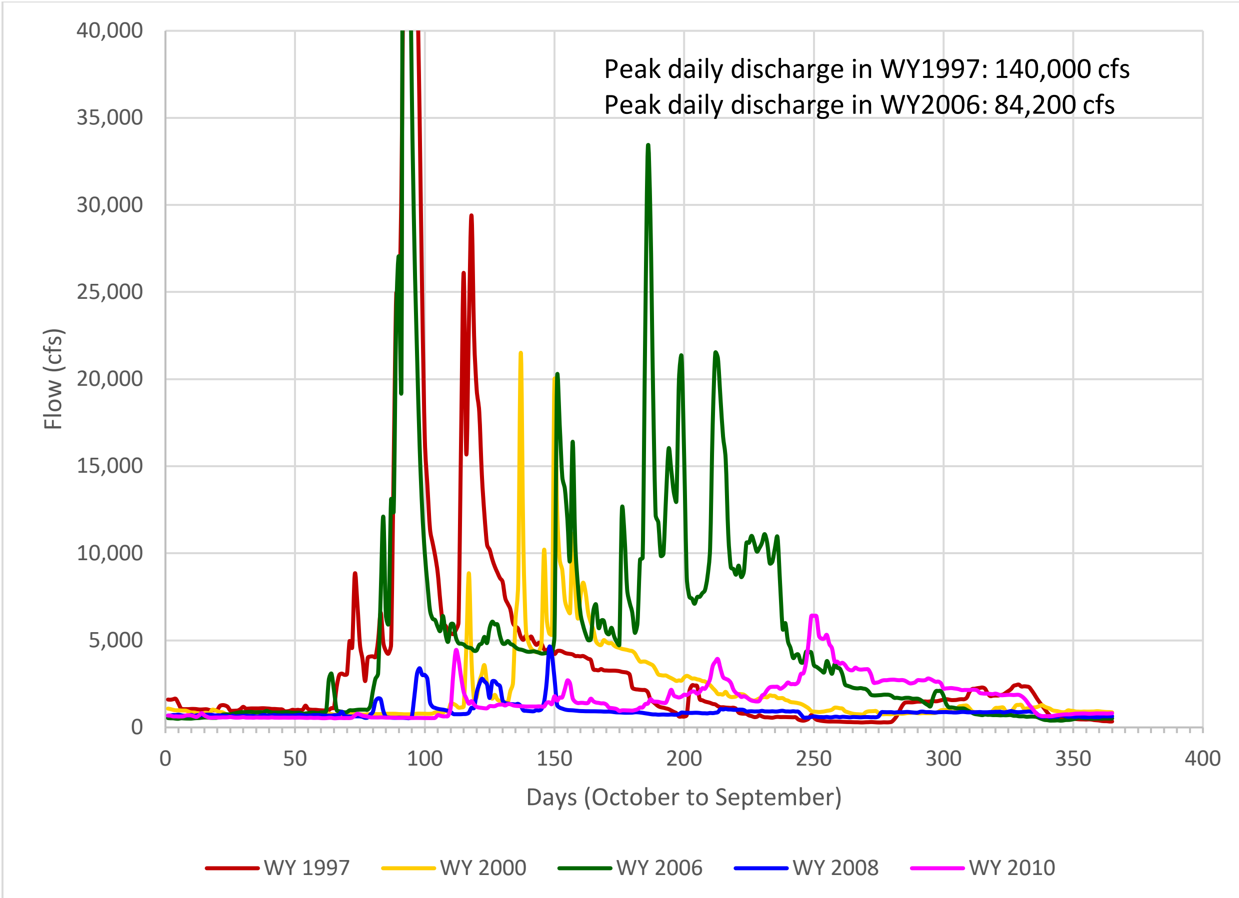

Figure 3. Observed Daily Discharge for 5 sample water years, Yuba River near Marysville.

3.3.1.3 Flood Frequency Analysis

The Sacramento District USACE conducted a hydrology study of the Central Valley in 2015 for the California Department of Water Resources. The study, titled "Central Valley Hydrology Study, 29, November 2015", presented Annual Chance of Exceedance (ACE) estimates for peak flows measured at the USGS Yuba River near Marysville Gage. The estimates were made using reservoir simulations of rare floods and the results were presented for a range of flood magnitudes from 10% (1/10) ACE to 0.002 (1/500) ACE. Table 3 presents these results in tabular format. These flows are considered suitable for evaluation of the ecosystem restoration alternatives presented in this report.

Table 3. Peak Discharges (Regulated) and Associated Annual Chances of Exceedance.

Annual Chance of Exceedance	Regulated Peak Discharge (CFS)
10% (1/10)	71,700
2% (1/50)	112,000
1% (1/100)	178,000
0.5% (1/200)	211,000
0.2% (1/500)	282,000

3.3.2 Modeled Flow Considerations

As described above, consideration of a range of flows was necessary to provide a comprehensive evaluation of habitat value under naturally occurring conditions. The selection of flows to incorporate into hydraulic modeling was based on two primary considerations: (1) the range of flows needed to facilitate an evaluation of the natural range of hydrologic conditions in the Yuba River as they relate to assessing ecosystem outputs of proposed actions, and (2) the incorporation of flows into the hydraulic modeling should be done in a manner consistent with the level of detail of the overall assessment approach. Given these considerations, it was decided that a low flow case medium flow case, and high flow case would be modeled. For the purpose of the YRERFS a low flow case was based on minimum flow requirements in the Lower Yuba River described by the Yuba Accord (YCWA 2007), a medium flow case was based on an approximation of average annual discharge, and a high flow case was based on an approximate bankfull discharge of 5,000cfs (Wyrick and Pasternack 2012). Although annual flows greatly exceed the bankfull discharge, those high flows are less relevant to the evaluation as the proposed actions are designed to address habitat deficiencies at lower discharges (high flows are relevant to the sustainability of habitat measures, see Appendix C – Engineering). The high, medium, and low flows are representative of around 94% of occurring annual flows. Forty-one years of flow record taken from the Proposed Project and Base Case scenarios from the YCWA relicensing website were utilized to develop an annual average flow and bins of flow frequency over the period of record (YCWA 2012a, 2012b). Forty-two years of daily data is a robust data set that allows for a straightforward frequency analysis based on a number of observations in a range versus the total observations for the data set. The methodology for determining these high, medium, and low flows is given below.

3.3.2.1 Average Annual Flow

Flow observations for each calendar year were averaged, giving a data set of 41 average annual flow rates. Outlier flows greater than bankfull flow were assigned a bankfull value of 5,000 cfs for purposes of determining an average annual flow, so that outliers (extreme, infrequent events) did not disproportionately skew the average. The 41 average annual flow rates were then averaged, yielding an annual average of 1,816 cfs. This average annual value was rounded to 1,850 cfs and was chosen as the target value for a bin, since average annual is an intuitive and representative value for the system.

3.3.2.2 - 700 TO 800 CFS BIN

Current and future operations call for a minimum flow of 700 cfs. In order to not fall below that minimum flow, a practical low flow of approximately 730 cfs to 750 cfs is expected in future operations. Choosing 800 cfs as an upper bound to this "low" bin yielded an average value of 750 cfs for all observations with the bin, giving a reasonable flow condition to model and a reasonable 100 cfs bin range (a smaller bin range could be problematic due to the accuracy of flow rate data). 7,205 observations fell within this 700 to 800 cfs bin, resulting in a frequency weighting of 7,205/14,610 = 49.3%.

3.3.2.3 - 800 TO 3,240 CFS BIN

With 800 as a lower bound, the goal of the second "medium" bin was to have the average of the observations within the bin to be close to the annual average flow of 1,850 cfs. Setting the bin upper bound at 3,240 cfs resulted in an average bin flow of 1,852.7 cfs. The 800 to 3,240 cfs bin contains 3,666 observations, resulting in a frequency weighting of 3,666/14,610 = 25.1%.

3.3.2.4 - 3,240 TO 8,000 CFS BIN

With 3,240 as a lower bound, the goal of the third bin was to have the average of the observations within the "high" bin to be close to a high end, near bankfull flow of 5,000 cfs. Using the full data set without outlier (over 5,000 cfs) value reassignment, a bin upper bound of 8,000 cfs results in a bin average 5,000 cfs. The number of observations in the full data set contained within the 3,240 to 8,000 cfs bin is 2,815, resulting in a frequency weighting of 2,815/14,610 = 19.3%.

3.3.2.5 - 8,000+ CFS BIN

The remaining observations greater than 8,000 cfs have a frequency weighting of 6.3%. These flows were considered to be outlier flows, resulting in hydrologic conditions beyond the range of anticipated performance for proposed actions. During high flows, the Lower Yuba overtops its normal banks and spreads out over a broad area; the benefits of the proposed restoration features would not be expected to be significant under these conditions. Therefore, while a fourth bin of flows was identified, these flows were not included in the hydraulic modeling. For the purpose of the ecosystem modeling, these flows (weighted at 6.3%) were assumed to have 0 value for both FWOP and FWP conditions. A summary of the bins and the observations within them for the 750, 1,850, and 5,000 cfs flow scenarios is presented in Table 4 below.

Table 4. Summary of hydraulic modeling representative flows and binning of observations

	Low Flow	Medium Flow	High Flow
Target Average Flow (cfs)	750	1,850	5,000
Lower Bound of Bin	700	800	3,240
Upper Bound of Bin	800	3,240	8,000
Number of observations (14,610 total)	7,205	3,666	2,815
Weighting (% of total flows)	49.3%	25.1%	19.3%
Average Flow (cfs)	751	1,853	5,001

3.3.2.6 - Application

The representative low, medium, and high flows were incorporated into the hydraulic and ecosystem modeling. The overall assessment approach strategy will evaluate ecosystem output through a modular approach; ecosystem value will be evaluated as the aggregate of key habitat types. Key habitat type value will be evaluated through the use of representative species. This approach will be accomplished by applying HSI models for representative species to key habitat types in a HEP framework. This evaluation strategy will be applied iteratively to each sub-unit of analysis under a wide range of scenarios; habitat value for sub-units of evaluation (i.e. key habitat types) will be used to develop averages to facilitate a broader comparison of alternatives. Scenarios include, for each proposed action: a range of hydrologic conditions and a range of key years of analysis under both FWOP and FWP conditions. Additional details regarding the development of flow weighted average habitat output, is described below.

3.3.2.7 - Hydrologic Uncertainty

The potential disruption of project features from naturally occurring dynamic processes is important to understand as incurred effects could be beneficial or detrimental to the ecosystem. For the purpose of this assessment approach it was assumed that the relative probability of disruption to any particular feature and subsequent effect to ecosystem benefits would be equal, therefore, any estimate of damage would be applied equally to all proposed increments and would not affect the relative evaluation and comparison of these proposed increments. Given this consideration and the inability at this time to reasonably quantify potential damage from dynamic riverine processes, these processes have not been incorporated into the modeling. These dynamic processes will be taken into consideration in the Monitoring and Adaptive Management Plan (Environmental Appendix D) and in the development of project costs (specifically operation, maintenance, repair, replacement, and rehabilitation; OMRR&R) described in the Engineering Appendix Section C-15). Furthermore, it is anticipated that detailed designs will take into consideration the site specific dynamic riverine processes and develop features to be resilient to disruption and/or benefit from the natural conditions to ensure that the project continues to meet objectives.

3.4 Hydraulic Modeling

This study used the HEC-RAS 5.0.3 (RAS) as a 2-dimensional gridded hydraulic model as part of HEP workflow. This RAS version uses an Implicit Solution Volume algorithm as its 2D unsteady flow equations solver. RAS is used to produce the necessary outputs of Depth, Velocity Water Surface Elevation, and Floodplain Extent for input in GIS-based HEP calculations.

3.4.1 Topographic Data

Existing topography and bathymetry were used for the study's hydraulic modeling efforts.

The topography for the HEC-RAS 2D model was previously collected by 1) the University of California at Davis and 2) Under contract for the Central Valley Floodplain Evaluation and Delineation (CVFED) Task Order 24. Base Terrain was taken from the Central Valley Floodplain Evaluation Delineation (CVFED) LIDAR 2008 data set for without-project, and this base was supplemented with the design measures for with-project topography (See Appendix C – Engineering Sections C-3-GIS and C-6-Civil Design for more detail on the nature and design of these measures).

All topographic data references the North American Vertical Datum of 1988 (NAVD88) and the North American Datum of 1983 (NAD83), projected in California State Plane Zone 2. The units are in feet.

CVFED LiDAR was captured in March/April 2008. Average point spacing was 3.28 ft, with Verical Accuracy of 0.6 ft (RMSE of 1.96), and Horizontal Accuracy of 3.5 ft (RMSE of 1.75). The LiDAR was collected with a Horizontal datum of UTM 10N, NAD 83 US foot and Vertical datum of NAVD 88.

UC Davis collected Bathymetry in August/September 2008, ground based topography in November 2008 and November 2009. Point spacing and accuracy per reach is provided below in Table 5.

Table 5. UC Davis Topographic Point Spacing and Accuracy

	Reach	Point Spacing	Accuracy
Bathymetry	EDR	4.5 ft	0.2 - 0.3 ft
	TBR	6.2 ft	0.2 - 0.3 ft
	others	4.2 ft	0.5 ft
Topographic	EDR	5.9 ft	0.03 - 0.06 ft
	TBR	9.7 ft	0.03 - 0.06 ft
	others	1.4 ft	0.5 ft

3.4.2 Channel Hydraulics

3.4.2.1 Channel Roughness Values

The land uses for this model were based on GIS files from the Department of Fish and Game, Northern Sierra Nevada Foothills Vegetation Project, as shown in Figure 4. Manning roughness coefficients associated with each land use are shown in Table 6. Roughness values were originally obtained from a nearby TUFLOW model for the Marysville area. Some land use categories contain a range due to varying conditions of the land use. Values were not adjusted to account for bend loses and these were accounted for in the 2D domain. These values were calibrated in the original model and are reasonable to previous studies and historic research. The value for the Goldfields is high due to the fact that flow will essentially be flowing around them and not through them.

Table 6. Model Land Uses and Associated Manning's Roughness Value

Material Type	Manning's Roughness Value/Range
Annual Grassland	0.022 - 0.059
Barren	0.022 0.047
Blue Oak Woodland	0.022
Blue Oak Foothill Pine	0.022 - 0.059
Coastal Oak Woodland	0.022
Coastal Scrub	0.022
Cropland	0.041 - 0.062
Eucalyptus	0.045
Fresh Emergent Wetland	0.022 - 0.047
Goldfields	0.044
Lacustrine (fluvial deposits)	0.044
Mixed Chaparral	0.022
Pasture	0.022
Riverine	0.022 - 0.062
Urban	0.022 - 0.062
Valley Foothill Riparian	0.022 - 0.062
Valley Oak Woodland	0.022

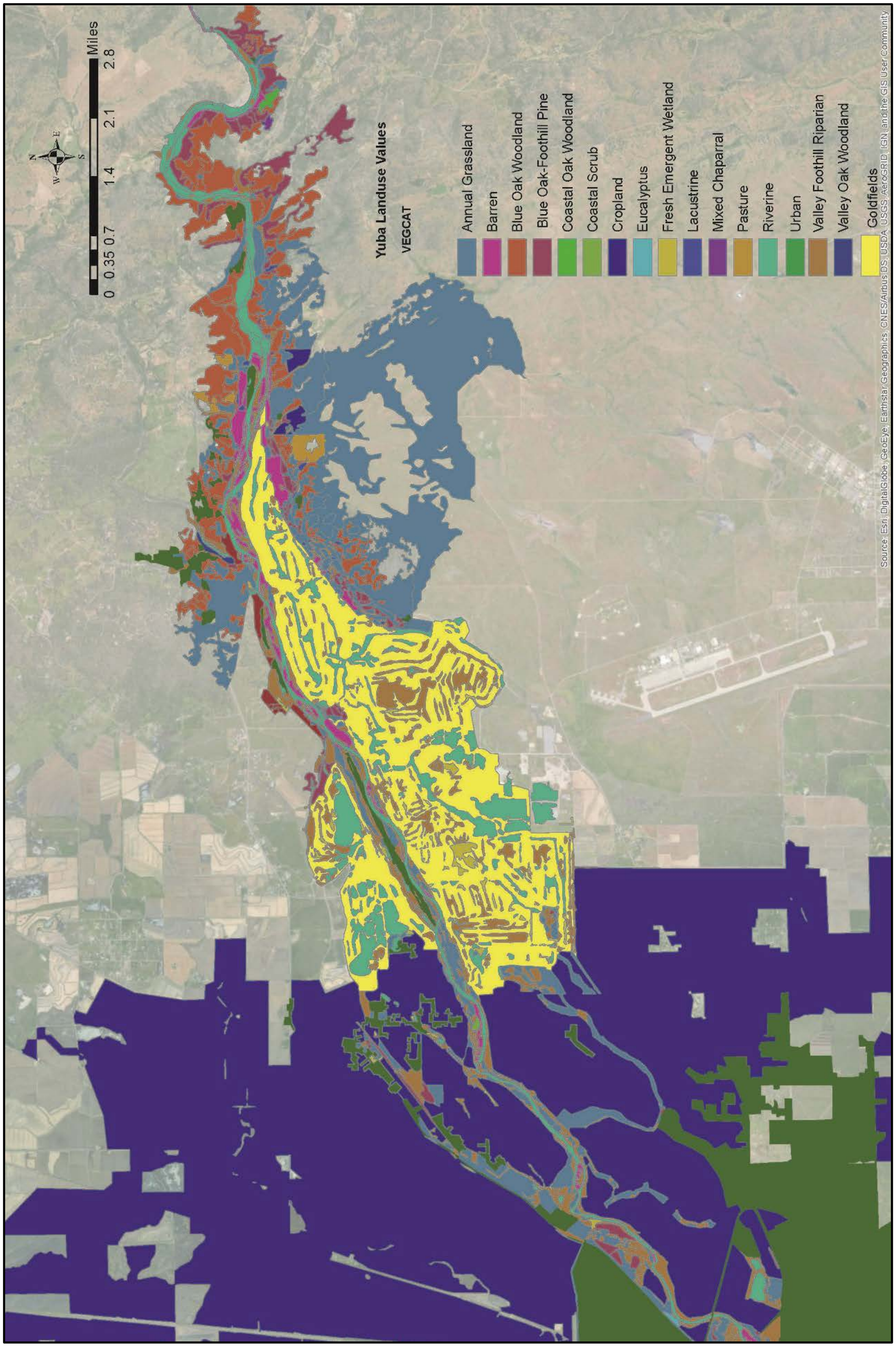

Figure 4. Model Land Uses

3.4.2.2 Model Mesh

The model mesh for YRERFS was generated from a combination of available terrain along with the project related features to be evaluated. These individual project related features were added to the existing terrain dataset using GIS. These features, called Action Groups were segregated into subtypes labeled Side Channel, Riparian Planting and Floodplain Lowering. Figure 5 illustrates one of these features. Detailed descriptions of these with-project features are contained in Appendix C – Engineering, C-3 GIS and Section C-6 Civil Design.

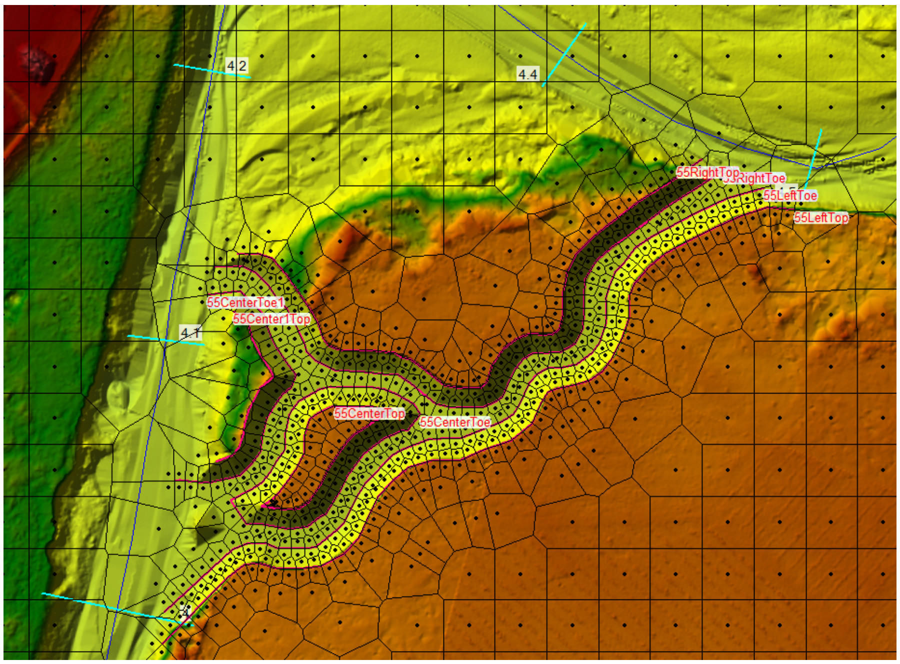

Figure 5. With-Project Mesh Feature

The extent of this model spans the Yuba River approximately 22.2 miles long from the confluence with the Feather River upstream to about 2 miles downstream of Englebright Dam. It is 500 foot (ft.) wide at the upstream boundary, 2800 ft. at the confluence of the Feather with the maximum width of 8750 ft. about 3 miles upstream. The model mesh was generated over the supplied terrain with a Computational Points Spacing of DX=100 & DY=100. This 100 (ft.) grid contains 39,199 cells where the average cell size is 7907 square feet (sq. ft.), the maximum cell size is 25,343 feet, minimum cell size is 103 sq. ft. The mesh also includes break lines that help define 14th Street, The railroads, Simpson Lane and additional topographic features; Plates 1-5 show the mesh for the entire model domain.

Daguerre Point is a point on the south bank of the Yuba River, slightly downstream from Browns Valley but upstream from the now defunct towns of Marigold and Hammonton, opposite Daguerre Point Drive. Built in 1906 the dam is not intended to obstruct the flow of water, but rather to prevent debris from hydraulic mining from washing into the Feather River and Sacramento River.

The Daguerre Point Dam is a submerged overflow ogee spillway dam with a concrete apron and concrete abutments on the Yuba River north of Daguerre Point. The overall length of the dam is about 1340 feet. The ogee spillway section is 575 feet long, the right non-overflow section is about 450 feet long, and the left non-overflow section is about 315 feet long. Flows over the spillway are contained by training walls at each end. The crest of the spillway is 24.3 feet above its apron and 5+/- feet above the streambed on the upstream side of the dam. The concrete non-overflow sections are 16.2 and 20.7 feet above the crest of the spillway, and the earthfill non-overflow sections are 24.7 feet above the crest of the spillway. See Plate I of the Daguerre Point O&M manual for more geometric information. The dam was reconstructed across the inlet end of a 660 foot wide rock diversion cut through Daguerre Point promontory. Originally the cut was 1000+/-, feet long, and averaged 25 feet in depth. The debris storage basin is upstream from this rock cut, and it was filled about 880,000 cubic yards of rock debris, which is about 12 to 15 feet deep and 600 feet wide mining debris about 100 years ago.

Daguerre Dam was modeled using the above stated geometry as a run of the river dam using elevation conversion to NAVD'88. The dam was modeled inside the 2D model as a Hydraulic Structure approximately halfway in the model, 11.5 miles upstream of the boundary, as shown in Figure 6. The hydraulic structure was modeled as a broad crested Weir with a weir coefficient of 2.6 and width of 20 ft.

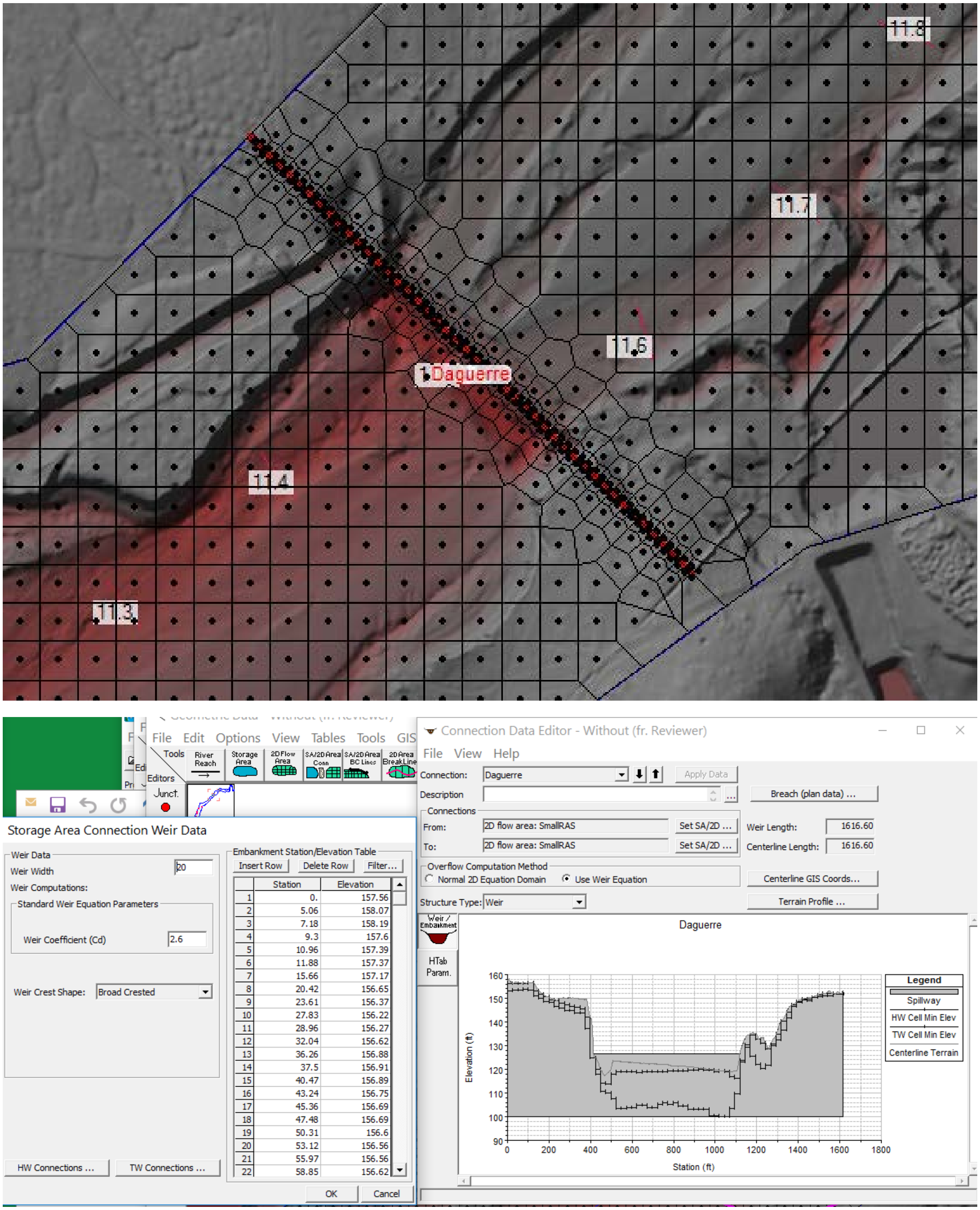

Figure 6. Daguerre Dam as Modeled in HEC-RAS2D

3.4.2.2 Upstream Boundary Condition Discharges

Modeled flows for habitat modeling, given in Cubic Feet per Second (cfs), were selected following (but not selected exactly from) datasets developed by the Yuba County Water Agency (YCWA) in support of their Federal Energy Regulatory Commissions' (FERC) hydroelectric relicensing. The selected peak steady flow values for analysis are (1) 750 cfs, (2) 1,850 cfs, (3) 5,000 cfs, (4) 22,100 cfs, and (5) 84,000 cfs represent a range of river flows that exist within the Yuba River greater than 90% of the time during the period of Record of USGS Gage 1148000, Yuba River below Englebright Dam, near Smartsville. The use of steady flows is predicated on the fact that the hydrologic model used was considered appropriate for all computations. For additional information regarding flow selection criterion please see the Environmental Engineering and Yuba River Ecosystem Restoration Modeling Flow Considerations Technical Memorandum documentation for this study. Figure 7 shows an illustration of the Steady Inflow Hydrograph used for analysis. Please note the 1 day duration used for warmup for this 5,000 cfs inflow hydrograph.

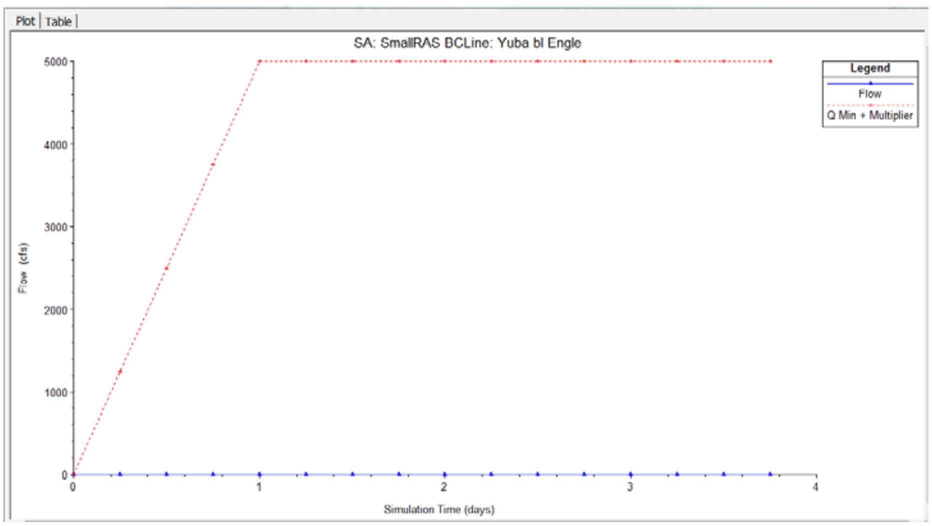

Figure 7. Sample of the Steady Flow Hydrograph (5,000 cfs)

3.4.2.2 Selected Downstream Rating Curve

Due to the lack of available calibration data from the SRH2D model development team a downstream boundary rating curve was created for this modelling effort using iterative normal depth calculations using the Manning's equation. Using the supplied terrain data a cross section (Figure 8) was taken at boundary of the model mesh far away from any point of interest to avoid the introduction of boundary condition errors. Using the Manning's equation a Slope of 0.002 ft/ft with Manning's roughness of 0.08 was assumed to produce the rating curve as shown in Figure 9.

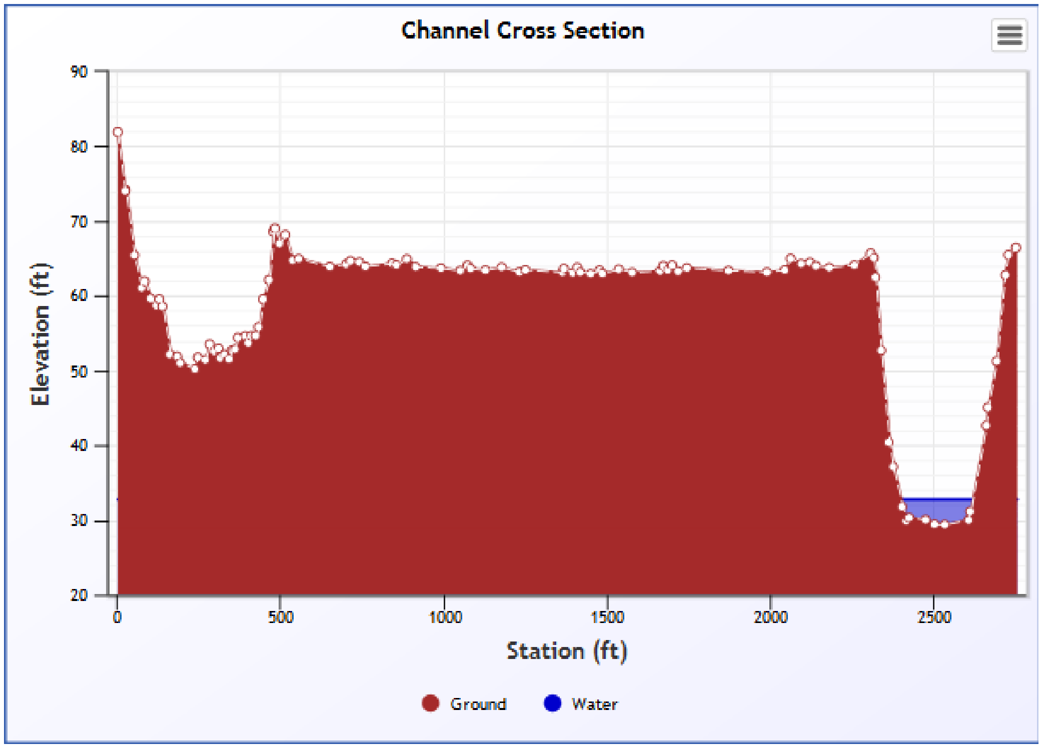

Figure 8. Channel Cross Section

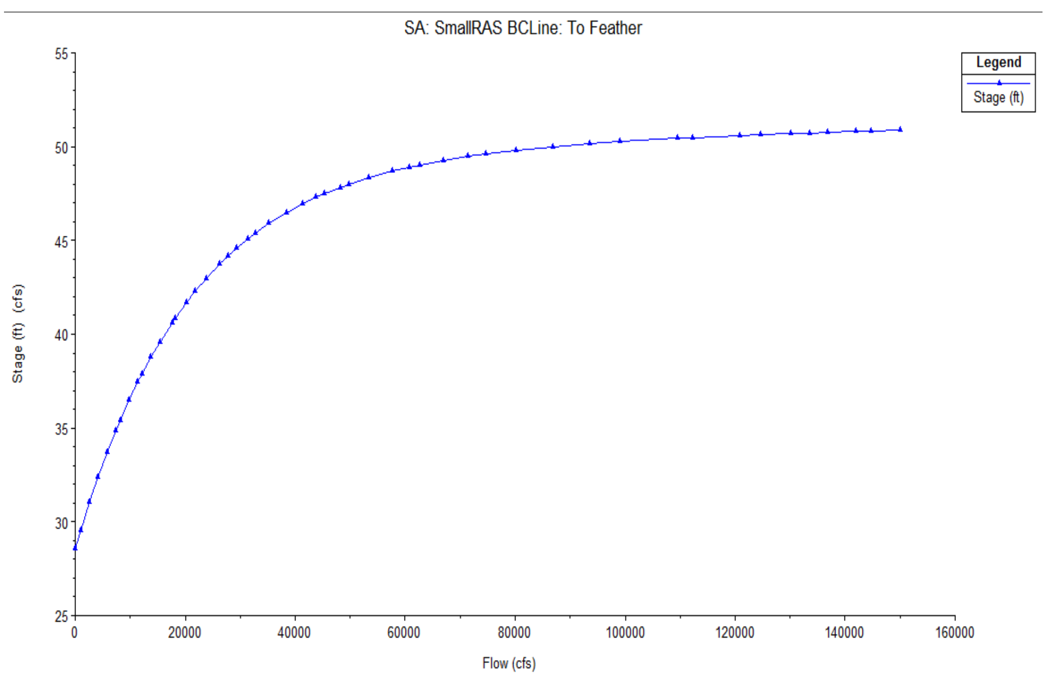

Figure 9. Yuba River Station 0.19 Downstream Boundary

3.4.3 Model Refinement

The model was refined using flow values from the USGS Gage 11421000 labeled “Yuba R NR Marysville, CA”. Refinement efforts involved multiple adjustments to model warmup times, roughness, mesh size and computational interval to reach a satisfactory refinement. Figure 10 below illustrates model results before and after review in comparison to the rating curve at the gage (blue line).

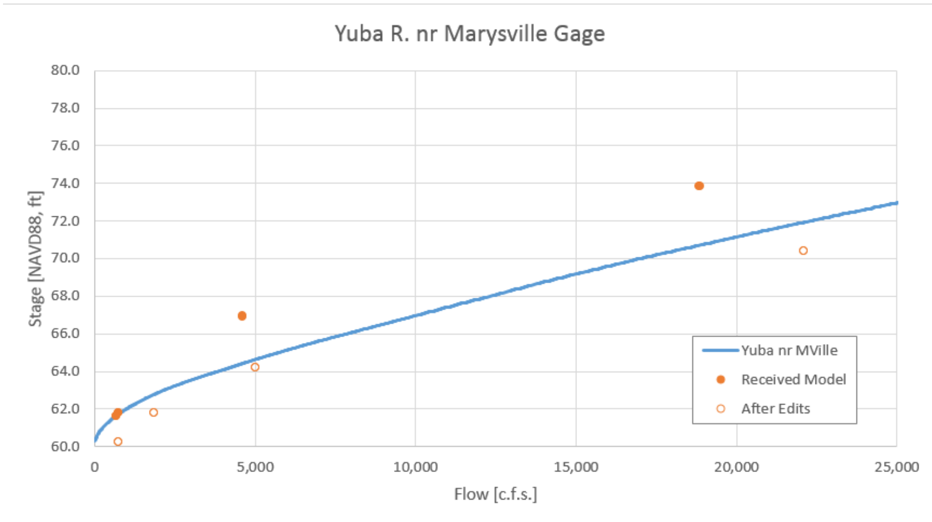

Figure 10. Model Refinement

3.4.1 Model Results

3.4.1.1 Velocity

An example of the 2D model velocity results for with-project conditions are shown in Plate 6. This example represents the with-project conditions, for a flow of 5,000 cfs, in the area just below the Goldfields. Maximum velocities are shown with the blue colors representing low velocities (less than 3 ft/s) and the red colors representing high velocities (greater than 10 ft/s). The velocity in the side channels is typically 2 to 3 ft/s with occasional peaks of 4 to 5 ft/s. The velocity in the main channel is typically 5 to 6 ft/s with peaks of 11 ft/s.

3.4.1.2 Water Surface Elevation and Depths

An example of the 2D model water surface elevations and depth results are shown in Plates 7 and 8, respectively. This example represents the with-project conditions, for a flow of 5,000cfs, in the area just below the Goldfields. The water surface elevations are around elevation 89 ft NAVD88at the upstream end of the segment shown and at elevation 68 ft NAVD88 at the downstream end of the reach shown. Water Depths range from less than a foot deep to 14 ft deep for the 5,000 cfs flow event. The side channels are typically 2 to 3 ft deep while the main channel is typically 5 to 7 ft deep with deeper pockets on the outside of bends (around 14 ft deep).

3.5 Benefits Model Platform

Although HSI models are traditionally performed in a spreadsheet environment, for the purpose of the YRERFS, the HSI models will be applied in the ArcGIS platform. Specifically, ArcGIS will be used to calculate habitat suitability for each representative species and corresponding key habitat type. The application of the assessment approach within ArcGIS accommodates all considerations described within this document, including three key habitat types, FWP and FWOP conditions, a range of flows, and a range of key years of analysis. Calculation of habitat units for each key habitat type would be followed by a process of combining and annualizing outputs for key habitat types. This will be conducted using more traditional spreadsheet-based methods.

ArcGIS facilitated an evaluation of increments at a resolution critical to understanding and evaluating benefits. As the range of anticipated benefits of habitat improvement measures (SIs presented in Tables –7 - 9 below) are focused in shallow and or low velocity areas, an HSI applied through a spreadsheet model would result in an averaging of physical habitat indicator conditions over a defined project area. This process of averaging is suitable for the evaluation of relatively uniform habitat types or project features, as is the case with riparian scrub-shrub and riparian forest. In the case of riverine habitat as evaluated through the juvenile steelhead HSI model, the averaging of depths, velocities, or cover across the full width of a riverine area could result in a single representative value that provides little or no habitat suitability value to the representative species. In other words, a broad scale application of an HSI model can result in a loss of the ability of the model to evaluate changes in microhabitat types. The juvenile steelhead HSI habitat-suitability relationships (SIs) describe a relatively narrow range of suitable depths and velocities. Although a spreadsheet application of the HSI model is not technically limited to a broad scale application, it is impractical to design a highly spatially detailed application of an HSI model without the support of a GIS program to manage data. ArcGIS will facilitate the evaluation of habitat suitability across a grid of fine scale, discrete locations, such that the anticipated ecosystem benefits that occur across a narrow range of habitat conditions would not be averaged out of consideration by areas of unsuitable habitat conditions. Furthermore, ArcGIS would facilitate the added complexity by providing a framework for managing the large data sets and synthesizing that fine scale analysis in a single output.

Specific application of the assessment approach in ArcGIS is summarized below.

4.0 Ecosystem Output Calculations

The process by which ecosystem outputs is calculated is summarized briefly below:

1. Develop inputs for each physical habitat variable (i.e., vegetation and hydraulic parameters included in each representative species HSI model)

2. Calculate the relative habitat suitability for each physical habitat variable type through the application of SIs.
3. Calculate the total habitat suitability value of each key habitat type by combining the habitat suitability for each physical habitat variable through application of HSI model formulas.
4. Calculate habitat units for each key habitat type by multiplying habitat suitability for each key habitat type by the corresponding area.
5. Calculate flow weighted average habitat units for each key habitat type based on frequency of occurrence of flows.
6. For each increment, calculate total habitat units as the sum of habitat units for each key habitat type. Habitat units for FWOP and FWP conditions are calculated separately.
7. Calculate average annual habitat units (AAHUs) for FWOP and FWP using the IWR Planning Suite Annualizer Tool. Annualization requires that habitat units for FWOP and FWP conditions (steps 1 – 5) be calculated for key years of analysis (i.e., 0, 1, 5, 15, 25, and 50). For the purpose of this evaluation, the preceding steps did not account for variation in habitat value from initial impacts or benefits that may occur during the period of construction of project features. In Step 7, the effect of the construction period on overall annualized benefits (over a period of 50 years) was incorporated into the analysis by offsetting the start of benefits (as represented by year 0), by the anticipated duration of construction.
8. Calculate ecosystem output as the difference between FWP and FWOP AAHUs.

Following is a more detailed outline of the ecosystem output calculation process (Figure 11). The full calculation of ecosystem outputs for the YRERFS involves a large number of assumptions in the development of inputs as well as the specific process-related calculations applied in ArcGIS. Therefore this document will only outline the process at a broad level of detail necessary to understanding the general process by which habitat units and ecosystem output would be calculated. Some additional context and detail is described in subsequent sections for each key habitat type.

- Step 1 will involve the development of inputs for relevant physical habitat variables. These physical habitat variables will be evaluated in later steps for relative suitability for representative species. Step 1 processes will be conducted in ArcGIS.
- The inputs required for this analysis include those variables that correspond to HSCs for the representative species HSI models. For the riverine key habitat type/juvenile steelhead HSI, HSC include depth, velocity, and cover. For the riparian scrub-shrub habitat type/yellow warbler HSI, HSCs include vegetation type, canopy height, and canopy cover. For the riparian forest habitat type/downy woodpecker HSI, HSCs include basal area. The specific development of inputs is detailed in the Engineering Appendix for the YRERFS and summarized below. At a minimum all inputs must be developed to evaluate FWOP and FWP conditions (including various flow scenarios) and key analysis years following construction (0, 1, 5, 15, 25, 50).
- Riverine habitat type inputs will include depth, velocity, and cover. FWOP and FWP depth and velocity inputs will be developed through hydraulic modeling. FWOP

hydraulic modeling will be based on an existing terrain digital elevation model (DEM) developed in support of the Yuba River Development Plan (YRDP) (YCWA 2013b). FWP hydraulic modeling will be based on a terrain model modified from the existing terrain DEM to include proposed features. FWOP cover inputs will be developed from existing information developed in support of the YRDP. FWP cover inputs will be developed by modifying the FWOP inputs as described in the Engineering Appendix.

- Riparian scrub-shrub habitat type inputs will include vegetation type, canopy height, and canopy cover. FWOP inputs will be developed from existing information developed in support of the YRDP (YCWA 2013a). FWP inputs will be developed by modifying the FWOP inputs as described in the attachments to the Engineering Appendix C.
- Riparian forest habitat type inputs will include basal area. FWOP inputs will be estimated from existing information developed in support of the YRDP (YCWA 2013a). FWP inputs will be developed by modifying the FWOP inputs as described in the attachments to the Engineering Appendix C.
- Additional inputs for defining the spatial extents of analysis will be developed including wetted area extents for modeled flows, upstream and downstream extents of analysis (+500 ft. buffer from project footprint), and lateral extents of analysis at 84,000 cfs flows).
- In general data sets will be developed in an ArcGIS compatible format, generally as a raster or shapefile format. To facilitate calculations in later steps, after initial development and import into the ArcGIS platform, physical habitat input data sets will be converted to raster format. For the purpose of this analysis, rasters were developed with a 3 foot by 3 foot pixel size. Physical habitat input raster data sets detail the specific physical conditions for a given variable at each specific location (pixel).
- Step 2 involves the calculation of relative habitat suitability for each physical habitat variable type through the application of SIs. SIs describe a relationship between a single physical habitat variable and the relative suitability (from 0 to 1) for a species. The SIs for the representative species and corresponding HSCs are described in more detail below (Tables 7 - 9). For this assessment approach the SIs described in Tables 7 – 9 were applied to each corresponding physical habitat input raster using a lookup table function in ArcGIS. The result from this step is the conversion of physical habitat input rasters to a set of SI rasters (grid of suitability values from 0 to 1). At this stage, the set of SI rasters will include separate data for each initial habitat variable (HSC), for FWOP and FWP conditions, for each representative year of analysis (0, 1, 5, 15, 25, 50), and for each modeled flow (750 cfs, 1,850 cfs, and 5,000 cfs).
- Step 3 involves the calculation of total habitat suitability value for each key habitat type by combining the SI rasters for each physical habitat variable through application of HSI model formulas. The HSI model formulas for representative species are described in more detail below. For this assessment approach, the HSI formulas will be used to combine SI rasters utilizing the raster calculator tool in ArcGIS. The result from this step is the combination of individual SI rasters (i.e. for riverine habitat depth SI, velocity SI, and cover SI) into a single HSI raster for each key habitat type. Each cell in the HSI rasters will be representative of the combined suitability (from 0 to 1) for all HSCs for that species model. At this stage, the data set will include separate HSI rasters for each key habitat type (riverine, riparian scrub-shrub, and riparian forest), for FWOP and FWP

conditions, for each representative year of analysis (0, 1, 5, 15, 25, 50), and for each representative modeled flow (750 cfs, 1850 cfs, and 5000 cfs).

- Step 4 involves the calculation of habitat units for each key habitat type by multiplying habitat suitability (HSI raster) by the corresponding area. This process is conducted in ArcGIS through the use of the raster calculator tool in which each cell (HSI value from 0 – 1) is multiplied by its corresponding area (3 foot x 3 foot cell = 9 square feet). The sum of all those values is then divided by 43,560 square feet per acre to represent acre based habitat units. This is the last step conducted in ArcGIS. At this stage, habitat units of each key habitat type (riverine, riparian scrub-shrub, and riparian forest), for FWOP and FWP conditions, for each representative year of analysis (0, 1, 5, 15, 25, 50), and for each representative modeled flow (750 cfs, 1,850 cfs, and 5,000 cfs) will be output to an Excel table.
- Step 5 involves the calculation of weighted average habitat units for each key habitat type. Up to this step, each key habitat type was evaluated under 3 representative flows. Weighting was based on the percentage of observed flows in the 41-year period of record hydrology for ranges of flow that averaged the three targeted flows. The flow range that averaged 750 cfs had a lower boundary of 700 cfs, an upper boundary of 800 cfs, and was observed 49.3 percent of the period of record. The 1,850 cfs average had flows that ranged from 801 cfs to 3,240 cfs and were observed 25.1 percent of the time. The range of flows averaging 5,000 cfs were between 3,241 cfs and the highest observed flow of the period of record. This range of flows occurred 19.3 percent of the time. Habitat units calculated at 750 cfs will be weighted at (0.493). Habitat units calculated at 1,850 cfs will be weighted at (0.251). Habitat units calculated at 5,000 cfs will be weighted at (0.193). The result of this step is a flow weighted habitat unit values for each key habitat type (riverine, riparian scrub-shrub, and riparian forest), for FWOP and FWP conditions, for each representative year of analysis (0, 1, 5, 15, 25, 50).
- Step 6 involves the calculation of total habitat units for each increment. The total habitat units for each increment is equal to the sum of habitat units for riverine, riparian scrub-shrub, and riparian forest key habitat types. This step results in total output (habitat units) for each increment for FWOP and FWP conditions and for each representative year of analysis (0, 1, 5, 15, 25, and 50).
- Step 7 involves the calculation of average annual habitat units (AAHUs) for FWOP and FWP using the IWR Planning Suite Annualizer Tool. AAHUs are calculated as the average output for an increment over a 50 year period of analysis. The inputs for the annualizer tool are the habitat units for each increment under FWOP and FWP for each key year of analysis. The annualizer tool then applies a liner interpolation between habitat units for key years and calculates AAHUs. The result of this step is AAHUs for FWOP and FWP for each increment.
- The final step involves the calculation of ecosystem output as the difference between FWP and FWOP AAHUs.

4.1 Context for the Calculation of Habitat Units for Riverine Key Habitat Type

For the purpose of this analysis the riverine key habitat type is generally defined as any wetted area. The representative species selected for evaluation of this key habitat is the steelhead, juvenile rearing life stage.

4.1.1 Habitat Suitability Criteria

The Juvenile Steelhead HSI model proposed for the YRERFS was adopted from an HSI model developed by YCWA for the Yuba River Development Project (YRDP) (YCWA 2013b). The juvenile steelhead HSI model is represented by the following formula:

$$juvenile\ steelhead\ HSI = (SI_{depth}\ x\ SI_{velocity}\ x\ SI_{cover})^{1/3}$$

Where:

SI_{depth} is the habitat suitability criteria value for depth

$SI_{velocity}$ is the habitat suitability criteria value for velocity

SI_{cover} is the habitat suitability criteria value for cover

YCWA originally developed the juvenile steelhead HSI to facilitate an evaluation of juvenile steelhead habitat in the lower Yuba River across various flow management scenarios. YCWA's juvenile steelhead HSI included HSCs for depth, velocity, and cover. The SIs developed for this model (Figure 12 and Tables 7 through 9) were collected and reviewed for specific applicability on the Yuba River (YCWA 2013b). The final selection of SIs were developed in a collaborative process between YCWA and YRDP Relicensing Participants. Relicensing Participants included Yuba County Water Agency (YCWA); United States Department of Agriculture, Forest Service (USDA-FS); U.S. Fish and Wildlife Service (USFWS); National Marine Fisheries Service (NMFS); U.S. Army Corps of Engineers (USACE); California Department of Fish and Wildlife (CDFW); California State Water Resources Control Board (SWRCB); Placer County Water Agency (PCWA); Pacific Gas & Electric Company (PG&E); and other non-governmental organizations (NGOs). The original SIs were sourced from site-specific curves developed from juvenile rearing data collected in the Yuba River downstream of Englebright Dam by the USFWS (Gard 2010a, 2010b), collaborative curves developed for the Tuolumne River (TRTAC 2010), and supplemental SIs for steelhead/rainbow trout fry and juvenile life stages (Hampton 1988; TRPA 2004; Hardin et al. 2005; USFWS 2011). Consensus was reached with agreement from all YRDP Relicensing Participants involved in the HSC selection process (YCWA 2013).

The juvenile steelhead SI for depth is evaluated in feet and is sensitive from 0 to 15 feet. The juvenile steelhead SI for velocity is evaluated in feet/second and is sensitive from 0 to 4 feet per second. The juvenile steelhead SI for cover includes five structural cover classes: cobble, boulder/riprap, riparian vegetation, and stream wood. Cobble and boulder/riprap classes are measured in particle size (mm). Further documentation regarding the SIs can be found in documentation for the YRDP, Technical Memorandum 7-10 - Instream Flow Downstream of Englebright Dam (YCWA 2013b).

4.1.2 Data Inputs

The input data required for the juvenile steelhead HSI include estimates of depth, velocity, and cover under FWOP and FWP conditions. Depth and velocity estimates were developed using USACE's Hydrologic Engineering Center River Analysis System 2D (HEC-RAS-2D) hydraulic model (Section 3.4). The hydraulic model was developed based on an existing digital elevation model (DEM) developed by YCWA in collaboration with the Yuba Accord River Management Team (YCWA 2013b). For the purpose of this evaluation, existing conditions were adopted to represent FWOP conditions. The existing DEM was used to evaluate depth and velocity under FWOP conditions. Depth and velocity for FWP conditions were evaluated by integrating a modified DEM reflecting physical habitat changes with various enhancement measures (creation of aquatic features including side channels, back waters, bank scalloping, and floodplain lowering). Instream cover estimates for FWOP conditions were developed by leveraging existing vegetation and substrate data sets (YCWA 2013b). Instream cover estimates for FWP conditions were developed by modifying existing data based on measure descriptions.

As discussed above, the Juvenile steelhead HSI model is sensitive within a relatively small range of habitat conditions. It is important to note that the model is also sensitive to relatively small changes in depth and velocity within the optimal range of conditions. This reflects the species preference for relatively narrow range of depths and velocities. The model is not particularly sensitive to variation in substrate or cover, as that habitat variable is only coarsely defined. Because the inputs for depth and velocity are derived from hydraulic modeling (rather than direct measurements) and the Juvenile steelhead HSI model is relatively sensitive to changes in those variables, it is important to discuss the influence that the hydraulic model has in the overall modeling process. Although slight changes in hydraulic modeling outputs would affect the modeled ecosystem benefits, the potential for any inaccuracies in inputs or modeling to affect the overall planning process is extremely limited. All inputs for existing and project conditions evaluated under the Juvenile steelhead HSI model were based on similar assumptions. It is reasonable to expect that any inaccuracy in inputs or modeling would be applied to all evaluated habitat increments in a similar way and would not alter the outcome of a comparison between the formulated alternatives.

4.1.3 Assumptions for the Analysis

***Temporal and Physical Extent of Analysis* –** The value of riverine habitat is dependent on naturally fluctuating conditions. As the water surface elevation and shoreline vary over a range of flows, the extent of the riverine key habitat type would also vary. The primary benefits to riverine habitat will be concentrated in shallower water habitat types, typified by slower velocities and shallower depths. Shallow water habitat tends to be concentrated at the margins of the stream, which would be expected to fluctuate with changing flow conditions; therefore, it is important to incorporate consideration of changing flows into the analysis to better understand anticipated project benefits. This evaluation has incorporated consideration of fluctuating conditions through the evaluation of habitat value across a range of flows. The final calculation of habitat value would be representative of an average (weighted by occurrence of flow) of the evaluated flows. The range of flows selected was based on a reasonable representation of low, medium, and high flows relative to the design objectives of proposed measures and rough distributions of flow occurrence. The flows identified for evaluation were 750 cfs, which is near Yuba Accord prescribed minimum flows in the Lower Yuba River, 1,850 cfs, which is near annual average flow, and 5,000 cfs which approximates bankfull flow. It is important to note here, that as area evaluated as riverine habitat (wetted area) expands under higher flow conditions, areas evaluated as riparian scrub-shrub or riparian forest would be reduced such that for any given location, only a single habitat type/value is evaluated.

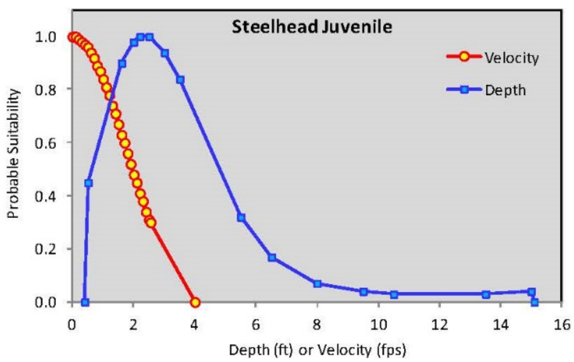

Figure 12. Steelhead habitat suitability for velocity and depth

Table 7. Juvenile Steelhead Suitability Index for Cover

Cover	Suitability Index Value
None	0.30
Cobble	0.50
Boulder/riprap	0.50
Riparian vegetation	1.00
Stream wood	1.00

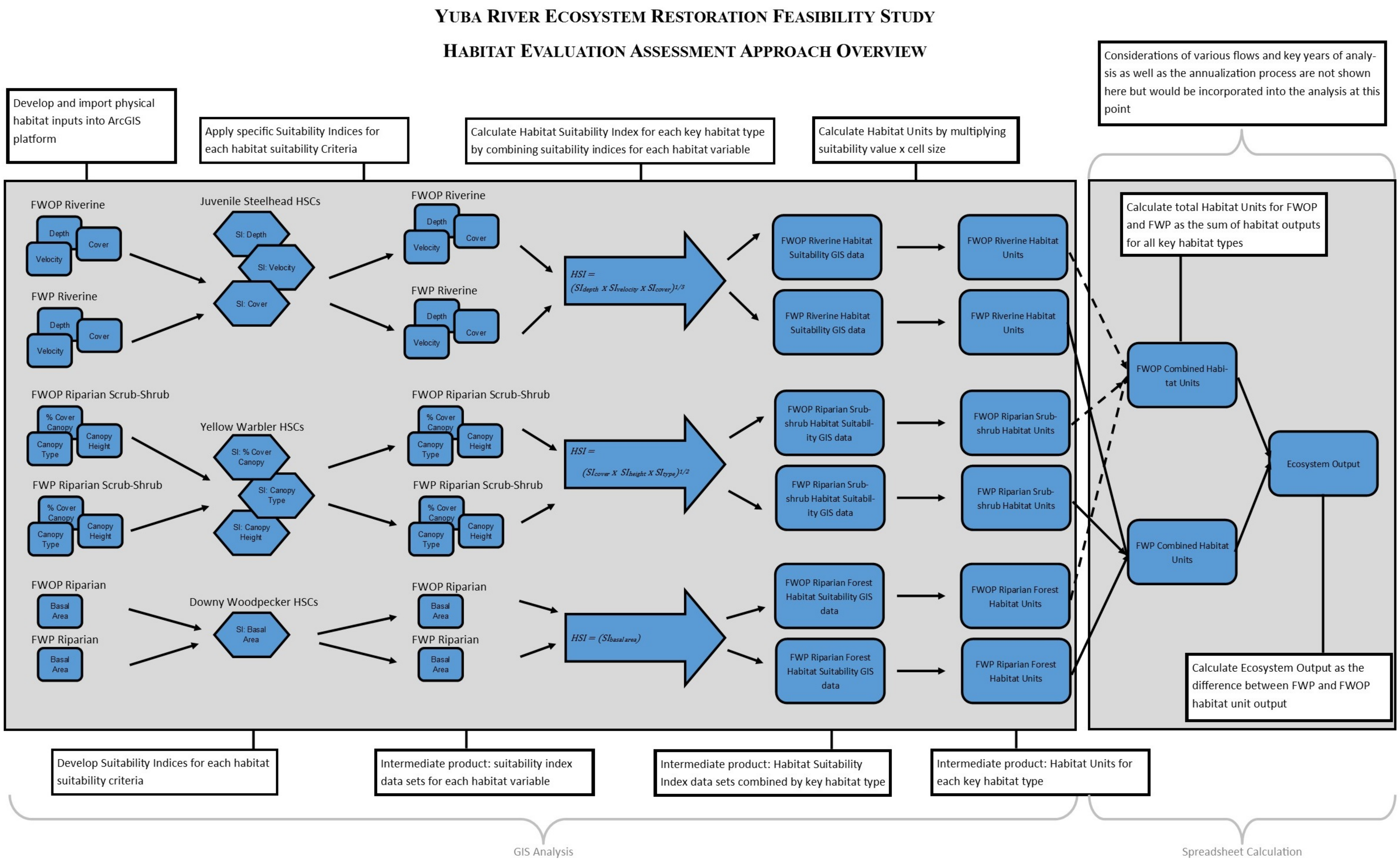

Figure 11. Ecosystem Output Assessment Approach Flow Chart

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Table 8. Juvenile Steelhead Suitability Index for Depth

Depth (feet)	Suitability Index Value
0.40	0.00
0.50	0.45
1.60	0.90
2.00	0.98
2.20	1.00
2.50	1.00
3.00	0.94
3.50	0.84
5.50	0.32
6.50	0.17
8.00	0.07
9.50	0.04
10.50	0.03
13.50	0.03
15.00	0.04
15.10	0.00

Table 9. Juvenile Steelhead Suitability Index for Velocity

Velocity (feet/second)	Suitability Index Value
0.00	1.00
0.10	1.00
0.20	0.99
0.30	0.98
0.40	0.97
0.50	0.96
0.60	0.94
0.70	0.92
0.80	0.89
0.90	0.87
1.00	0.84
1.10	0.81
1.20	0.78
1.30	0.74
1.40	0.71
1.50	0.67
1.60	0.63
1.70	0.60
1.80	0.56
1.90	0.52
2.00	0.48
2.10	0.45
2.20	0.41
2.30	0.38
2.40	0.34
2.50	0.31
2.55	0.30
4.00	0.00

This simplification will result in habitat value of some features (i.e., vegetation) transitioning between habitat types under different flow conditions. For example, for a low flow, a patch of willows on the bank would be evaluated as riparian scrub-shrub and under higher flows that vegetation would be evaluated as riverine habitat. While the value of vegetation might be evaluated under different conditions dependent on the flow, ultimately all HSI models provide some evaluation of vegetation (benefits to birds or during inundation benefits to fish as cover) such that the features would be evaluated under all conditions.

4.2 Context for the Calculation of Habitat Units for Riparian Scrub-Shrub Key Habitat Type

For the purpose of this analysis the riparian scrub/shrub key habitat type is defined as vegetated area consisting of hydrophytic vegetation less than 5 meters in height (Schroeder 1982b). The representative species selected for evaluation of this key habitat is the yellow warbler.

4.2.1 Habitat Suitability Criteria

The yellow warbler habitat suitability modeling element includes HSCs for percent deciduous shrub crown cover less than 5 meters, average height of deciduous shrub canopy, and percent of deciduous shrub canopy comprised of hydrophytic shrubs. SIs were developed as part of the Yellow Warbler blue book HEP model (Figure 13 and Tables 10 through 12) (Schroeder 1982b) and is currently approved for use by USACE. The habitat suitability index for the yellow warbler is calculated as a factor of canopy cover, canopy height, and hydrophytic canopy cover based on the following formula:

$$Riparian\ scrub/shrub\ Habitat\ Units = (SI_{canopy\ cover}\ x\ SI_{canopy\ height}\ x\ SI_{hydrophytic\ canopy})^{1/2}$$

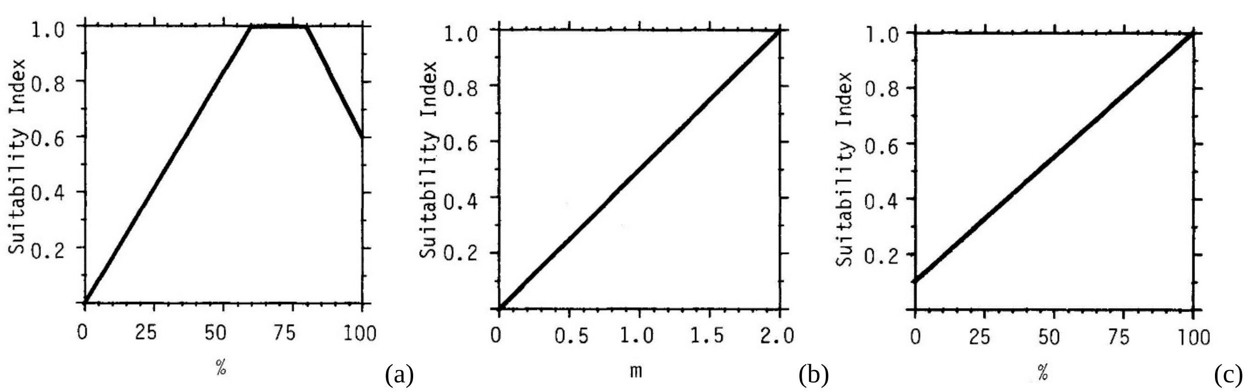

Figure 13. Yellow warbler habitat suitability (a) Percent deciduous shrub crown cover (b) Average height of deciduous shrub canopy (c) Percent of deciduous shrub canopy comprised of hydrophytic shrubs.

Table 10. Percent Deciduous Shrub Cover

% Cover	Suitability Index Value
0	0
25	0.4
50	0.75
60	1.0
80	1.0
90	0.8
100	0.6

Table 12. Percent Canopy Comprised of Hydrophytic Shrubs

% Hydrophytic shrubs	Suitability Index Value
0	0.1
25	0.3
50	0.55
75	0.8
100	1.0

Table. 11 Average Height of Deciduous Shrub Canopy

Canopy Height (m)	Suitability Index Value
0	0
1	0.5
>2	1.0

For the purpose of this assessment approach, functions were developed for the percent deciduous shrub crown cover, average height of deciduous shrub canopy, and percent of deciduous shrub canopy comprised of hydrophytic shrubs Tables 13 – 15).

Table 13. Functions for % Deciduous Shrub Cover

% cover range	Formula
for % cover from 0 to 60%	SI = 0.0167 x % Cover
for % cover from 60 to 80%	SI =1
for % cover from 80 to 100%	SI = (-0.05 x % Cover) + 5

Table 14. Functions for Average Height of Deciduous Shrub Canopy

Average Canopy Height (ft)	Formula
for canopy height from 0 to 6.56ft	SI = 0.1524 x height
for canopy height greater than 6.56ft	SI =1

Table 15. Function for % Canopy Comprised of Hydrophytic Shrubs

% Hydrophytic Cover	Formula
All values	SI = (0.009 x canopy type) + 0.1

4.2.2 Data Inputs

The input data required for this modeling element include the extent of FWOP vegetation and estimates for extent of vegetation under FWP conditions, as well as percent deciduous shrub crown cover less than 5 meters (percent cover), average height of deciduous shrub canopy (height), and percent of deciduous shrub canopy comprised of hydrophytic shrubs (canopy type). For the purpose of this evaluation, existing extents of vegetation were assumed to be representative of FWOP conditions.

FWOP extents of vegetation were developed from existing data developed for the YRDP (TM 6-2 Riparian Habitat Downstream of Englebright Dam, YCWA 2013a). Data included fine scale canopy extents, vegetation type classification, and canopy heights. These data sets were developed through analysis of imagery, LiDAR, and ground based surveys. The existing vegetation extents and attributes were transformed as described in the attachments to the Engineering Appendix C to be suitable for evaluation through the yellow warbler SIs. FWP vegetation extents were developed by modifying the existing vegetation extents based on the descriptions of measures and guidelines developed in the Engineering Appendix C.

4.2.3 Assumptions for the Analysis

***Temporal and Physical Extent of Analysis* –** As stated above, the extent of riparian scrub-shrub habitat is dependent on naturally fluctuating conditions. For the purpose of this evaluation, the spatial extent of the riparian scrub-shrub key habitat type will be defined as any vegetation <5m in height excluding inundated areas under any given flow condition.

Similar to dynamic hydrologic processes, the long term growth of vegetation requires consideration. Both existing and planted vegetation have the potential for long term growth. In general, existing habitat conditions, including terrain and vegetation are assumed to be constant throughout the period of analysis. While terrain modifications are generally assumed to be static following construction for FWP conditions, planted vegetation can be reasonably expected to provide a range of benefits as it establishes and matures over the period of analysis.

The growth of planted vegetation was taken into consideration by applying a simple set of assumptions with regards to relevant HSCs. For the yellow warbler these assumptions included percent cover, height, and canopy type. In general, the anticipated “growth” of these attributes was estimated by referencing existing data for representative years and developing simple regressions to extrapolate data for the key analysis years used in this study (0, 1, 5, 15, 25, and 50). For the purpose of this assessment approach, areas of planted vegetation were defined in an ArcGIS polygon shapefile format. The growth assumptions were then applied to the polygons such that for any given year of analysis, the appropriate estimated variables (% cover, height, and canopy types) would be applied.

An important note is that the simplified assumptions applied to height resulted in estimations for planted vegetation less than 5 meters in early years and greater than 5 meters in later years. This resulted in areas of planted vegetation being evaluated as riparian scrub-shrub in early years and as riparian forest in later years. This is similar to the situation in which changing flows affected the wetted area/extent of riverine vs vegetative habitat types. Although a given area is evaluated as different habitat type under different conditions (analysis years), the project feature (vegetation) will be adequately valued under either habitat type/HSI model and no area of habitat will be double counted.

4.3 Context for Calculation of Habitat Units for Riparian Forest Key Habitat Type

For the purpose of this analysis the riparian forest key habitat type is defined as vegetated area consisting of vegetation greater than 5 meters in height. The representative species selected for evaluation of this key habitat is the downy woodpecker.

4.3.1 Habitat Suitability Criteria

The downy woodpecker habitat suitability modeling element includes HSCs for basal area of forest and number of snags greater than 6 inches. For the purpose of this analysis, only the HSC for basal area will be considered. The HSC for number of snags was not included because: (1) existing information for number of snags was not readily available, (2) there is a lack of data available to reasonably project the number of snags likely to occur within a planted stand of vegetation, (3) the production of snags would be an indirect effect rather than direct effect of riparian planting, and (4) the natural production of snags occurs on a time scale incommensurate with the period of analysis for this study. SIs were developed as part of the Downy Woodpecker blue book HEP model (Figure 14 and Table 16) (Schroeder 1982a) and is currently approved for use by USACE. The HSI for downy woodpecker is equivalent to the suitability criteria value for basal area:

$$Riparian\ Forest\ Habitat\ Units\ = (SI_{basal\ area})$$

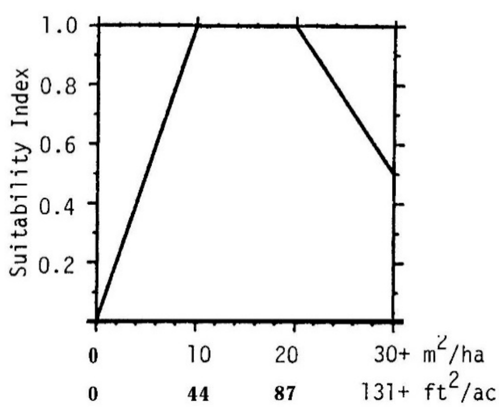

Figure 14. Downy woodpecker habitat suitability for basal area.

Table 16. Basal Area Suitability Index Value

Basal Area (m^2/ acre)	Suitability Index Value
0	0
2	0.2
4	0.4
6	0.6
8	0.8
10	1.0
12	1.0
14	1.0
16	1.0
18	1.0
20	1.0
22	0.9
24	0.8
26	0.7
28	0.6
30	0.5

For the purpose of this assessment approach functions were developed for basal area (Table 17).

Table 17. Functions for Basal Area

Basal Area Range	Formula
for basal area from 0 to 10 (m2/ hectare)	SI = 0.1 x Basal Area
for basal area from 10 to 20 (m2/ hectare)	SI =1
for basal area from 20 to 30 (m2/ hectare)	SI = (-0.05 x Basal Area) + 2
for basal area greater than 30 (m2/ hectare)	SI = 0.5

4.3.2 Data Inputs

The input data required for this modeling element include the extent of FWOP vegetation and estimates for extent of vegetation under FWP conditions, as well as basal area. FWOP extents of vegetation were developed from existing data included in the YRDP's TM 6-2 Riparian Habitat Downstream of Englebright Dam (YCWA 2013a). Existing data used in the development of vegetation extents included fine scale canopy extents, vegetation type classification, and canopy heights. These data sets were developed through analysis of imagery, LiDAR, and ground based surveys. For the purpose of this evaluation, existing extents of vegetation were assumed to be representative of FWOP conditions. The existing vegetation extents and attributes were transformed as described in the attachments to the Engineering Appendix C to be suitable for evaluation through the downy woodpecker HSCs. FWP vegetation extents were developed by modifying the existing vegetation extents based the on descriptions of measures and guidelines developed in the Engineering Appendix C.

4.3.3 Assumptions for the Analysis

Temporal and Physical Extent of Analysis – As stated above, the extent of the riparian forest key habitat type is dependent on naturally fluctuating conditions. For the purpose of this evaluation, the spatial extent of the riparian forest key habitat type will be defined as any vegetation greater than 5 meters in height excluding inundated areas under any given flow condition.

As described above, the long term growth of vegetation requires consideration within the context of the riparian forest key habitat type and the downy woodpecker HSI model. Similar to the yellow warbler HIS model the growth of planted vegetation was taken into consideration by applying a simple set of assumptions for relevant downy woodpecker HSCs. For the downy woodpecker, these assumptions included basal area. The anticipated "growth" of basal area was estimated by referencing existing data for representative years and developing simple regressions to extrapolate data for the key analysis years used in this study (0, 1, 5, 15, 25, and 50). For the purpose of this assessment approach, areas of planted vegetation were defined in an ArcGIS polygon shapefile format. The growth assumptions were then applied to the polygons such that for any given year of analysis, the appropriate estimated variables (basal area) would be applied.

4.4 Annualization of Habitat Units

One of the last steps in developing ecosystem outputs for the CE/ICA is annualization of habitat units. The CE/ICA requires inputs (ecosystem outputs and costs) to be annualized. Annualization of outputs will convert habitat units to AAHUs. First, habitat units for FWOP and FWP will be annualized into AAHUs using the IWR Planning Suite Annualizer Tool. Then as a final step, ecosystem output will be calculated as the difference between FWP and FWOP AAHUs.

To support the annualization process, habitat units would be developed in ArcGIS for key years of analysis (year 0, 1, 5, 15, 25, 50 following construction) for both FWOP and FWP conditions for each habitat increment under consideration. A critical point in developing ecosystem outputs is giving appropriate consideration to construction schedule. In discussing construction schedule, it is important to restate the context for this assessment approach which is to develop ecosystem outputs for increments (distinct actions) rather than alternatives (combinations of increments). Alternatives would be evaluated and formulated through a CE/ICA of costs and ecosystem outputs developed for individual habitat increments.

This distinction is important because in the absence of developed alternatives, assumptions regarding construction schedule were made independently for each increment. The basic assumption for construction schedule applied to each habitat increment is that construction for any given habitat increment would take 3 years. Also is assumed that during the construction period, no net benefits or net impacts would occur and that benefits would begin to accrue in the year following construction. The assumption that no net impacts or benefits would occur during construction is based on the assumption that proposed actions would largely occur out of water and avoid impacts where practical to existing vegetation. Under a more refined analysis, it is likely that some impacts as well as potential benefits would occur during construction years, but these impacts and benefits are unlikely to affect the evaluation of habitat increments within the context of the feasibility study and therefore will not be included in this assessment approach. In practical application the assumption of a 3 year construction period will result in benefits being accrued following in year 4 which will slightly reduce the final calculated AAHUs for FWP conditions. For the purpose of annualization, the habitat units developed for representative years (0, 1, 5, 15, 25, and 50 following construction) will be effectively applied as years (3, 4, 8, 18, 28, and 53).

5.0 Model Review Requirements

The application of the assessment approach will be subject to review as part of the Draft Integrated Feasibility Report/Environmental Assessment (FR/EA); however, additional review and approval of modeling elements will be required as defined in the Corps guidelines for Assuring Quality Planning Models (EC 1105-2-412). Most of the modeling elements proposed for use on this study have been approved or certified for use. The Juvenile Steelhead HSI model will be subject to review by the USACE Ecosystem Restoration Program Center of Expertise

(Eco-PCX) and approval by USACE HQ. The Sacramento District requested and received a one-time approval for use of the modeling elements in the development of ecosystem outputs for the YRERFS.

6.0 Modeling Results

As described above, this assessment approach leveraged the ArcGIS platform to conduct a fine scale HEP analysis over a range of flows which resulted in the majority of the calculations being automated in ArcGIS. To improve transparency of the habitat assessment results, a backcheck of was performed in which intermediate values and calculations (i.e., acreages, average SIs, and Habitat Units prior to annualization) were extracted or extrapolated from the ArcGIS data sets and are discussed below. The methods for the extraction or extrapolation of intermediate data discussed in the following sections should not be confused with the methods described above in section 4.0 Ecosystem Output Calculations. The results used in the CE/ICA were calculated using the method described in Section 4.0 of this TM. The methods described below were used to develop intermediate data that was used to demonstrate the validity of the automated ArcGIS method.

6.1 Area

Area was extrapolated from the ArcGIS data sets developed during the analysis for each habitat increment by key habitat type, flow condition, and key year of analysis (Table 18). Area was extrapolated by identifying all of the cells classified as a particular key habitat type and multiplying that value by 9 ft^2. It is important to note that the data tables below contain a column for “evaluation unit”. In some cases, “evaluation units” were developed within the ArcGIS program to reduce the gaps between features within a Habitat Increment and these units have no consequence for the interpretation of the results. It is also important to note that the areas included in Table 18 are not equivalent to areas associated with the proposed actions elsewhere in the document. The areas in Table 18 are based on areas of evaluation, which were established as large areas to encompass the potential benefits of the proposed features.

6.2 Average Suitability Index

Average SIs were extracted from the ArcGIS data sets developed during the analysis for each habitat increment by key habitat type, flow condition, and key year of analysis (Table 19) Average SIs were calculated by multiplying each cell in the physical habitat data sets (depth, velocity, cover, etc.) by relevant suitability index, then taking the average of all cell of a particular key habitat type.

6.3 Habitat Units

Habitat Units were calculated using the extrapolated data for area and average SI described above. Habitat Units were calculated by multiplying area by average SI for each habitat increment by key habitat type, flow condition, and key year of analysis (Table 20).

6.4 Comparison of Results

Habitat units output by the ArcGIS method are presented in Table 21. The Habitat Units calculated by the backcheck method above were compared to results from the ArcGIS outputs (Table 21). The backcheck demonstrates that the method automated in the ArcGIS platform was successful. This backcheck did result in identification of a discrepancy in the area used to calculate habitat units for habitat increment 2 riparian scrub-shrub key habitat type, at 1,850 cfs under FWOP conditions. The discrepancy resulted in less than a 2% difference in habitat output for each alternative and was considered significant enough to affect plan selection.

6.5 Average Annual Habitat Units

The calculated habitat units were annualized using the IWR Planning Suite Annualized tool for FWOP and FWP conditions. Average Annual Habitat Units were calculated as the difference between FWOP and FWP conditions (Table 23).

Table 23. Summary of Annualized Outputs.

Habitat Increment	Annualized Outputs		**Average Annual Habitat Units (AAHUs)**
	FWOP	**FWP**	
H1	12.7	16.3	**3.6**
H2	7.9	21.9	**14.0**
H3A	34.4	59.2	**24.8**
H5A	31.2	50.6	**19.4**
H5B	39.4	60.7	**21.4**

6.6 Uncertainty in Results and Risk to Study Recommendation

An important component of the discussion of results is understanding the uncertainty in the modeling and the risk of utilizing erroneous results to draw incorrect conclusions and/or support a bad recommendation. This assessment approach includes a variety of modeling components (i.e., hydraulic modeling, terrain modeling, growth assumptions), each with its own set of assumptions that may influence the modeled results.

The primary factors of uncertainty in this modeling approach include assumptions made during the development of inputs and the sensitivity of the modeling components to those inputs. For example, the Juvenile Steelhead HSI model is relatively sensitive to small changes in depth and velocity, which were developed for this study through hydraulic modeling. Therefore, the modeled results are dependent on assumptions used in the hydraulic modeling. For the purpose of this study all inputs were developed in accordance with USACE SMART planning principals, using existing information to the greatest extent possible, and are consistent with the level of detail required to support a feasibility study. All inputs were developed using standardized assumptions and all models were applied equally to all evaluated alternatives. For the purpose of this study, it is reasonable to assume that any potential inaccuracies in assumptions or modeling would not disproportionately affect the modeled results for any particular habitat increment. In other words, although there is inherent uncertainty in the modeled results of this assessment approach, the uncertainty is similar for all evaluated alternatives and is within the expectations for this study.

The primary risk associated with uncertainties in modeling is that ecosystem outputs could be misidentified and as a results a less efficient or less effective plan could be identified. The consequences of this risk are relatively minor, in that the identification of any of the proposed alternatives as the recommended plan would be expected to result in ecosystem benefit. The risk of identifying the wrong plan are further mitigated by the additional refinement of the recommended plan that would be conducted in PED.

Table 18. Summary of Area (acres)

			FWOP			FWP Year 1			FWP Year 5			FWP Year 15			FWP Year 25			FWP Year 50		
			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type		
Habitat increment	Evaluation Unit # (old)	Flow	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest
H1	Evaluation Unit 1	750 cfs	11.5	0.4	4.5	11.5	5.3	4.4	11.5	5.3	4.4	11.5	0.4	7.6	11.5	0.4	7.6	11.5	0.4	7.6
		1850 cfs	11.6	0.4	4.3	11.6	5.3	4.3	11.6	5.3	4.3	11.6	0.4	7.5	11.6	0.4	7.5	11.6	0.4	7.5
		5000 cfs	6.3	0.4	4.1	6.3	5.1	4.0	6.3	5.1	4.0	6.3	0.4	7.2	6.3	0.4	7.2	6.3	0.4	7.2
	Evaluation Unit 2	750 cfs	6.6	5.4	6.0	6.6	7.6	6.0	6.6	7.6	6.0	6.6	5.4	8.3	6.6	5.4	8.3	6.6	5.4	8.3
		1850 cfs	6.1	5.2	5.9	6.1	7.5	5.9	6.1	7.5	5.9	6.1	5.2	8.3	6.1	5.2	8.3	6.1	5.2	8.3
		5000 cfs	3.9	4.8	5.9	3.9	7.0	5.9	3.9	7.0	5.9	3.9	4.8	8.3	3.9	4.8	8.3	3.9	4.8	8.3
H2	Evaluation Unit 3	750 cfs	15.4	5.3	1.2	15.4	26.4	1.2	15.4	26.4	1.2	15.4	5.3	23.8	15.4	5.3	23.8	15.4	5.3	23.8
		1850 cfs	13.5	5.1	1.2	13.5	25.2	1.2	13.5	25.2	1.2	13.5	5.1	22.8	13.5	5.1	22.8	13.5	5.1	22.8
		5000 cfs	7.4	4.0	1.1	7.4	23.0	1.1	7.4	23.0	1.1	7.4	4.0	21.1	7.4	4.0	21.1	7.4	4.0	21.1
H3a	Evaluation Unit 4	750 cfs	28.4	10.7	5.3	28.4	30.2	5.3	28.4	30.2	5.3	28.4	10.7	24.9	28.4	10.7	24.9	28.4	10.7	24.9
		1850 cfs	29.6	10.5	5.3	29.6	29.1	5.3	29.6	29.1	5.3	29.6	10.5	24.0	29.6	10.5	24.0	29.6	10.5	24.0
		5000 cfs	25.0	9.1	5.1	25.0	25.5	5.1	25.0	25.5	5.1	25.0	9.1	21.6	25.0	9.1	21.6	25.0	9.1	21.6
	Evaluation Unit 5	750 cfs	21.8	9.0	2.2	21.8	29.3	1.3	21.8	29.3	1.3	21.8	7.6	23.1	21.8	7.6	23.1	21.8	7.6	23.1
		1850 cfs	20.9	8.9	2.1	20.9	29.2	1.3	20.9	29.2	1.3	20.9	7.5	23.0	20.9	7.5	23.0	20.9	7.5	23.0
		5000 cfs	14.6	8.3	2.1	14.6	28.0	1.3	14.6	28.0	1.3	14.6	7.1	22.2	14.6	7.1	22.2	14.6	7.1	22.2
H5a	Evaluation Unit 8	750 cfs	24.1	8.2	20.1	24.1	40.8	18.9	24.1	40.8	18.9	24.1	6.9	53.1	24.1	6.9	53.1	24.1	6.9	53.1
		1850 cfs	25.0	7.9	19.9	25.0	40.3	18.7	25.0	40.3	18.7	25.0	6.7	52.7	25.0	6.7	52.7	25.0	6.7	52.7
		5000 cfs	20.9	6.7	18.9	20.9	37.8	17.7	20.9	37.8	17.7	20.9	5.5	50.2	20.9	5.5	50.2	20.9	5.5	50.2
H5b	Evaluation Unit 8/9	750 cfs	35.0	18.8	18.6	35.0	52.6	17.2	35.0	52.6	17.2	35.0	16.9	53.9	35.0	16.9	53.9	35.0	16.8	53.9
		1850 cfs	39.6	18.1	18.4	39.6	51.6	16.9	39.6	51.6	16.9	39.6	16.3	53.2	39.6	16.3	53.2	39.6	16.3	53.2
		5000 cfs	32.6	15.4	17.4	32.6	46.9	15.9	32.6	46.9	15.9	32.6	13.7	49.8	32.6	13.7	49.8	32.6	13.7	49.8

Table 19. Summary of Average SI

			FWOP			FWP Year 1			FWP Year 5			FWP Year 15			FWP Year 25			FWP Year 50		
			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type		
Habitat increment	Evaluation Unit # (old)	Flow	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest
H1	Evaluation Unit 1	750 cfs	0.52	0.05	0.50	0.52	0.10	0.50	0.52	0.30	0.50	0.52	0.05	0.71	0.52	0.05	0.71	0.52	0.05	0.50
		1850 cfs	0.44	0.05	0.50	0.44	0.10	0.50	0.44	0.30	0.50	0.44	0.05	0.71	0.44	0.05	0.71	0.44	0.05	0.50
		5000 cfs	0.42	0.05	0.50	0.42	0.10	0.50	0.42	0.30	0.50	0.42	0.05	0.72	0.42	0.05	0.72	0.42	0.05	0.50
	Evaluation Unit 2	750 cfs	0.51	0.10	0.50	0.51	0.09	0.50	0.51	0.17	0.50	0.51	0.10	0.64	0.51	0.10	0.64	0.51	0.10	0.50
		1850 cfs	0.41	0.10	0.50	0.41	0.09	0.50	0.41	0.17	0.50	0.41	0.10	0.64	0.41	0.10	0.64	0.41	0.10	0.50
		5000 cfs	0.40	0.10	0.50	0.40	0.09	0.50	0.40	0.17	0.50	0.40	0.10	0.64	0.40	0.10	0.64	0.40	0.10	0.50
H2	Evaluation Unit 3	750 cfs	0.51	0.31	0.57	0.51	0.13	0.57	0.51	0.32	0.57	0.51	0.31	0.98	0.51	0.31	0.98	0.51	0.31	0.50
		1850 cfs	0.41	0.31	0.58	0.42	0.13	0.58	0.42	0.32	0.58	0.42	0.31	0.98	0.42	0.31	0.98	0.42	0.31	0.50
		5000 cfs	0.41	0.32	0.58	0.44	0.12	0.58	0.44	0.32	0.58	0.44	0.32	0.98	0.44	0.32	0.98	0.44	0.32	0.50
H3a	Evaluation Unit 4	750 cfs	0.52	0.37	0.89	0.53	0.18	0.89	0.53	0.34	0.89	0.53	0.37	0.98	0.53	0.37	0.98	0.53	0.37	0.58
		1850 cfs	0.44	0.37	0.89	0.45	0.18	0.89	0.45	0.34	0.89	0.45	0.37	0.98	0.45	0.37	0.98	0.45	0.37	0.59
		5000 cfs	0.39	0.37	0.90	0.40	0.18	0.90	0.40	0.34	0.90	0.40	0.37	0.98	0.40	0.37	0.98	0.40	0.37	0.59
	Evaluation Unit 5	750 cfs	0.53	0.33	0.98	0.53	0.15	0.99	0.53	0.33	0.99	0.53	0.34	1.00	0.53	0.34	1.00	0.53	0.34	0.53
		1850 cfs	0.46	0.33	0.98	0.46	0.15	0.99	0.46	0.33	0.99	0.46	0.34	1.00	0.46	0.34	1.00	0.46	0.34	0.53
		5000 cfs	0.42	0.33	0.98	0.42	0.15	0.99	0.42	0.33	0.99	0.42	0.34	1.00	0.42	0.34	1.00	0.42	0.34	0.53
H5a	Evaluation Unit 8	750 cfs	0.48	0.39	1.00	0.48	0.13	1.00	0.48	0.33	1.00	0.48	0.39	1.00	0.48	0.39	1.00	0.48	0.39	0.68
		1850 cfs	0.41	0.39	1.00	0.41	0.13	1.00	0.41	0.33	1.00	0.41	0.39	1.00	0.41	0.39	1.00	0.41	0.39	0.68
		5000 cfs	0.40	0.39	1.00	0.41	0.13	1.00	0.41	0.33	1.00	0.41	0.39	1.00	0.41	0.39	1.00	0.41	0.39	0.68
H5b	Evaluation Unit 8	750 cfs	0.52	0.39	1.00	0.52	0.18	1.00	0.52	0.35	1.00	0.52	0.40	1.00	0.52	0.40	1.00	0.52	0.40	0.66
		1850 cfs	0.43	0.39	1.00	0.44	0.18	1.00	0.44	0.35	1.00	0.44	0.40	1.00	0.44	0.40	1.00	0.44	0.40	0.66
		5000 cfs	0.39	0.39	1.00	0.40	0.17	1.00	0.40	0.34	1.00	0.40	0.39	1.00	0.40	0.39	1.00	0.40	0.39	0.66

Table 20. Summary of Habitat Units

			FWOP			FWP Year 1			FWP Year 5			FWP Year 15			FWP Year 25			FWP Year 50		
			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type		
Habitat increment	Evaluation Unit # (old)	Flow	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest
H1	Evaluation Unit 1	750 cfs	6.0	0.0	2.2	6.0	0.5	2.2	6.0	1.6	2.2	6.0	0.0	5.4	6.0	0.0	5.4	6.0	0.0	3.8
		1850 cfs	5.1	0.0	2.2	5.1	0.5	2.1	5.1	1.6	2.1	5.1	0.0	5.3	5.1	0.0	5.3	5.1	0.0	3.7
		5000 cfs	2.6	0.0	2.0	2.6	0.5	2.0	2.6	1.5	2.0	2.6	0.0	5.2	2.6	0.0	5.2	2.6	0.0	3.6
	Evaluation Unit 2	750 cfs	3.4	0.5	3.0	3.4	0.7	3.0	3.4	1.3	3.0	3.4	0.5	5.4	3.4	0.5	5.4	3.4	0.5	4.2
		1850 cfs	2.5	0.5	3.0	2.5	0.7	3.0	2.5	1.3	3.0	2.5	0.5	5.3	2.5	0.5	5.3	2.5	0.5	4.2
		5000 cfs	1.5	0.5	3.0	1.5	0.7	3.0	1.5	1.2	3.0	1.5	0.5	5.3	1.5	0.5	5.3	1.5	0.5	4.1
H2	Evaluation Unit 3	750 cfs	7.8	1.7	0.7	7.8	3.4	0.7	7.8	8.5	0.7	7.8	1.7	23.3	7.8	1.7	23.3	7.8	1.7	12.0
		1850 cfs	5.6	1.6	0.7	5.6	3.3	0.7	5.6	8.1	0.7	5.6	1.6	22.3	5.6	1.6	22.3	5.6	1.6	11.5
		5000 cfs	3.0	1.3	0.6	3.3	2.8	0.6	3.3	7.4	0.6	3.3	1.3	20.6	3.3	1.3	20.6	3.3	1.3	10.6
H3a	Evaluation Unit 4	750 cfs	14.9	3.9	4.7	14.9	5.5	4.7	14.9	10.2	4.7	14.9	3.9	24.3	14.9	3.9	24.3	14.9	3.9	14.5
		1850 cfs	13.2	3.8	4.7	13.3	5.3	4.7	13.3	9.9	4.7	13.3	3.8	23.4	13.3	3.8	23.4	13.3	3.8	14.0
		5000 cfs	9.6	3.3	4.6	10.0	4.7	4.6	10.0	8.7	4.6	10.0	3.3	21.1	10.0	3.3	21.1	10.0	3.3	12.8
	Evaluation Unit 5	750 cfs	11.4	3.0	2.1	11.4	4.3	1.3	11.4	9.6	1.3	11.4	2.6	23.0	11.4	2.6	23.0	11.4	2.6	12.1
		1850 cfs	9.6	3.0	2.1	9.6	4.3	1.3	9.6	9.5	1.3	9.6	2.5	22.9	9.6	2.5	22.9	9.6	2.5	12.1
		5000 cfs	6.1	2.8	2.1	6.2	4.1	1.3	6.2	9.1	1.3	6.2	2.4	22.2	6.2	2.4	22.2	6.2	2.4	11.7
H5a	Evaluation Unit 8	750 cfs	11.6	3.2	20.0	11.6	5.4	18.9	11.6	13.6	18.9	11.6	2.7	53.1	11.6	2.7	53.1	11.6	2.7	36.0
		1850 cfs	10.2	3.1	19.8	10.2	5.3	18.7	10.2	13.4	18.7	10.2	2.6	52.6	10.2	2.6	52.6	10.2	2.6	35.6
		5000 cfs	8.3	2.6	18.8	8.5	4.7	17.7	8.5	12.6	17.7	8.5	2.2	50.2	8.5	2.2	50.2	8.5	2.2	33.9
H5b	Evaluation Unit 8/9	5001 cfs	18.2	7.3	18.6	18.3	9.6	17.2	18.3	18.2	17.2	18.3	6.7	53.9	18.3	6.7	53.9	18.3	6.7	35.5
		5002 cfs	17.1	7.1	18.4	17.2	9.3	16.9	17.2	17.8	16.9	17.2	6.4	53.2	17.2	6.4	53.2	17.2	6.4	35.0
		5003 cfs	12.7	6.0	17.3	13.1	8.1	15.9	13.1	16.1	15.9	13.1	5.4	49.8	13.1	5.4	49.8	13.1	5.4	32.8

Table 21. Summary of Habitat Units Output by ArcGIS

			FWOP			FWP Year 1			FWP Year 5			FWP Year 15			FWP Year 25			FWP Year 50		
			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type		
Habitat increment	Evaluation Unit # (old)	Flow	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest
H1	Evaluation Unit 1	750 cfs	6.0	0.0	2.2	6.0	0.5	2.2	6.0	1.6	2.2	6.0	0.0	5.4	6.0	0.0	5.4	6.0	0.0	3.8
		1850 cfs	5.1	0.0	2.2	5.1	0.5	2.1	5.1	1.6	2.1	5.1	0.0	5.3	5.1	0.0	5.3	5.1	0.0	3.7
		5000 cfs	2.6	0.0	2.0	2.6	0.5	2.0	2.6	1.5	2.0	2.6	0.0	5.2	2.6	0.0	5.2	2.6	0.0	3.6
	Evaluation Unit 2	750 cfs	3.4	0.5	3.0	3.4	0.7	3.0	3.4	1.3	3.0	3.4	0.5	5.4	3.4	0.5	5.4	3.4	0.5	4.2
		1850 cfs	2.5	0.5	3.0	2.5	0.7	3.0	2.5	1.3	3.0	2.5	0.5	5.3	2.5	0.5	5.3	2.5	0.5	4.2
		5000 cfs	1.5	0.5	3.0	1.5	0.7	3.0	1.5	1.2	3.0	1.5	0.5	5.3	1.5	0.5	5.3	1.5	0.5	4.1
H2	Evaluation Unit 3	750 cfs	7.8	1.7	0.7	7.8	3.4	0.7	7.8	8.5	0.7	7.8	1.7	23.3	7.8	1.7	23.3	7.8	1.7	12.0
		1850 cfs	5.6	0.2	0.7	5.6	3.3	0.7	5.6	8.1	0.7	5.6	1.6	22.3	5.6	1.6	22.3	5.6	1.6	11.5
		5000 cfs	3.0	1.3	0.6	3.3	2.8	0.6	3.3	7.4	0.6	3.3	1.3	20.6	3.3	1.3	20.6	3.3	1.3	10.6
H3a	Evaluation Unit 4	750 cfs	14.9	3.9	4.7	14.9	5.5	4.7	14.9	10.2	4.7	14.9	3.9	24.3	14.9	3.9	24.3	14.9	3.9	14.5
		1850 cfs	13.2	3.8	4.7	13.3	5.3	4.7	13.3	9.9	4.7	13.3	3.8	23.4	13.3	3.8	23.4	13.3	3.8	14.0
		5000 cfs	9.6	3.3	4.6	10.0	4.7	4.6	10.0	8.7	4.6	10.0	3.3	21.1	10.0	3.3	21.1	10.0	3.3	12.8
	Evaluation Unit 5	750 cfs	11.4	3.0	2.1	11.4	4.3	1.3	11.4	9.6	1.3	11.4	2.6	23.0	11.4	2.6	23.0	11.4	2.6	12.1
		1850 cfs	9.6	3.0	2.1	9.6	4.3	1.3	9.6	9.5	1.3	9.6	2.5	22.9	9.6	2.5	22.9	9.6	2.5	12.1
		5000 cfs	6.1	2.8	2.1	6.2	4.1	1.3	6.2	9.1	1.3	6.2	2.4	22.2	6.2	2.4	22.2	6.2	2.4	11.7
H5a	Evaluation Unit 8	750 cfs	11.6	3.2	20.0	11.6	5.4	18.9	11.6	13.6	18.9	11.6	2.7	53.1	11.6	2.7	53.1	11.6	2.7	36.0
		1850 cfs	10.2	3.1	19.8	10.2	5.3	18.7	10.2	13.4	18.7	10.2	2.6	52.6	10.2	2.6	52.6	10.2	2.6	35.6
		5000 cfs	8.3	2.6	18.8	8.5	4.7	17.7	8.5	12.6	17.7	8.5	2.2	50.2	8.5	2.2	50.2	8.5	2.2	33.9
H5b	Evaluation Unit 8/9	750 cfs	18.2	7.3	18.6	18.3	9.6	17.2	18.3	18.2	17.2	18.3	6.7	53.9	18.3	6.7	53.9	18.3	6.7	35.5
		1850 cfs	17.1	7.1	18.4	17.2	9.3	16.9	17.2	17.8	16.9	17.2	6.4	53.2	17.2	6.4	53.2	17.2	6.4	35.0
		5000 cfs	12.7	6.0	17.3	13.1	8.1	15.9	13.1	16.1	15.9	13.1	5.4	49.8	13.1	5.4	49.8	13.1	5.4	32.8

Table 22. Comparison of Habitat Units Output by Backcheck Method vs. ArcGIS Method

			FWOP			FWP Year 1			FWP Year 5			FWP Year 15			FWP Year 25			FWP Year 50		
			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type			Key Habitat Type		
Habitat increment	Evaluation Unit # (old)	Flow	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest	Riverine	Riparian Scrub-Shrub	Riparian Forest
H1	Evaluation Unit 1	750 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1850 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5000 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Evaluation Unit 2	750 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1850 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5000 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H2	Evaluation Unit 3	750 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1850 cfs	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5000 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H3a	Evaluation Unit 4	750 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1850 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5000 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Evaluation Unit 5	750 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1850 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5000 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H5a	Evaluation Unit 8	750 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1850 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5000 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H5b	Evaluation Unit 8/9	750 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		1850 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		5000 cfs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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7.0 References

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Environmental Appendix D
Attachment 9a

Notice of Intent

Yuba River Ecosystem Restoration Feasibility Study

Prepared By:

U.S. Army Corps of Engineers

Sacramento District

November 2017

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BILLING CODE: 3720-58

DEPARTMENT OF DEFENSE

Department of the Army, Corps of Engineers

Notice of Intent to Prepare an Integrated Feasibility Report & Draft Environmental Impact Statement for the Yuba River, California, Ecosystem Restoration Feasibility Study

AGENCY: Department of the Army, U.S. Army Corps of Engineers; DOD.

ACTION: Notice of Intent.

SUMMARY: The U.S. Army Corps of Engineers, Sacramento District (Corps), intends to prepare an integrated Feasibility Report & Draft Environmental Impact Statement (DEIS) for the Yuba River Ecosystem Restoration Feasibility Study. The Corps will serve as the lead agency for compliance with the National Environmental Policy Act. The Yuba County Water Agency (YCWA) will serve as the non-federal sponsor. The feasibility study is evaluating opportunities for ecosystem restoration in the Yuba River watershed, located in portions of Sierra, Placer, Yuba, and Nevada counties.

DATES: Written comments should be submitted by November 9, 2015.

ADDRESSES: Written comments should be sent to U.S. Army Corps of Engineers, Sacramento District, Attn: Michael Fong, CESPK-PD-RP, 1325 J Street, Sacramento, CA, 95814-2922.

FOR FURTHER INFORMATION CONTACT: Questions about the feasibility study and the DEIS may be addressed to U.S. Army Corps of Engineers, Sacramento District, Attn: Michael Fong, CESPK-PD-RP, 1325 J Street, Sacramento, CA, 95814-2922 or submitted by e-mail to *Michael.R.Fong@usace.army.mil.* Requests to be placed on the mailing list should also be sent to this address.

SUPPLEMENTARY INFORMATION:

1. *Study Purpose*. The Corps, in cooperation with YCWA, is conducting a cost-shared feasibility study to identify and respond to problems and opportunities associated with ecosystem restoration in the Yuba River watershed. The authority to study the Sacramento River Basin, including the Yuba River watershed, for flood control and allied purposes, was granted in the Rivers and Harbors Act of 1962, Public Law 87-874, Section 209. A reconnaissance study of ecosystem restoration opportunities in the Yuba River watershed was conducted in 2014 under the authorization of the Energy and Water Development Appropriations Act of 2014, Division D of Public Law 113-76, the Consolidated Appropriations Act, 2014. The Civil Works study process provides a systematic and rational framework for developing and analyzing alternative plans. This feasibility study will be conducted under the SMART Planning framework, an efficient, risk-informed process.

2. *Study Area.* The Yuba River Watershed is located in northern California on the western slopes of the Sierra Nevada Mountain Range. The watershed encompasses 1,340 square miles in portions of Sierra, Placer, Yuba, and Nevada counties. The Yuba River is a tributary of the Feather River which, in turn, flows into the Sacramento River near the town of Verona, California. The study area begins in the city of Marysville and extends upstream approximately 90 miles, past Sierra City, California, in Sierra County.

The Yuba River flows through forest, foothill chaparral, and agricultural lands. Levees are absent from most of its course except for near the river's confluence with the Feather River. At that point, the Yuba River is bounded by setback levees for approximately six miles.

The primary watercourses of the upper Yuba River watershed are the South, Middle, and North Yuba rivers. The Middle Yuba River flows into the North Yuba River and together they are referred to as the upper Yuba River. Current conditions in the Yuba River watershed are largely defined by the legacy of historic gold mining and presence of dams.

3. *Scoping Process.* A series of public Scoping meetings will be held in October and November 2015 to present information and receive comments from the public. These meetings are intended to initiate the process to involve concerned individuals, non-governmental organizations, interested parties, and local, State, and Federal agencies. Public Scoping meetings will be held as follows:

Meeting #1 – Wednesday, October 28, 2015, 1:00pm – 3:00pm at John E. Moss Federal Building Stanford Room (650 Capitol Mall, Sacramento, CA 95814).

Meeting #2 – Thursday, October 29, 2015, 5:00pm – 7:00pm at Nevada County Library Community Room (980 Helling Way, Nevada City, CA 95959).

Meeting #3 – Wednesday, November 4, 2015, 5:00pm – 7:00pm at Yuba County Government Center Marysville and Wheatland Conference Room (915 8th Street, Marysville, CA 95901).

Significant issues to be analyzed in depth in the integrated Feasibility Report & DEIS include effects on hydraulics, wetlands and other waters of the U.S., vegetation and wildlife resources, special-status species, aesthetics, cultural resources, recreation, land use, fisheries, water quality, air quality, noise, transportation, socioeconomics, and cumulative effects of related projects in the study area.

The Corps will coordinate with State and Federal resource agencies in order to comply with all pertinent environmental laws, regulations, and policies. Moreover, the Corps will coordinate with effected Native American Tribes to address their concerns and to ensure compliance with all applicable Federal statutes, executive orders, and Corps policies.

4. *Availability.* The integrated feasibility report & DEIS is scheduled to be available for public review and comment in December 2016. A 45-day public review period will be provided for individuals and agencies to review and comment on the DEIS. All interested parties are encouraged to respond to this notice and provide a current address if they wish to be notified of the DEIS circulation.

SEP 28 2015

Date:

for Michael J. Farrell
COL, U.S. Army
District Commander

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Environmental Appendix D
Attachment 9b

Response to Public Comments

Yuba River Ecosystem Restoration Feasibility Study

Prepared By:

U.S. Army Corps of Engineers

Sacramento District

October 2018

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Contents

Introduction.......... D9b-5
Major Thematic Concerns.......... D9b-5
Topic 1 - Plan Formulation - Daguerre Point Dam Fish Passage.......... D9b-6
Topic 2 – Life Safety.......... D9b-7
Topic 3 – Scope of the recommended plan.......... D9b-7
Topic 4 – US Army Corps of Engineers Study Authority and Responsibilities.......... D9b-8
Topic 5 - Habitat Measure Design, Risk, and Resiliency.......... D9b-9
Topic 6 – Potential Impacts Related to Mercury.......... D9b-11
Individual Comments and Responses.......... D9b-17
Responses to Public Comments Received on the Draft FR/EA.......... D9b-19

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Introduction

This attachment documents the responses to public and agency comments received during the public comment period on the Yuba River Ecosystem Restoration (YRER) draft Interim Feasibility Report/ Environmental Assessment (FR/EA).

The draft FR/EA was circulated for public review for a 45 day period (January 08, 2017 - February 23, 2018). Letters were sent to interested parties notifying them of the availability of the document and the time and location of public workshops. Public workshops were held in locations within the project area, including:

- Marysville - Tuesday, January 16, 2018, 5:00pm - 7:00pm at the Yuba County Government Center Marysville, Wheatland Conference Room (915 8th Street, Marysville, CA 95901).
- Sacramento - Monday January 22, 2018, 1:00 pm - 3:00 pm at John E. Moss Federal Building, Stanford Room (650 Capitol Mall, Sacramento, CA 95814).

An electronic version of the draft FR/EA was made available for download on the Sacramento District, Corps of Engineers website (http://www.spk.usace.army.mil/Missions/EnvironmentalProjects/Yuba-River-Eco-Study/). Hard copies of the final draft FR/EA were provided to area libraries, including:

- Sacramento Public Library Central Branch - 828 I Street, Sacramento, CA 95814
- Nevada County Public Library - 980 Helling Way, Nevada City, CA 95959
- Yuba County Library- 303 Second Street, Marysville, CA 95901
- Downieville Branch Library- 318 Commercial Street, Downieville, CA 95936

All comments received during the public review period were considered and incorporated into the final FR/EA, as appropriate.

Major Thematic Concerns

Each public comment was reviewed and addressed. The full record of response to comments is included in the following section of this appendix. To facilitate a better understanding of the major thematic comments received during the public review, comments with the same or related concerns were grouped together to develop representative "concern statements". The concern statement summarizes the main points or common themes expressed across one or more substantive comments. Such statements are derived from and supported by quotes from original correspondence. Each statement is worded to give decision makers a clear sense of the concern and what if any action is being requested. Public concern statements are also intended to help guide the reader to comments on specific topics of interest. They do not replace the actual comments received from individuals. Rather, concern statements should be considered as one means of accessing information contained in original public comments. Responses were developed for each major thematic concern and where appropriate, responses to individual comments point the reader back to the responses in this section. These major thematic comments are addressed below in no particular order.

Topic 1 - Plan Formulation - Daguerre Point Dam Fish Passage

Concern Statement: Extensive study has been conducted on the condition of fish passage at Daguerre Point Dam and there is more than enough information to evaluate and recommend a fish passage improvement action at Daguerre Point Dam.

> *Comment JJ - "However, the reasoning that I have been provided to justify the exclusion of a step pool is difficult to rationalize, at best. Throughout our discussions, the Corps has maintained that there is an insufficient body of scientific information to understand whether Daguerre Point Dam is a barrier to fish passage on the Yuba River. The Corps has stated that the presence of spawning redds above the dam indicate that it may not be a significant barrier to fish passage. It is simply common sense that while the current system of ladders at Daguerre undoubtedly allows some level of passage, a step pool would improve passage for salmon and steelhead and allow better access to the higher quality habitat above the dam for larger numbers of spawning fish."*
>
> *Comment PP - "Army Corps staff have suggested that there is insufficient data to prove that Daguerre Point Dam impedes fish passage. However, fish passage at Daguerre Point Dam has long been documented as an issue for Chinook salmon, steelhead, and sturgeon."*

Response: As part of the feasibility study, USACE and non-Federal partner, the Yuba County Water Agency, have considered step pools and other measures to improve fish passage at Daguerre Point Dam. As described in draft feasibility report (Section 3.4), measures were screened based on their relative efficiency (quantity and quality of habitat restoration compared to costs) and risks to efficiency. The availability of existing fish ladders at Daguerre Point Dam was factored into the efficiency rankings of all measures at Daguerre Point Dam. Although the Daguerre Point Dam step pools measure was among the higher ranked measures, it was found to have higher risks to efficiency and significantly lower efficiency than the top-ranked Lower Yuba River habitat restoration measure. For those reasons, the step pool measure was not carried forward in the study to the most detailed level of evaluation.

For a restoration plan to be recommended, the benefits of the plan must be shown to exceed the costs, which requires quantification of the ecological benefits using a USACE-approved ecosystem model. At Daguerre Point Dam, the extent to which the presence of the dam impairs fish passage has not been defined in a way that would readily support an evaluation of the problem in quantitative terms relevant to the Feasibility Study. Uncertainty in the extent of the problem translates to uncertainty in the potential benefits associated with proposed measures. The evaluation of ecological benefits serves as a critical tool in identifying, recommending, and justifying an ecosystem restoration action under a Corps Feasibility Study authority. In order to quantify ecological benefits that could result from any action at Daguerre Point Dam, additional study would be required to better define and quantify the specific problems at Daguerre Point

Dam, identify specific measures to address those problems, and develop a USACE-approved model to quantify the degree of improvement in ecological outputs those measures would provide. Because of schedule and budget constraints, USACE was not able to pursue those additional studies as part of the current feasibility study.

Topic 2 – Life Safety

Concern Statement: Fish passage improvements at Daguerre Point Dam should consider the potential decrease in hazard to life safety associated with Daguerre Point Dam.

> *Comment III "The Daguerre Point Dam Step Pool Alternative also would save human lives by replacing the current 20-foot drop and hydraulic reversal at the bottom of the dam (which has trapped and drowned people who have passed over the dam) with a series of step pools with relatively small drops."*

> *Comment AAA "Friends of the River urges the Corps to reconsider its Tentatively Selected Plan, and in a revised report, fully address the ecological advantages and safety benefits to kayakers and river rafters if Daguerre Point Dam is removed."*

Response**:** Ensuring public safety is always USACE's highest priority when planning a new project for one of our authorized missions, which include flood risk management, ecosystem restoration, and navigation. To be recommended to Congress for authorization, a proposed project must satisfy specific requirements associated an authorized USACE mission, in addition to meeting general requirements including the protection of public safety. The purpose of the Yuba River feasibility study is to recommend authorization of a new project for ecosystem restoration, while the Congressionally-authorized purpose of Daguerre Point Dam is to retain sediment to protect navigation and reduce flood risk. USACE recognizes that modification of Daguerre Point Dam for ecosystem restoration could also improve public safety, but under USACE policy the improvement of public safety cannot be the main justification supporting the recommendation of a new ecosystem restoration project. A safety issue at an existing project would be appropriately addressed through the use of funds provided for the operation of that project, rather than by authorization of a new project serving a different basic purpose.

Topic 3 – Scope of the recommended plan

Concern Statement: The recommended plan does not go far enough in addressing ecosystem degradation and planning objectives.

Comment WW - "The three types of habitat restoration included in the TSP are necessary, but not sufficient for the USACE to fulfill its duty and accomplish its mission, for several reasons. First, the scale of the actions (178 acres) is not commensurate with the magnitude of the impact of USACE facilities and operations or the scope and scale of ecosystem restoration needs in the Yuba River. Second, the USACE's evasion of the issue of impaired passage is particularly frustrating given the universal recognition of the problem at both Daguerre Point Dam and Englebright Dam, and the immense amount of resources that many stakeholders have devoted to resolving the issue, including co-project lead Yuba County Water Agency. Finally, the Report and TSP do not [include] an approach to evaluating the problem and developing solutions that adequately account for the ecological functions disrupted by USACE facilities and operations, including a functional relationship between the channel and frequently inundated floodplain habitat. As such, the TSP, while implementing useful projects, is unlikely to significantly improve long-term ecosystem conditions."

Comment HHH – "CDFW believes other restoration measures exist that may provide a larger-scale and longer-term benefit to the ecosystem than the preferred Project alternative. The TSP would not resolve some significant issues impairing the ecosystem such as blocked and impaired fish passage and altered hydrologic and sediment transport regimes caused by existing dams"

Response: The feasibility study is an interim response to the full scope of the authority to conduct ecosystem restoration in the Yuba River Watershed. In other words, the proposed alternative does not represent a complete restoration of ecosystem degradation in the Yuba River watershed, rather the study considered various measures to achieve ecosystem restoration and identified the most efficient and effective measures for addressing ecosystem degradation and identified planning objectives. Furthermore, the recommended plan is a complete and independent action that would provide significant benefits to the Yuba River ecosystem without additional measures.

Topic 4 – US Army Corps of Engineers Study Authority and Responsibilities

Concern Statement: The study should have included a fish passage action in the recommended plan because the US Army Corps of Engineers is the only Agency with the authority to improve these structures and it is the Corps' responsibility to address this issue.

Comment PP – "As the feasibility study anticipates, we are disappointed that projects to improve or provide for fish passage at either Englebright Dam or Daguerre Point Dam were not extensively studied during this process. The Army Corps is the only agency with the authority to address fish passage at both Daguerre Point Dam and Englebright Dam, which are identified in the feasibility study as projects that would improve longitudinal connectivity of the Yuba River watershed."

Comment S – "The Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams, and is responsible for this fish passage. Habitat restoration is very important, but the Army Corps should focus its efforts on improving the facilities it owns and is responsible for."

Response: The Feasibility Study was conducted under a broad authority to study the Sacramento River Basin (including the Yuba River Watershed) for flood control and allied purposed, including ecosystem restoration (see Section 1.2 of the Final FR/EA). Under that authority, a variety of potential measures were considered. Nine of initial measures considered in the feasibility study were focused on fish passage improvements at Englebright and Daguerre Point Dams. Based on the information available within the scope of the study, all nine initial measures at the dams were found to have significantly lower efficiency (restoration benefits compared to costs) and higher risks to efficiency than habitat restoration on the lower Yuba River. The objective or priority of a USACE ecosystem restoration project is to identify the National Ecosystem Restoration plan that maximizes benefits compared to costs. For that reason, habitat restoration on the lower Yuba River was carried forward in the study for detailed evaluation.

It is important to note that the study was not conducted as a legal requirement of an existing USACE project or current biological opinion. USACE owns, operates, and maintains Daguerre Point Dam and Englebright Dam at the direction of Congress. At Daguerre Point Dam, USACE non-discretionary activities include maintenance of the existing fish ladders. USACE does not have authority or discretion to modify the physical structures for improved fish passage. USACE does not have authority to modify the physical structure of the dams outside the original project purpose, which is to retain hydraulic mining debris to protect navigation in the Feather and Sacramento Rivers. While the Corps would be involved in modification and removal of the dam, it is not correct that the Corps is the only entity with the authority to address fish passage at the dams. Interested proponents, could propose modification or removal of Daguerre Point Dam or Englebright Dam and seek USACE review and approval through an appropriate process. Additionally, significant modification or removal of either dam could require decommissioning of the dam through congressional action.

Topic 5 - Habitat Measure Design, Risk, and Resiliency

Concern Statement: The habitat restoration measures in the recommend plan are unsustainable and will not result in long term improvements to ecosystem value.

Comment HHH – "Given that environmental changes, such as scouring and changes in river course caused by high flows, that occur in the Yuba River may impact the permanence of restoration projects, it would be more prudent for USACE to address modifications to existing dam facilities for this Project that are not compliant for fish passage (e.g. DPD) in the lower Yuba River. The longevity of conventional habitat *restoration would have a much shorter life span than modifications to DPD. For example, a single high spring flow event could eliminate implemented habitat restoration activities in a matter of minutes, but would not affect river connectivity provided by the removal of DPD."*

Comment U – "A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. By contrast, habitat restoration projects can be "blown out" in a single storm."

Response: Although the Lower Yuba River is dynamic in nature and subject to changes in geomorphology, all measures in the recommended plan are sited on persistent landforms in the Yuba River (e.g. Upper Gilt Edge Bar, Parks Bar, Lower Gilt Edge Bar, First Island, Hidden Island that have persisted through the current regulated flow regime (post 1970, see cbec et al. 2010, HDR 2016). The siting of the habitat measures in the Selected Plan came from three primary references (described below) that included morphologic analyses, modeling, and expert judgment to choose restoration locations.

The Yuba Accord River Management Team (RMT), which includes Yuba County Water Agency (YCWA), California Department of Fish and Game (CDFG), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), the South Yuba River Citizens League (SYRCL), the Bay Institute, Friends of the River, Trout Unlimited, PG&E, and the California Department of Water Resources (DWR), with the collaboration of the Pacific States Marine Fisheries Commission (PSMFC) and University of California at Davis (UC Davis), published siting of side channel restoration locations in RMT (2009) based upon morphological analyses utilizing historical aerial photography for channel alignments, site visits, and expert judgment.

cbec, inc., South Yuba River Citizens League, and McBain & Trush, Inc. utilized flow frequency analyses for the current regulated flow regime (1970-2009) and morphologic analyses based on aerial photography from 1952-2009 and a site visit for proposed bank scalloping, backwater creation, riparian planting, floodplain enhancement (including boulder and woody debris) siting in cbec et al. (2010).

Wyrick and Pasternack (2012) conducted a thorough geomorphic assessment of the Lower Yuba River using digital elevation models and detailed 2D hydrodynamic modeling that was extensively referenced in the hydrologic and geomorphic analysis to support rehabilitation planning by cbec (2013). This report built upon cbec et al. (2010) through use of detailed 2D modeling results and the geomorphic characteristics of the Lower Yuba River to recommend habitat measure sites (including depth to baseflow groundwater assessments to inform floodplain lowering sites/elevations for subsequent riparian planting).

HDR (2016) reviewed several references that recommended restoration activities for the Lower Yuba River including RMT (2009), cbec et al. (2010) and cbec (2013) to generate a list of potential restoration activities and recommend further activities on previously analyzed persistent landforms for USACE and YCWA as part of the USACE Planning Process.

The analyses involved in the siting of the habitat measures in the Recommended Plan are documented in Appendix C – Engineering. Detailed modeling results (including shear rasters at various river flows, substrate data) and the geomorphic characterization results from Wyrick and Pasternack (2012) were used to conduct a risk assessment to the habitat restoration benefits of the Selected Plan and the cost-risk associated with benefit retention over time in Appendix C – Engineering. Risk to project benefits was based on probability and potential severity of damage based on the assessment of available data. Cost-risk was based on risk to benefits, cost of benefit restoration (note, necessarily reconstruction of same measure or at precisely the same site), initial acreage of benefits, reconstruction type, and cost.

Following the feasibility phase, detailed surveying, further hydrodynamic and morphologic modeling, and other technical assessments will be performed prior to the generation of final plans and specifications for habitat restoration measures, should this project be Authorized and appropriated.

Literature Cited for this General Response:

cbec, inc. (cbec). 2013. Hydrologic and Geomorphic Analysis to Support Rehabilitation Planning for the Lower Yuba River from Parks Bar to Marysville. Prepared for the South Yuba River Citizens League with Funding Provided by the Anadromous Fish Restoration Program.

cbec, inc., South Yuba River Citizens League and McBain & Trush, Inc. 2010. Rehabilitation Concepts for the Parks Bar to Hammon Bar Reach of the Lower Yuba River. November 2010. Prepared for the USFWS with Funding Provided by the Anadromous Fish Restoration Program.

HDR (2016). Yuba River Ecosystem Restoration Feasibility Study Habitat Measures, Prepared for the US Army Engineer District Sacramento and Yuba County Water Agency, October 2016.

Yuba Accord River Management Team (RMT). 2009. Appendix M of the Habitat Expansion Agreement for Central Valley Spring-Run Chinook Salmon and California Central Valley Steelhead Final Habitat Expansion Plan Habitat - Expansion for Spring-Run Chinook Salmon and Steelhead in the Lower Yuba River Prepared for the HEA Steering Committee by Members of the Yuba Accord River Management Team.

Topic 6 – Potential Impacts Related to Mercury

Concern Statement: The project does not include adequate avoidance, minimization, or mitigation measures to address potential impacts related to mercury.

> *Comment ZZ – "The Lower Yuba River has been placed on the Clean Water Act Section 303 (d) list due to mercury levels that exceed water quality standards. Water bodies on the 303 (d) list are also referred to as "impaired" waters. Yet this study does not*

succinctly discuss this listing nor appropriate measures to limit release of mercury into the environment."

Comment FFF – "The FR/EA identifies all of the major rivers in the Yuba River watershed as water bodies on the California's Clean Water Act Section 303(d) List; and fish tested for mercury in the tributaries of the Yuba River were the highest in the state (Yuba County, 2015). In regards to the determination of no significant impact on environmental resources, Central Valley Water Board staff does not see sufficient mitigation measures to ensure no significant impact and recommend consideration of additional mitigation measures."

<u>Response</u>: USACE acknowledges that the lower Yuba River's status as a 303 (d) list impaired water is directly related to the presence of mercury in the system and that there are risks to water quality associated with construction activities that may disturb mercury laden sediments and or change conditions in the system that affect the natural methylation process. While USACE acknowledges that mercury is present in the system, the specific concentration of mercury at any of the proposed measures in the recommended plan is unquantified at this time. The recommended plan is similar to projects implemented on the lower Yuba River including the Hallwood Floodplain and Side Channel and Restoration Project and the Yuba River Canyon Restoration Project and it is anticipated that lessons learned from implementation of those projects would be incorporated into the implementation of the recommended plan during PED, resulting in improved benefits and reduced impacts. In the absence of site specific information, the project has incorporated a robust set of commitments to avoid and minimize any potential affects related to the release of mercury as described below.

The potential for release of contaminants will be characterized prior to construction in the PED phase site characterization studies. If unacceptable levels of mercury are identified (to be coordinated with the CVRWQCB) the project would consider appropriate actions, which may include avoiding construction at that location, incorporating additional BMPs, or redesigning the proposed feature.

To reduce potential impacts that may occur during construction, additional avoidance, minimization, and mitigation measures, including monitoring protocols were adopted for the recommended plan based on a previously approved project on the lower Yuba River (Yuba River Canyon Project). Furthermore, a 401 Water Quality Certification will be obtained during PED in coordination with the CVRWQCB and any additional necessary commitments would be incorporated to ensure that the project is compliant with CWA requirements. The additional avoidance, minimization, and mitigation measures are described in section 4.3.7 and are listed below.

- Comply with relevant environmental regulations
    - The project will comply with Section 401 of the Clean Water Act and obtain certification for project-related activities to control sediment from entering the

main river channel during construction. To minimize risk from additional fine sediments, all trucks and equipment will be cleaned away from flowing water.
    - In addition, the proposed project would include preparation and implementation of a SWPPP in compliance with the State Water Resources Control Board's General Permit for Discharges of Storm Water Associated with Construction Activity.
- Minimize potential discharges
    - Straw bales, straw wattles and silt fences would be installed at source sites for each project, as appropriate.
    - Operation of heavy machinery in the active channel would be minimized to avoid disturbance of substrates.
    - The project limits would be clearly demarcated. Erosion control fencing would be placed at the edges of construction where the construction activities are upslope of aquatic habitats to prevent washing of sediments into these features including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets on exposed slopes. All fencing would be installed prior to any construction activities beginning and would be maintained throughout the construction period.
    - Substrates, either obtained onsite or from a commercial source, will be appropriately screened prior to being placed in the river to avoid introduction of fine material into the Yuba River. On-site substrates will be screened and sorted; substrates imported from a commercial source, if necessary, will be clean-washed and of appropriate size.
    - In-stream construction will proceed in a manner that minimizes sediment discharge.
    - In-water work would be minimized. Construction would occur to the greatest extent possible at low flows and "in-the- dry.
- Monitor water quality
    - Turbidity and settleable solids would be monitored according to water quality permits. If acceptable limits are exceeded, work would be suspended until acceptable measured levels are achieved.
    - Throughout the construction period, water quality (turbidity, settleable material, and/or visible construction pollutants) will be monitored as required by Section 401 Regional Water Quality Control Board (RWQCB) certification requirements to ensure that it stays within acceptable limits. This will include regular grab samples to monitor turbidity and settleable material. Construction pace will be slowed and/or stopped if turbidity exceeds criteria established by the RWQCB.
    - Total mercury concentrations from excavated fine sediments (fines) will be evaluated to ensure materials used within the restoration footprint are below or within an acceptable range of natural background levels. Excavated fines will be monitored and tested regularly, following methods in the Stillwater Sciences Mercury Assessment conducted at Merced River Ranch (2004). For construction activities that involve fines, samples will be randomly collected every other day from the 'fines' pile at the processing plant. All samples will be delivered to and analyzed by a qualified laboratory located within driving distance of the project site. The laboratory will supply collection jars and collection methods, and sampling quantities will follow laboratory instructions. Thresholds shall be

established for acceptable mercury levels, in coordination with the RWQCB as a part of the Section 401 permit process; sampling results will be compared to these established thresholds. If fines contain acceptable levels of mercury, they could be placed in upslope areas away from drainages, and used to provide a soil matrix for re-vegetation of riparian species, or to serve as a base above which additional topographic variation is created. If fines are determined to contain mercury above acceptable levels, they may be buried and capped with coarser materials, or hauled off-site for proper disposal, based upon resource agency direction. As laboratory turn-around times are generally short (< 48 hrs.), the monitoring team will obtain approximate real-time information about any potential mercury-related issues. All on-site construction activities involving the use and/or placement of fines will cease, if mercury measurements above established thresholds are observed, to allow for coordination with appropriate resource agencies, for the assessment of contamination potential and the appropriate type(s) of use and/or disposal.

- Maintain clean Equipment
    - Equipment used for the project would be thoroughly cleaned off-site to remove any invasive plant material or invasive aquatic biota prior to use in the action area.
    - Oil and grease used in equipment will be vegetable based.
    - All equipment working within the stream corridor will be inspected daily for fuel, lubrication, and coolant leaks; and for leak potentials (e.g., cracked hoses, loose filling caps, stripped drain plugs); and, all equipment must be free of fuel, lubrication, and coolant leaks.
    - Vehicles or equipment will be washed/cleaned only at approved off-site areas. All equipment will be steam cleaned prior to working within the stream channel to remove contaminants that may enter the river and adjacent lands. All equipment will be fueled and lubricated in a designated staging area located outside the stream channel and banks.
    - All equipment entering the river that has been used in or near other Central Valley rivers would be steam cleaned before it is used to minimize the chance of introducing New Zealand mud snails or other invasive species to the project site.
    - All hazardous materials, such as fuels, oils, solvents, etc., would be stored in sealable containers in designated locations that are at least 100 feet away from drainages or other aquatic habitats. All fueling and maintenance of vehicles and other equipment would occur within designated areas or at least 100 feet away from drainages or other aquatic habitats.
- Avoid disturbance to sensitive resources
    - Environmentally sensitive areas, sensitive plant species and wetland areas would be avoided during project activities to the maximum extent practicable.
    - High visibility fencing would be placed around these areas to minimize disturbance.
    - Soil and excavated material and/or fill material would be stockpiled in existing clearings when possible.
    - During construction operations, stockpiling of construction materials, portable equipment, vehicles, and supplies would be restricted to the designated construction staging areas. To eliminate an attraction to predators, all food-related trash items,

such as wrappers, cans, bottles, and food scraps, would be disposed of in closed containers. Revegetation would occur on all areas temporarily disturbed from construction activities.

- Restore temporarily disturbed areas
  - All access and staging areas would be treated with erosion control measures after project completion each season. Erosion control measures would include placement of erosion control fabric on any upland slopes or ground areas (outside of the active channel) disturbed by equipment travel, coir logs for roadside trapping of fine sediment from the roadway, and hay and straw over other disturbed ground surfaces.
  - All temporary impact areas would be restored to pre-project contour and revegetated.
  - A revegetation plan would be developed to address all temporarily impacted native areas.
- Establish Contingencies
  - A Spill Prevention and Response Plan would be prepared that identifies any hazardous materials to be used during construction; describes measures to prevent, control, and minimize spillage of hazardous substances; describes transport, storage and disposal procedures for these substances; and outlines procedures to be followed in case of a spill of a hazardous material. The Spill Prevention and Response Plan would require that hazardous and potentially hazardous substances stored onsite be kept in securely closed containers located away from drainage courses, agricultural areas, storm drains, and areas where stormwater is allowed to infiltrate. It would also stipulate procedures, such as the use of spill containment pans, to minimize hazard during onsite fueling and servicing of construction equipment. Finally, the Spill Prevention and Response Plan would require that all agencies listed in the Spill Prevention and Response Plan be notified immediately of any substantial spill or release.
  - Spill prevention kits will be in close proximity to construction areas and workers will be trained in their use.

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Individual Comments and Responses

The following pages include a list of public comments received on the draft FR/EA, followed by a table of responses to public comments broken down by salient points.

Public Comments Received on the Yuba River Ecosystem Restoration Feasibility Report/ Environmental Assessment

A	Email from Leslie Roberts
B	Email from Robert Ingram
C	Public Meeting Comment Sheet from Mark Rockwell
D	Public Meeting Comment Sheet from Karl Ronning
E	Public Meeting Comment Sheet from Frank Rivella
F	Public Meeting Comment Sheet from Clayton Barney
G	Public Meeting Comment Sheet from Carrie Monohan
H	Email from Tyrone Gorre & Jack Sanchez
I	Email from Dale Pierce
J	Email from Tim Hutchins
K	Verbal Public Meeting Comment from Tom Johnson
L	Verbal Public Meeting Comment from Izzy Martin
M	Verbal Public Meeting Comment from Bill Thompson
N	Verbal Public Meeting Comment from Alex Keeble-Toll
O	Verbal Public Meeting Comment from Joel Wurm
P	Verbal Public Meeting Comment from Ricky Prows
Q	Verbal Public Meeting Comment from Carrie Monohan
R	Email from Alan Kilgore
S	Email from Jess Swigonski
T	Email from Sean Minard
U	Email from Colin Brown and Susan Schafer
V	Email from Ani Kington
W	Email from David Sussberg
X	Email from Teri Personeni
Y	Email from Kelsey Ewing
Z	Email from Georgia Green
AA	Email from Kalita Todd
BB	Email from Ken Buchanan
CC	Email from Ann Johnson
DD	Email from Maggie Lickter
EE	Email from Janet Tache
FF	Email from John Murphy
GG	Email from Dan Alvey
HH	Email from Tanya Sheya, California Department of Fish and Wildlife
II	Email from Nina Allen
JJ	Email from John Garamendi, U.S. Congress
KK	Email from Cathy Balan
LL	Email from Nina Allen
MM	Email from Kathleen Madeira

NN	Email from Matt Emrick
OO	Email from Chris Shutes, California Sportfishing Protection Alliance
PP	Email from Rachel Hutchinson, South Yuba River Citizens League
QQ	Email from Patricia Weisselberg
RR	Email from Susan Cutuli
SS	Email from Scott Goebl, DWR & PG&E
TT	Email from Betsy Harbert
UU	Email from Rachel Hutchinson, South Yuba River Citizens League
VV	Email from Rachel Hutchinson, South Yuba River Citizens League
WW	Email from Steve Rothert, American Rivers
XX	Email from Matt Brush, Sierra Nevada Conservation
YY	Email from Hans Cole, Patagonia
ZZ	Email from Elizabeth Martin, The Sierra Fund
AAA	Email from Eric Wesselman, Friends of the River
BBB	Email from Mitch Stewart
CCC	Email from Fred Schardt
DDD	Mail from Dale Pierce
EEE	Mail from Sean Minard
FFF	Email from Stephanie Tadlock, Central Valley Regional Water Quality Control Board
GGG	Email from Gary Sprague, National Marine Fisheries Service
HHH	Email from Tanya Sheya, California Department of Fish and Wildlife
III	Email from Curt Aikens, Yuba County Water Agency

Table 1. Responses to Public Comments Received on the Draft FR/EA

Comment	Comment Text	Response
A	The Yuba River Ecosystem Restoration Feasibility Study is nothing but a money-grabbing scam by the environmentalists. There is NO imperative to do this, especially in terrible economic times. These scam artists benefit while the public gets very little in exchange. Shaky science as well. I live near this river system and am always out there; I would hate to see what these out of touch elitist environmentalists would do to the river. LEAVE IT ALONE!!!	Comment noted.
B	Save the tax payers nearly $100, 000, 000 and a colossal waste of time and effort. One 1964, 1987 or 1996 winter event will destroy every penny of your restoration work, guaranteed. You, the Army Corps of Engineers know or should, the Yuba County Water Agency knows or should and regardless you will not appease the environmentalists who don't know and don't care. The federal government sits 20 trillion in debt and heading for 30 trillion and you want to temporarily satiate the enviro-elitists so you can keep your two damn a little longer, spineless and pathetic. Mother Nature will not participate or honor your efforts. Hydraulic mining proved the power of water to detach and move vast amounts of Mother Earth. What do you think another 50 or 100 year event will do to your river and riparian "restoration" efforts? Your minimal, minuscule and feel good manipulation of the river and it's edges will blow downstream faster than Turkey Squirts out a Environmentalist's ass. I remember the uncontrolled power and destruction in the path and wake of the 1964, 1987 or 1996 rain on snow winter burps. Most of the Earth Muffins you are trying make "happy" were not here or if they were, again, don't care, BUT RESPONSIBLE BUREAUCRATS AND MANAGERS OF TAX DOLLARS SHOULD! Don't be another pathetic example of why Trump won the Presidency.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
C-1	The 5 ton 3' diameter boulders to be placed at the head of side channels are way too small. The would be washed out at even lower high flow levels (25,000 cfs) suggest you do at least 20 ton to be able to withstand reasonable common high flows (not extreme flows).	The boulder sizes represented in the study were assumed for the purpose of estimating potential costs associated with the construction of the project. During PED, the design of the proposed measures including boulders, woody material, plantings, and contouring would

Comment	Comment Text	Response
		be refined based on site specific considerations and analyses and designed to maximize sustainability and positive project outcomes.
C-2	Should provide funding for a change of Daguerre point dam from current configuration to a step pool barrier like that being proposed by Teichert Gravel. This would help the fisheries by improving up and downstream migration, and reduce predation on fish by eliminating the current plunge pool below the current dam	Please refer to the discussion of the major thematic concern "Daguerre Point Dam Fish Passage – Plan Formulation" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
D	We noticed that the preferred alternative, alternative 5, includes Habitat Increment 3a and a project at Bar A. Bar A is the same project location for the USFWS AFRP funded Long Bar Project. This appears to be an error that should be resolved. The AFRP Long Bar Project is making progress with 65% designs in draft form. If you would like to discuss the proposed Long Bar Project please get in touch with Rachel Hutchinson - rachel@yubariver.org	Throughout the study, potential actions in the project area were identified and evaluated. Actions that were deemed likely to be constructed were classified as part of the Future Without Project condition and were considered appropriately. The standard for assuming projects are likely to be constructed was the existence of dedicated construction funds. Because the AFRP Long Bar project has not been funded through completion, the study did not assume that the project would be built. However, should the AFRP Long Bar project be completed or receive sufficient construction funding, USACE would reconsider proposed actions in the area and adjust the proposed plan accordingly.
E-1	Build a step pool ladder for fish to pass over Daguerre Point Dam (Teichert Co. Project).	Please refer to the discussion of the major thematic concern "Daguerre Point Dam Fish Passage – Plan Formulation" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
E-2	Stop Putting Large Wood upon the flood plane Below Hwy20. This becomes a hazard for boaters and fisherman-it floats away each year.	The placement of LWD is part of voluntary conservation measures conducted in association with the ongoing maintenance of DPD and is not subject to the outcome of this feasibility study.
F	The fish bypass ladder would consist of three parts. The first part would consist of the confluence of Deer Creek in the Yuba River. The fish run up Deer Creek to an elevation of roughly 500 feet. Second part of the ladder would be to excavate a man made river/canal heading north northwest toward the Yuba River Canyon. In the canal we would make spawning beds with the capability to have hydromanipulation that would stir the gravels as needed. There would be camera systems up and down the entire bypass to monitor. When the fish enter the canyon it will be the third part of the bypass. It will be an engineered elevated canal that will backside of the dam there will be a fish	A similar fish bypass at Englebright Dam was considered (see Description of Initial Measures, section 3.4.2) but was screened from further evaluation because it would have lower efficiency and higher risks for design and construction complexity than other restoration measures that were evaluated.

Comment	Comment Text	Response
	monitoring laboratory directly underneath off to the side of the canal with a clear roof for viewing the fish. The lab would have a computer system camera for tracking tagged salmon and other fish of interest such as lamprey and sturgeon. Engineering a hole through the dam at lake level for the ladder with flood control doors/emergencies would be up to USACE	
G	Submitter dropped off a variety of pamphlets and materials. No specific comment included.	Comment noted.
H-1	Marysville meeting 01/16/2018 6.10pm 915 8th st Marysville CA Native Americans and Sierra Salmon Alliance arrived to locked doors. By 6.40pm security stop us said we were late after a meeting participant had let us in. No time to make statement so on line is all we get. Miwok friends told me about marysville because I just got the army corp letter dated 01/04/18 on 01/019/18 by us mail. 1. You are late to notify participants forcing the general public out of the process. 2. DOA has failed to gain First Peoples participation.	USACE has provided appropriate opportunity for the public to participate in the study. Please see Chapter 7 in the Final FR/EA. The public comment period for the Draft FR/EA was open from January 8th, 2018 to February 23, 2018, providing more than the statutory 30 day review period for an EA. Notification of the availability of the draft document for review and public meetings was disseminated via mail, e-mail, and online social media. The Draft FR/EA was made available for public review via online download and in hard copy in the Sacramento Public Library Central Branch, Nevada County Public Library, Yuba County Library, and Downieville Branch Library. 2 public meetings were held during the public review period in Marysville (1/16, 2018) and in Sacramento (2/2/2018). USACE has further engaged tribal parties through opportunities to comment on the development of the Programmatic Agreement. Please see attached Programmatic Agreement in Cultural Appendix B.
H-2	3. USACE has allowed YCWA to divert there FERC federal energy regulatory commission responsibilities as licenscees to Native TCPs and wild salmon populations.	The Feasibility Cost Share Agreement signed 2 June 2015 is the formal agreement signed by the YCWA to voluntarily serve as the non-Federal sponsor for the study. The non-Federal sponsor is aware that the proposed project may not include any action that is legally required of another entity, including the FERC relicensing process, as described in Section 2.5 of the report. Some habitat restoration features of the Recommended Plan have been adopted from the work of the Lower Yuba River Accord River Management Team, however these features or any other features of the Recommended Plan are not associated with the Yuba River Development Project FERC (#2246) relicensing process.

Comment	Comment Text	Response
H-3	4. USACE has lost the focus of public law 87-874, but should keep lead agency status and start economic options for water system transfers to Bear river, Camp Far West, Beals Air Force Base and volitional salmonids sustainability.	Reallocation of water from non-USACE projects as a primary measure is not within USACE's ecosystem restoration mission because the acquisition of water rights would be a non-Federal responsibility under USACE policy.
I	We wish to comment on the access roads depicted for Habitat Increment 3A (Figure 3-5, page 53, Draft Interim Feasibility Report and Environmental Assessment). There are 2 roads indicated on the North bank of the river. As the owners of both of those roads, we wish to point out that the easterly road is constructed as a residential road unlikely to serve well for construction. The westerly road is the haul road for the existing gravel facility and is preferred. This road is owned by Long Bar Mine LLC and could provide access to the Lower Gilt Bar restoration area to the east. For Long Bar Mine LLC, and for Yuba River Properties. For Long Bar Mine LLC, and for Yuba River Properties.	The easterly route mentioned in the comment was removed from the proposed access routes. Instead the nearest staging areas on the north side of the river will both be access through the westerly route. Please see Chapter 4 for a discussion of staging and access. Appendix C - Engineering Section C-6 Civil Design also discusses assumed staging areas and access/haul routes
J	I would like to comment on the Yuba River restoration study. The lower Yuba has been degraded and became a environmental wasteland from It's long history of gold dredging. Anything that promotes the restoration of this destroyed landscape should be moved forward. The restoration of the rivers salmon and steelhead should be a priority.	Comment noted.
K	My concern is that the mining company Teichert, not so much Knife River -- I live right next to Knife River and they are not very close to the river. Teichert is right next to the river, and they have been mining for several years. But they've taken an enormous amount of aggregate, is what they -- they mine aggregate. And there's probably 800 trucks a day that come out of there mining. Well, there used to be just an enormous amount of old mining tailing that -- the board of the river, that stopped it during high water, that stopped it from coming in the Hallwood area, which is where we live. But now when high water comes, there's only one levy and it consists of hobble walk and small rock, and when the high water comes you can actually see it. In fact, we have pictures of it flowing through the levy, and it floods that whole area where they mine, and it comes down through Hallwood and floods it where it never flooded years and years ago. Like I said, I have been there all my life. I'm 71 years old. I was a	An increase in flood risk is inconsistent with USACE policy for ecosystem restoration projects. Detailed hydraulic analyses and modeling would be conducted during PED to ensure that all design requirements are met, including the requirement to avoid increase to flood risk.

Comment	Comment Text	Response
	young person, we never worried about flooding because there was so much mining material, now it's gone. What I am concerned about is the little bit of material that they have between the river and Hallwood is Very minute. If it ever washes away and there's no real substantial earth or anything holding that berm, if it ever washed away they would never be able to stop that water and the flood could turn out to be very disastrous for all of Hallwood and all the residents of Hallwood. The old channel used to run right through Hallwood and there's not enough capacity to hold all the water. Even if it broke, it would just flood all of Hallwood. It'd be devastating. That's my concern. I don't know if they need to take that into consideration, but we have pictures of it going through those levees and we'd be willing to show them to anybody. During highwater, I mean it's like a regular river coming underground. It floods that area, just to let you know. That's all I have.	
L-1	Thank you for this opportunity to comment. I'm the CEO of The Sierra Fund. The Sierra Fund is working to restore ecosystem resiliency in the Gold Country post gold rush -- especially remediation of legacy gold mining impacts such as mercury contamination of the watershed, as well as the loss of volitional fish passage. You've examined the ecosystem report and our study about this meeting tonight. We're compiling extensive technical comments to be submitted by the deadline. In general, we support the effort to restore habitat in the lower Yuba gold fields as a way to improve fisheries and ecosystems. However, we have some concerns about three issues in the report.	Comment noted.
L-2	One, the overall characterization of sediment retained by Daguerre and Englebright. In terms of potential removal and/or treatment of these sediments, we are concerned about the way that the mercury contaminated sediments are discussed. These sediments, which are both above and below the reservoir, have an important impact on water quality especially, and fish habitat. The impact of this mercury have not been taken take into account in this study, especially where the study suggests the dredging of channels and other activities that will move around these mercury contaminated sediments.	Section 4.3.7 Water Quality in the Affected Environmental and Environmental Effects Chapter 4 of the Final FR/EA discusses the potential effects on water quality related to potential release of mercury for the final array of alternatives. Elemental mercury and methylmercury are known contaminants of concern in the lower Yuba River; however, no concentrations of any material are anticipated at levels that would be classified as Hazardous or acutely Toxic (Appendix C - Phase I Environmental Site Assessment). The potential for release of contaminants will be addressed through pre-

Comment	Comment Text	Response
		construction characterization, monitoring during construction, and adaptive controls. Appendix C, section C-10. Construction Procedures and Water Control Plan discusses some potential controls and Best Management Practices (BMPs) to mitigate risks from contaminant releases during construction. Contaminant concentrations that may be environmentally relevant will be addressed through characterization, monitoring and adaptive controls through the 401 Certification process. Appendix C, section C-21 Special Studies puts forth possible means of mitigating encountered hazardous and toxic materials. It is possible that based on Special Studies, site-specific water quality criteria for mercury will be used to address potential methylmercury effects. In response to a related comment, additional avoidance, minimization, and mitigation measures, including monitoring protocols were adopted for the recommended plan.
L-3	Finally, we have grave concerns about the temperature data in the report. We believe that the Englebright Dam needs to be altered as this is the only effective tool for restoration of volitional fish passage in the watershed. And we think that we have understood from a variety of studies that restoring fish passage at this site is among the most feasible targets for this activity to restore health of the salmon run in the entire state. We urge the army corps to further explore these issues, and we're going to turn in gobs and gobs of data.	Suitability of habitat related to temperature was not used to support habitat quantity calculations in the feasibility report. The screening exercise described in section 3.4.3 used simplified assumptions to estimate potential benefits of management measures. These assumptions were based on the full length of the mainstem river to the uppermost impassible barrier. The outcome of the screening exercise revealed that Englebright Dam Removal had the highest scores for the quality and quantity of habitat restored. However, the USACE National Ecosystem Restoration objective is to reasonably maximize benefits compared to cost, and Englebright Dam Removal also received the highest scores for cost and risk to cost certainty. As a result, the management measure did not compare well with other, more efficient measures.
M	My concern is the flooding. The river now behind Teichert is in the new channel, they call it. If they move it into the old channel, which is right next to Teichert, that's going to mean more flooding for Hallwood. Teichert's moved so much material over the last few years. It used to be rock pile after rock pile, now it's one big flat. There's one little mountain between the river and Hallwood that Teichert left there. They had to leave that there. I have been back there taking pictures of	An increase in flood risk is inconsistent with USACE policy for ecosystem restoration projects. Detailed hydraulic analyses and modeling would be conducted during PED to ensure that all design requirements are met, including the requirement to avoid increase to flood risk.

Comment	Comment Text	Response
	what it's doing. I grew up my whole life out there. I've been there since '51 and I can see the changes that's been made out there, in regards to fish and everything. Fish used to be thick out there. But my opinion too, if they don't do something to the Feather River, the salmon got to come up the Feather River to get to the Yuba River, and it's so soaked up and sanded. It used to keep a good channel therefor the fish to run, they don't do it anymore. I think that had a lot to do with the salmon up there too. My main concern is the flooding. Last year, it got all close to my house last year and I know some friends of mine got water in their house, and we've never got flooded. Like I said, I been there since '50 and now we're starting to get flooding. Every time we get high water, we get flooding. It's just a matter of time before it takes out some homes. That needs to be -- to me that's more important than the fish channel. Teichert has some responsibility for that as far as I am concerned. They know it floods because they got to take their equipment out every winter because all the motors get underwater. I've talked to them too. Okay.	
N	I am the program manager at The Sierra Fund. Master's degree in sociology and Master's in Environmental Sciences, and my comment is related to the time frame that's associated with the restoration plan. I greatly appreciated the presentation and the fact that it did address the historic impacts on the watershed. And I think that knowing what we know about gold rush history, and the fact that over 150 years after hydraulic mining, we're still seeing impact in the lower Yuba, I would urge the army corps and the associated parties to think with a similarly long scope in terms of the restoration efforts. And that -- I understand this is a step in the right direction to do restoration in the lower Yuba. But at The Sierra Fund we would love to see inclusion of possibilities for restoration above Englebright Dam and in the potential 90 miles of stream ridge habitat that are up there. Because I think that if you restore the lower Yuba successfully, which I'm sure based on the effort that's been undertaken so far will be the case, it will not be a terribly long time before you see fish that need additional holding habitat and that need access to even greater potential habitat above Englebright. And that when we're devoting money to doing restoration activities in lower regions, we need to take into consideration the fact that at some point we may need to consider removing Englebright Dam to open up the additional area of habitat, and in doing so would potentially be	Fish passage and dam removal were considered as potential management measures at Englebright Dam, but were screened from further evaluation because they would have lower efficiency and higher risks than other restoration measures that were evaluated. Please review Chapter 3 of the FR/EA for a discussion of the screening of measures and formulation of alternatives. Additionally, the Englebright Dam Removal measure assumed that sediments behind the dam cannot be transported downstream by the river after dam removal. All sediments would be excavated to pre-dam topography before dam removal and disposed of at a dry site above the reservoir. Complete sediment removal is required due to known contamination, including methylmercury, and the sheer volume of sediment that would raise downstream river bed levels, impact habitat, and increase flood risk.

Comment	Comment Text	Response
	negating all of the work and funding that had gone towards that lower Yuba restoration. And if we think about them all within the same scope of planning, then we can have a sense of the order of events that is required to ultimately provide the species with access to 120 miles of the usable habitat instead of just 30.	
O	My concerns are more about the flooding than the fish, and what they are going to do as far as keeping the river from eroding the banks more, above and below this project. Because what the project is, it's not -- there's no danger much of, you know, cutting into a bunch of private property or anybody's house or anything like that. Downriver from it, depending on, you know, what our winters do, there's no way of telling what it's going to do beyond -- you know, after it's finished. Anyway, that's about it. You know what, I got one more. I'm curious as to how they are going to spend $97 million on 160-something acres.	An increase in flood risk is inconsistent with USACE policy for ecosystem restoration projects. Detailed hydraulic analyses and modeling would be conducted during PED to ensure that all design requirements are met, including the requirement to avoid increase to flood risk. Please review the FR/EA for a discussion of the recommended plan, its ecosystem benefits, and associated costs.
P	I'm a Native American and you guys are planning on doing some work on the river and stuff like that, and I'm really sure there are native artifacts wherever you are planning on doing work. So I want to know how are you letting the Native people know about this so that they can be monitors to check what's going on? And if you can, let me know and get back to me so that I could get people to stand firm with guys.	A Programmatic Agreement is being developed that identifies protocols to avoid, minimize, and mitigate for potential effects to cultural and historic resources. Please review Section 4.3.10 for an analysis of the cultural and historic resources in the project area and potential effects from proposed actions. Please review Appendix B - Programmatic Agreements for a description of the proposed protocols for avoiding, minimizing, and mitigating potential effects to cultural and historic resources.
Q-1	My name is Carrie Monohan. I'm the science director at The Sierra Fund and adjunct professor at Chico State and I want to thank you for holding this wonderful event. We will be submitting detailed comments that relate to two things. One is the habitat of stream of Englebright and second is management of mercury contaminated sediment as it pertains to restoration actions in lower Yuba and sediment removal from Englebright. First, previous studies on habitat of stream Englebright have prematurely concluded that there's not sufficient habitat to warrant the whisking of fish passage and removal of Englebright. There is more than 92 miles of river upstream of Englebright with 88 cold water pools, none of which were included in a study that monitored temperature. Specifically TidbiT or temperature thermistors were placed in easy to reach locations where bridges crossed the river and	Suitability of habitat related to temperature was not used to support habitat quantity calculations in the feasibility report. The screening exercise described in section 3.4.3 used simplified assumptions to estimate potential benefits of management measures. These assumptions were based on the full length of the mainstem river to the uppermost impassible barrier. The outcome of the screening exercise revealed that Englebright Dam Removal had the highest scores for the quality and quantity of habitat restored. However, the USACE National Ecosystem Restoration objective is to reasonably maximize benefits compared to cost, and Englebright Dam Removal also received the highest scores for cost and risk to cost certainty. As a result, the management measure did not compare well with other, more efficient measures.

Comment	Comment Text	Response
	the data was extrapolated to represent miles and miles of nearby habitat rather than representing the cold water habitat that fish would use.	
Q-2	Second, we're developing best management practices for sediment removal projects in other mercury impacted reservoirs based on the current and best understanding of mercury fate and transport. We believe that these best management practices should be included in any gravel or sediment moving activities in the lower Yuba, and monitoring should be incorporated in order to better understand the effects of mercury transport.	Additional avoidance, minimization, and mitigation measures, including monitoring protocols were adopted for the recommended plan. Prior to construction, Mercury and Methylmercury will be tested for during PED phase site characterizations and monitored in the river during construction. A 401 Water Quality Certification will be obtained during PED in coordination with the Central Valley Regional Water Quality Control Board to ensure that the project is compliant with CWA requirements.
Q-3	Lastly, after speaking with people today, I understand that the army corps has had to rely on existing studies that were done by others for different reasons. Some of these studies have flaws in them and by using them in this analysis, we're unintentionally propagating that error, and not able to do a fair, imbalanced evaluation of specific actions. In particular a mining engineer that we hired to evaluate the sediment removal costs from behind Englebright using the technical guidelines for environmental dredges of contaminated sediments developed by army corps in 2008 came up with vastly less expensive estimates. And we encourage army corps to evaluate sediment removal as part of this ecosystem feasibility study before precluding the removal of Englebright in their analysis.	Assumptions regarding sediment removal from behind Englebright Dam were adopted from Assessment of Infrastructure and Related Items to Support Anadromous Fish Passage to the Upper Yuba River Watershed (MWH Americas, Inc. March 2013). The major assumption is that sediments behind the dam cannot be transported downstream by the river after dam removal. All sediments would be excavated to pre-dam topography before dam removal and disposed of at a dry site above the reservoir. Complete sediment removal is required due to known contamination, including methyl mercury, and the sheer volume of sediment that would raise downstream river bed levels and increase flood risk.
R-1	I am a member of SYRCL- The South Yuba River Citizens League. I am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. Thank you for the opportunity to provide comments and for the FR/EA. Daguerre Point and Englebright Dams blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the Yuba watershed to spawn. Historically 15% of Spring run Chinook spawned in the Yuba watershed. Damage to the river landscape by historic gold mining has decimated fish habitat. Fish populations in the Yuba River watershed continue to struggle because they do not have access to their historic	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments. The Chief of Engineers has authority to modify projects without further authorization from Congress within strictly defined limits, i.e., as long as the scope of the project, including the function and purpose of the project, and the area served by the project, is not materially changed. The original purpose of Daguerre Point Dam and Englebright Dam was to retain hydraulic mining debris to protect navigation in the Feather and Sacramento Rivers. Modifications outside the scope of the project would require specific authorization by Congress. USACE does not currently have authority to modify the physical structure of Englebright Dam and

Comment	Comment Text	Response
	spawning grounds. These two dams were constructed in response to the massive sediment problem associated with historic hydraulic mining. The Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon by providing access to their historic habitat.	Daguerre Point Dam. Other entities could make changes to the dams after applicable approvals by USACE.
R-2	The FS EA did not consider fish passage by dam removal or dam notching and ladders. While these options have higher initial costs they would have long term benefit. When conducting cost/benefit analysis the value of a healthy population of spring run salmon should be elevated, and the costs of fish passage should be considered over a long term. I believe the FR/EA is incomplete without consideration of these options.	Dam removal was considered as a restoration measure in the feasibility study. Dam modifications such as lowering and notching were considered to be substantively similar in potential costs, benefits, and associated risks, and were evaluated as a conceptual group. Please see Chapter 3.4.2 in the Final FR/EA for a description of the initial measures considered in the feasibility study. The dam notching/lowering conceptual group was screened from further consideration due to high uncertainties in technical feasibility, high potential O&M requirements, and relatively low potential for restoration of habitat. The potential benefits associated with proposed actions were estimated as 'acres of habitat' which provided a common representative unit by which to evaluate dissimilar types of proposed measures [i.e., fish passage (access to existing habitat) vs habitat restoration (physical improvement of habitat)]. The benefits to populations of species were not quantified. The USACE ecosystem restoration mission is focused on improvements to habitat rather than specific species; the management of species and populations is the specific mission of the USFWS and NMFS. Please refer to Chapter 3 for a discussion of the benefits assessment used in the consideration and screening of measures.
R-3	Habitat restoration is very important, and the efforts to improve riparian habitat in the lower Yuba are commendable. However, habitat improvements can be lost in large storms such as experienced in the winter of 2017. While gold mining has profited a few with great wealth, most of society is left with the liability of mercury pollution, habitat degradation, sedimentation. As a society we need to collectively	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	address and correct these problems, rather than letting them linger for centuries.	
S-1	I live in the Yuba River watershed and call this area my home. I recreate in the Yuba River and am a supporter of SYRCL (The South Yuba River Citizens League). I am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. When this study was initiated in 2015, SYRCL and our members asked the Army Corps of Engineers to include actions that would restore salmon populations. We turned out 180 attendees to public meetings and submitted 224 written comments. SYRCL commends the study for focusing on alternatives that will restore habitat in the Lower Yuba River, which is a critical component to restoring fish populations in the Yuba River watershed. However, even though the study describes options for improving fish passage at Daguerre Point and Englebright Dams, it determines that improving or removing these structures is not feasible. I am writing to express that we need to consider these options more fully and include them as possibilities. Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon.	Daguerre Point Dam and Englebright Dam measures were evaluated and screened from consideration based on an estimated lower efficiency and higher risk than other restoration measures that were evaluated. Please review Chapter 3 of the FR/EA for a complete description of the plan formulation process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is beyond the scope of the feasibility study to continue detailed evaluation for measures that are not included in the final array of alternatives. For the purpose of this study, ‘nonviable’ does not confer a determination on the overall feasibility of a particular action, rather ‘nonviable’ refers to measures and alternatives that were determined to be ineligible for recommendation under this study through the plan formulation process. It is also important to note that the this study is an interim response to the authority to conduct ecosystem restoration in the Yuba River watershed and the recommended plan in no way precludes future implementation of any other potential restoration actions in the watershed by any organization.
S-2	The Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams, and is responsible for this fish passage. Habitat restoration is very important, but the Army Corps should focus its efforts on improving the facilities it owns and is responsible for. A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
S-3	Habitat restoration projects can be “blown out” in a single storm. Please consider the removal of Englebright and Daguerre Point Dams as restoration options for the Yuba.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
T	On behalf of RB Satori LP (aka Wilbur) Ranch, MHM Incorporated was asked to review the Draft Interim Feasibility Report and Environmental Assessment – Yuba River Ecosystem Restoration Feasibility Study as it relates to the Wilbur Ranch. Based on this review, Wilbur Ranch supports the project as a whole but believes portions of the Habitat Increments that have been eliminated should be included to protect aquatic and riparian habitat along the lower Yuba River. The Wilbur Ranch consists of numerous parcels, but the parcels located adjacent to the Yuba River are APN 018-140-011, 018-140-015, and 018-240-041. According to the report, Habitat Increment 5C has been eliminated from the study. We would like to request at a minimum that the upper 7,000 feet of the left bank of Habitat Increment 5C be included as part of the study and project. This 7,000 feet of the left bank of the Yuba River has been experiencing ongoing bank erosion and degradation. There is an Oxbow (39°09'47.50" N, 121°33'11.61" W) located in the middle section of this 7,000 feet section that lost over twelve (12) acres and 650,000 cubic yards of material into the Yuba River. A majority of this erosion occurred over a five (5) month period from October 2016 to April 2017. This erosion continues to be ongoing and can be observed in the Google Earth Aerial taken May 18, 2017. In this aerial, the turbidity in the water is noticeable from just upstream of this Oxbow downstream to the Feather River (see exhibit attached of the Yuba River which highlights the area of concern). Using Google Earth historic aerials, the change in the river and loss of bank (Oxbow) from August 22, 2016 to May 18, 2017 is substantial. The erosion of the bank started in early 2016 but accelerated during the winter of 2016/17. The Wilbur Family has farmed this property for over sixty (60) years and previously worked with the California Debris Commission (CDC) to install bank protection, channelization features (rip rap training spurs), tree plantings, rock slope protection, and other features along their ranch to help protect the bank and maintain the Yuba River Channel alignment. Wherever possible, Wilbur Ranches will not farm to the river bank but instead allow trees and other riparian habitat to develop along the bank. They have found this helps stabilize the bank and provide a wave/flow buffer to their ranch. In many locations this	Thank you for your support of the recommended plan. During winter 2016-2017, high flows significantly altered existing conditions at the proposed site for measures associated with habitat increment 5c. The proposed measures as designed are no longer feasible at that location and were removed from consideration, as is consistent with USACE planning policy. Please refer to Chapter 3 for a discussion of the screening of habitat increment 5c. Although there may be benefits to existing habitat associated with erosion protection, the process of erosion is largely a natural ecosystem function. Bank armoring measures for the sake of flood risk management are generally viewed as a move away from natural conditions and often are conducted under a different authorized purpose (i.e. flood risk management, which is not an authorized purposed of the feasibility study). Project designs, including the project footprint, will be refined during the Preconstruction Engineering and Design phase.

Comment	Comment Text	Response
	buffer has been lost, and in some locations there is active erosion of their orchard lands. Wilbur Ranch owns other lands along one of the old river channels and is concerned that if the Yuba River left bank is left unprotected, flows into the old river channel will become more common thereby resulting in further damage to riparian habitat located along the old river channel. Wilbur Ranch would be willing to work with the USACE and YCWA to extend Habitat Increment 5B downstream about 1.35 miles (upper 7,000 feet of Habitat Increment 5C on left bank). We can provide access to the property and provide exhibits and details of the ongoing erosion on the left bank of the Yuba River.	
U-1	My wife, and our children reside part-time in the Yuba River Watershed and love to recreate there. and I are members of SYRCL- The South Yuba Citizens League. We are writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. Our residence is on the Middle Yuba below Our House Dam and above the confluence with the North Yuba. We have often wondered why there are relatively few fish there, in what seems like an otherwise teeming ecosystem. We are now informed of the following points: * Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. * Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon. * Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. * A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. By contrast, habitat restoration projects can be “blown out” in a single storm.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	We would like to support research and study of this important ecosystem and urge implementation of these practical, long term measures.	
U-2	* Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. * The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. * That habitat restoration is very important, but that the Army Corps should focus its efforts on improving the facilities it owns and is responsible for.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
V-1	I live in the Yuba River watershed/recreate in the Yuba River watershed/am a member of SYRCL- The South Yuba River Citizens League/other and am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. · The Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. · Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon. · The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. · Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. · Habitat restoration is very important, but I ask that the Army Corps focus its efforts on improving the facilities it owns and is responsible for.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
V-2	· A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects can be “blown out” in a single storm.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
W	To whom it may concern;	Comment noted.

Comment	Comment Text	Response
	Please give fish a save passage through the Dams of the Yuba River Watershed.	
X	I confess that I am not well informed about this proposal by SYRCL. I do have an opinion about Englebright Dam, and that is that it should be left alone. Any fish that have been living in the Yuba River since the dam was built have ingrained in their instinct just where to go to spawn. They will not likely go beyond the place of their hatching. Meanwhile, if the dam is removed just how does SYRCL intend to contain all the silt that has settled on the bottom of the lake? What will happen to the fish and wildlife downstream when this dam is destroyed, flooding all in it's path? It is my understanding that this dam was built to contain the silt from the hydraulic mines. It prevented that silt from covering the valley agriculture and also helped prevent flooding in that same area. With the recent evacuations in Oroville it should be foremost in our minds to keep our dams in good order to prevent damage downstream. Incidentally, many of my friends and I have boats. We like to recreate on Lake Englebright whether skiing, swimming, fishing or just enjoying the lap of the water on the side of the boat. Where are our wishes? Since when does one group dictate what they feel is good for an area. Please leave Englebright Dam and Lake just as it is. I do hope there are periodic inspections of the dam to insure the safety of all involved.	The recommended plan does not propose any ecosystem restoration actions that would modify Englebright Dam or the reservoir.
Y-1	I live and recreate in the Yuba River watershed and am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. • Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. • Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	• The Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. • The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. • Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. • Habitat restoration is very important, but the Army Corps should focus its efforts on improving the facilities it owns and is responsible for.	
Y-2	• A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects can be "blown out" in a single storm. • Salmon fish passage and the Yuba River important to me because I want to see some of the ecological disasters caused by dams at least partly mitigated.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
Z-1	I live in the Yuba River water shed and am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. * Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. * Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon. * That the Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. * The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. * Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	* Habitat restoration is very important, but that the Army Corps should focus its efforts on improving the facilities it owns and is responsible for.	
Z-2	* A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects can be “blown out” in a single storm.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
AA-1	I live in the Yuba River watershed and consider the Yuba River watershed my main place to walk, swim, meditate and take my grandchildren into nature. I am a member of SYRCL- The South Yuba River Citizens League and Sierra Harvest, a non-profit promoting growing and consumption of local, sustainably grown foods. I am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. The Yuba River is one of the only free flowing rivers coming from the northern sierras until it is blocked by the Englebright Dam and Daguerre Point Dam on it's lower flow. You must consider these two dams in your assessment of the Yuba. To omit these glaring long time obstructions to Salmon and Steelhead's spawning grounds is to walk around the elephant in the room.	Measures to improve fish passage at Daguerre Point and Englebright Dams were considered in the feasibility study, but were screened from consideration during formulation of alternatives because of high costs and risks relative to potential restoration benefits in comparison to other measures considered. Please review Chapter 3 of the FR/EA for a discussion of the plan formulation process.
AA-2	Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. The Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon. The Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. The Army Corps is responsible to insure fish passage at Englebright Dam and Daguerre Point Dam. the Army Corps must focus its efforts on improving the facilities it owns and is responsible for.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
AA-3	Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. This habitat restoration is very important for the health and vitality of the Yuba River and the bio-region. Also, to offer recreation and a food source to	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	fisherman. A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Without it habitat restoration projects can be "blown out" in a single storm. Please use the power of this office, the Army Corp of Engineers, to do what is best for the river, the fish population, the people and the environment.	
BB-1	I live in Penn Valley, California, about 3 miles from the Yuba River and I am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. The Yuba River and its basin are important to me and to my family, these things concern us greatly: • Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. • Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon. • That the Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. • The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. • Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. • That habitat restoration is very important, but that the Army Corps should focus its efforts on improving the facilities it owns and is responsible for.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
BB-2	• A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects can be "blown out" in a single storm. • Why are Salmon fish passage and the Yuba River important to you?	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
CC	In these times of gutting the EPA and denying the science of climate change we must be diligent in protecting our fragile environment not	Comment noted.

Comment	Comment Text	Response
	only to protect the well being of human life but for all life on our precious planet.	
DD-1	I live in the Yuba River watershed. The South Yuba River Citizens League and I am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. Points that can be made: • Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. • Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon. • That the Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. • The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. • Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. • That habitat restoration is very important, but that the Army Corps should focus its efforts on improving the facilities it owns and is responsible for.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
DD-2	• A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects can be “blown out” in a single storm. • Why are Salmon fish passage and the Yuba River important to you?	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
EE-1	My family of ten adult members and I live in different parts of the watershed of the South Yuba River. I am writing to give our comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	* Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. This is not okay with my family! * Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon. This also is not okay with us! * The Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. The agency is responsible for fish passage at Englebright Dam and Daguerre Point Dam. Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. WE NEED TO PRESERVE THEM, TO ENABLE THEM TO SPAWN AND SURVIVE! * We wish for the Army Corps to focus its efforts on improving the facilities it owns and is responsible for.	
EE-2	* A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects can be “blown out” in a single storm. * We love to have fish in our waters, and we want to preserve the lives and well-being of all living creatures, including fish. We ourselves do not fish, but we want the fish populations to increase for the good of all.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
FF	I recreate in the Yuba River watershed and am a member of SYRCL-The South Yuba River Citizens League and am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

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	That the Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. That habitat restoration is very important, but that the Army Corps should focus its efforts on improving the facilities it owns and is responsible for. A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects don't seem to be making a difference. As an angler who regularly fishes the Yuba, I have seen the gradual decrease in the fishing over the past 30 years. Dams may have benefit to some people but they are destructive to these anadromous fish as they continue to decline. You have a chance to make history by helping these fish recover.	
GG-1	I live in the Yuba River watershed/recreate in the Yuba River watershed/am a member of SYRCL- The South Yuba River Citizens League/other and am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. Points that can be made: · Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. · Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon. · That the Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. · The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. · Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	· That habitat restoration is very important, but that the Army Corps should focus its efforts on improving the facilities it owns and is responsible for.	
GG-2	· A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects can be “blown out” in a single storm. · Why are Salmon fish passage and the Yuba River important to you?	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
HH	The California Department of Fish and Wildlife would like to request additional time to prepare comments on the Yuba River Ecosystem Restoration Feasibility Study. We are requesting an additional two weeks from February 23, 2018 in order to provide meaningful comments. Please let me know as soon as possible if this is acceptable.	The public comment period extended for more than 45 days, which exceeds the required 30 period of review by more than 2 weeks. Unfortunately limitations in scope and schedule cannot accommodate additional extension to the public review period.
II-1	[*the typos below were included in the submitted comment*] You can help by writing a letter to the Army Corps, asking them to?? give fish passage a chance. Be sure to send us a copy as well (cc:??info@syrcl.org <mailto:info@syrcl.org>). ?? Written comments on the draft FR/EA may be submitted (by Feb. 23) to: U.S. Army Corps of Engineers Sacramento District, Attn: Planning Division 1325 J Street, 10th Floor, Sacramento, California 95814 Or by email to:??Yuba-River-Eco-Study@usace.army.mil mailto:Yuba-River-Eco-Study@usace.army.mil For e-mailed comments, please include?????Yuba River Ecosystem Restoration Feasibility Study?????in the subject line and include the commenter???s U.S. Postal Service mailing address. Sample Letter to USACE <Blockedhttp://yubariver.org/wp-content/uploads/2018/02/FeasiblityStudy-PublicComment-FINAL.pdf> SAMPLE/DRAFT LETTER Email to Yuba-River-Eco-Study@usace.army.mil mailto:Yuba-River-Eco-Study@usace.army.mil	Measures to improve fish passage at Daguerre Point and Englebright Dams were considered in the feasibility study, but were screened from consideration during formulation of alternatives because of high costs and risks relative to potential restoration benefits in comparison to other measures considered. Please review Chapter 3 of the FR/EA for a discussion of the plan formulation process.

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	I?? am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. I live on the North Fork of Deer Creek in the Yuba River watershed.?? I moved to this watershed specifically to enjoy and protect this Yuba River.?? I am a member of SYRCL- The South Yuba River Citizens League and Sierra Streams Institute.?? I joined both organizations as soon as I bought my property.?? Over the twenty years that I have?? gotten to know the problem with fish passage and Salmonid extinction in the Yuba.?? It is heart breaking to realize we have lost most of the spring run salmon and almost all if not all of the steelhead in this riversystem due to the two dams and the loss of the fry feeding lowland wetlands.???? Englebright Dam was installed at the end of the hydraulic mining days to stop massive debris flows from inundating crop land and was not needed by the time it was built .?? It is way too tall for a fish ladder.?? Not mentioning any possible solution for fish passage is a gross and purposeful oversite of the Army Corps and supports?? popular perception that the organization is ignorant and behind the times, doing environmental damage in the name of progress.?? I know it is a bad time to get support from the Congress right now but that situation may change sooner rather than later.?? It would behoove your agency, which could do great things to heal the decades of environmental degradation that you helped create, to at least mention some possibility of lowering Englebright so that fish ladders could work.?? Daguerre fish passage needs to be reengineered to actually work.	
II-2	Points that can be made: * Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. * Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

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	* That the Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. * The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. * Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. * That habitat restoration is very important, but the little the Army Corps is doing below the dam will not let the fish get up to the higher cooler water that they need to flourish. The Army Corps should focus its efforts on improving the facilities it owns and is responsible for.	
II-3	* A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects can be ???blown out??? in a single storm and much of the snags you placed were blown out and are now useless.?? I rafted down in that area this past fall. * letting our wild salmonids go extinct is like killing off the once millions of buffalo or passenger pigeon.?? There essential biological nutrient input is irreplaceable in the watershed not to mention the economic effect on fisheries and the humans they support. lets come together and come up with a creative solution.?? I wonder if a bond measure would work to contribute funding to the expensive dam/fish passage fixes. that are imperative to save our salmonids.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
JJ-1	California's 3rd Congressional District, which I represent, includes almost all of the Yuba River below New Bullards Bar Dam. As the only major river in California without a hatchery, the Yuba is uniquely suited for fisheries restoration efforts, especially for two of California's signature species, salmon and steelhead: Restoring the Yuba is one of my top priorities and must be done to mitigate the damage done by previous decades of irresponsible hydraulic mining in the region. I applaud the U.S. Army Corps of Engineers' (Corps) effort to continue restoration efforts of the Yuba but I am deeply concerned that the Draft Feasibility Report/Environmental Assessment (FR/EA) does not include a Daguerre Point Dam step pool alternative (step pool).	Because study resources and time were limited, it was not possible to further analyze in the final array of alternatives the Daguerre Point step pool measure, which was not a candidate for selection based on cost-efficiency and risks relative to the other measures evaluated. Please refer to the discussion of the major thematic concern "Daguerre Point Dam Fish Passage – Plan Formulation" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments. Public safety is always USACE’s highest priority when planning a new project. To be recommended to Congress for authorization, a proposed project must satisfy specific requirements associated with an authorized USACE mission, in addition to meeting general

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	The Sacramento Valley has been highly altered for flood control and water supply purposes since it was first settled in the mid-19th century. While it is impossible to return the valley to its original pristine state, the Corps can and should play a more responsible role in restoring and enhancing existing habitat, where possible, to improve the environment. Habitat restoration is a crucial piece of this overall goal but it is not the only piece - the modification of existing infrastructure is an equally important part of the solution. This includes the construction of a new step pool at Daguerre Point Dam. Such a structure, which would be comprised of a number of ascending, curved steps, beginning at the top of the dam and cascading away on the downstream side would allow migrating fish and wildlife to safely pass over the dam, both upstream and downstream, and at all times of the year. While the environmental benefits of a step pool are clear, the project would also save lives. There is no question that a step pool would greatly improve public safety at Daguerre Point Dam. There have been numerous accidents and fatalities at the dam since it was built in the early 20th century - a fact that I am continually reminded of by my constituents in the area. Most recently, an Air Force Chief and his stepson tragically drowned at Daguerre in 20 11. It is frustrating that the FR/EA does not include an analysis of the public safety benefits that would occur as a result of the step pool. The underlying authorization for the FR/EA, P.L. 87-874 authorizes the Secretary of the Army to "cause surveys for flood control and allied purposes ....” It is hard to imagine a world in which public safety would not be an "allied purpose" of flood control, therefore the FR/EA is an appropriate place to address it.	requirements including the protection of public safety. This study seeks to recommend authorization of a new project for ecosystem restoration. Under USACE policy, the improvement of public safety cannot be the main justification supporting the recommendation of a new ecosystem restoration project. A safety issue at an existing project would be appropriately addressed through the use of funds provided for the operation of that project, rather than by authorization of a new project serving a different purpose. USACE currently uses operations and maintenance funding to maintain warning signs upstream of Daguerre Point Dam, increase public contact during periods of unusually high flows, and issue news releases to increase public awareness of safety at dams.
JJ-2	I appreciate the transparent way in which the Corps has worked with my staff and I to answer questions about the approach used to develop the Tentatively Selected Plan (TSP). However, the reasoning that I have been provided to justify the exclusion of a step pool is difficult to rationalize, at best. Throughout our discussions, the Corps has maintained that there is an insufficient body of scientific information to understand whether Daguerre Point Dam is a barrier to fish passage on the Yuba River. The Corps has stated that the presence of spawning redds above the dam indicate that it may not be a significant barrier to	Please refer to the discussion of the major thematic concern "Daguerre Point Dam Fish Passage – Plan Formulation" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments. The Corps determination that there is not enough evidence to understand the problem of fish passage at DPD was made with the specific context of the screening process by which all proposed measures were evaluated. In a very simple sense, the Corps

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	fish passage. It is simply common sense that while the current system of ladders at Daguerre undoubtedly allows some level of passage, a step pool would improve passage for salmon and steelhead and allow better access to the higher quality habitat above the dam for larger numbers of spawning fish.	recognizes that fish passage is a problem at DPD. However, the evaluation of proposed measures was based on an estimate of benefits, costs, and remaining risks and uncertainties. The evaluation of potential benefits associated with step pools was dependent on (1) an understanding of the existing conditions of fish passage, and (2) an assumption of potential passage rates with step pools. Existing conditions. Many studies, including some prepared by the Corps, have indicated that there is a problem with fish passage at DPD. Unfortunately, in the case of DPD, it is difficult to quantify fish passage as a problem and these reports can only qualify fish passage as a problem. Therein lies the problem, Although the Corps recognizes that the dam affects fish passage (as is consistent with basic principles of ecology), for the purpose of this feasibility study, the problem must be quantified. In order to recommend step pools as a good investment of Federal dollars, the effectiveness and efficiency must be demonstrated; in other words, step pools must be proven to be a better plan than similar plans (i.e., dam removal, dam bypass, improved ladders) and better than or complimentary to non-similar plans (i.e., lower Yuba habitat restoration, fish passage improvements at Englebright). This hurdle of a quantitative assessment is a very basic and essential part of the feasibility study process. Unfortunately, there is not enough information by which to develop a sufficient quantitative assessment of potential improvements to fish passage at DPD because (1) the quantitative evidence that is available on the fish passage problem does not address the full range of perceived impacts of the dam (2) the potential costs (and risks) for all potential fish passage actions at DPD are not well understood. The screening exercise resulted in fish passage actions not being carried forward to the final array of alternatives. Given the existing information and limitations in modeling tools (not discussed in this response), it is impossible to justify construction of step pools over other potential fish passage actions at DPD (i.e. dam removal) or to evaluate step pools in an equitable way with habitat restoration actions. As stated in the Final FR/EA, inclusion of step pools in the study would require significant additional time and funding to resolve some

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		outstanding uncertainties in the costs and risks associated with potential fish passage at DPD, development/ certification of an ecological model capable of equitably evaluating fish passage and habitat restoration measures in terms of ecosystem benefits, and given the new information, inclusion of step pools would still require demonstration through the screening process that the proposed measure is reasonably effective & efficient compared to other proposed measures. Because fish passage at DPD is an independent action (not dependent on other actions to achieve benefits, and no other actions are dependent on fish passage at DPD to achieve benefits) of other proposed measures, there was no requirement to modify the study scope or schedule to include the proposed step pool action. Furthermore, the Corps and the Non-Federal Sponsor decided that it was not in the interest of either party to expand the scope of the study. In conclusion, the inclusion of step pools in the study would require additional time and budget to conduct the necessary work to appropriately evaluate the proposed measure, and in absence of that commitment from the Corps and NF Sponsor, the FR/EA screened the proposed measure from consideration. in recognition of the interest expressed by the public and the NF Sponsor (through comments) in the inclusion of step pools in the recommended plan, the Corps recommends that the issue be examined under any future ecosystem restoration efforts in the watershed.
JJ-3	The FR/EA notes ongoing restoration projects that are already occurring at various places along the Yuba River, including the Hallwood Side Channel and Floodplain Restoration project (below Daguerre Point Dam) and the Hammon Bar Restoration Project (above Daguerre Point Dam). The Corps' TSP also includes restoration measures above and below Daguerre Point Dam. The habitat connectivity benefits that would be created by a step pool at the dam cannot be understated. Absent a step pool, restoration efforts on the Yuba will continue in a piecemeal fashion that does not realize the full ecosystem benefit potential. Page ES-8 of the FR/EA notes:	As described in Chapter 3 of the Final FR/EA, step pools were not carried forward to the final array of alternatives due to a combined evaluation of potential benefits, costs, and remaining risks and uncertainties. Although the recommended plan contributes toward meeting all study objectives, it does not represent a complete response to the full scope of ecosystem degradation in the Yuba River watershed. Many degraded elements of ecosystem function will remain unaddressed, including connectivity (in terms of fish passage). The proposed habitat restoration actions included in the recommended plan will result in significant ecosystem benefit independent of construction of step pools or other fish passage action at DPD. This is demonstrated in the Final FR/EA and further evidenced by the existing, ongoing,

<table>
<tr><th>Comment</th><th>Comment Text</th><th>Response</th></tr>
<tr><td></td><td>"Specifically, the TSP would not resolve the problem of blocked and impaired fish passage and altered hydrologic and sediment transport regimes caused by existing dams. Additional investigation of this unresolved problem could be addressed in a fi1ture study under the same authority. "

I appreciate the budget and schedule constraints the Co1ps has faced during this study process. However, from a purely pragmatic standpoint, it seems the Corps should have addressed the issues at Daguerre Point Dam in the FR/EA. An additional study, as suggested in the FR/EA, will likely require more time and funding than would have been needed ·in the current study.</td><td>and future planned restoration actions on the Lower Yuba River supported by various agencies and local stakeholders.</td></tr>
<tr><td>JJ-4</td><td>The ongoing 45-day public comment period is a critical component of the study development process. I strongly encourage the Corps to carefully review and consider the suggestions and concerns that are submitted during this period, particularly those related to the step pool. As mentioned above, while the Corps may have exhausted its budget and schedule for this study, the Council on Environmental Quality (CEQ) guidance on agency response to public comments found in 40 CFR 1503.4 states:

"An agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond by one or more of the means listed below, stating its response in the final statement. Possible responses are to:

(1) Modify alternatives including the proposed action.

(2) Develop and evaluate alternatives not previously given serious consideration by the agency"

This guidance clearly provides an opportunity for the Corps to reevaluate the proposed alternatives and make modifications in the final EIR/EIS. I strongly recommend the Corps further review the step pool alternative and include it in its final recommendation to the Chief of Engineers.

I greatly appreciate your attention to the issues raised in this letter and look forward to your response.</td><td>Although many public comments identified an interest in including step pools in the final recommended plan, the public comment period did not result in any new information that would change the outcome of the screening exercise described in Chapter 3 of the Final FR/EA.

Please refer to the discussion of the major thematic concern "Daguerre Point Dam Fish Passage – Plan Formulation" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.</td></tr>
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KK-1	I live in the Yuba River watershed/recreate in the Yuba River watershed/am a member of SYRCL- The South Yuba River Citizens League/other and am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall run, and steelhead (threatened) to the upper portions of the watershed to spawn. Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon. That the Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. That habitat restoration is very important, but that the Army Corps should focus its efforts on improving the facilities it owns and is responsible for.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
KK-2	A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects can be "blown out" in a single storm. It is imperative that we prioritize the journey of the salmon and make its passage the number one concern. It is more than the salmon species that benefits but we as a human species and mother earth.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
LL-1	I am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. I live on the North Fork of Deer Creek in the Yuba River watershed. I moved to this watershed specifically to enjoy and protect the Yuba River ecosystem. I immediately joined the South Yuba River Citizens	Measures to improve fish passage at Daguerre Point and Englebright Dams were considered in the feasibility study, but were screened from consideration during formulation of alternatives because of high costs and risks relative to potential restoration benefits in comparison to other measures considered. Please review Chapter 3 of the FR/EA for a discussion of the plan formulation process.

Comment	Comment Text	Response
	League and Sierra Streams Institute. I have lived in this beautiful area for twenty years now, and in that time I have studied the contribution that wild salmonids make to the health of the riparian ecosystem and the devastating effects that dams have on these fish and therefore the watershed. It is heart breaking to realize that we have lost most of the spring-run salmon and almost all, if not all, of the steelhead in this river system due to the two dams and the loss of the juvenile feeding floodplains. These wild genes are almost extinct. Englebright Dam was installed at the end of the hydraulic mining days to stop massive debris flows from inundating crop land and was not needed by the time it was built. It is way too tall for a fish ladder. Not mentioning any possible solution for fish passage is a gross and purposeful over site of the Army Corps and supports popular perception that the organization is ignorant and behind the times, doing environmental damage in the name of progress. I know that it is a bad time to get support from Congress but that situation may change sooner rather than later. It would behoove your agency, which could do great things to heal the decades of environmental degradation that you helped create, to at least mention some possibility of lowering Englebright and re-engineering Daguerre's fish ladder. * Englebright Dam blocks access for Chinook spring-run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. * Daguerre Point Dam impedes fish passage for Chinook, steelhead and sturgeon.	
LL-2	* The Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. * The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. * Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. The wild genes are almost extinct. It is heart breaking to realize that we have lost most of the spring-run salmon and almost all, if not all, of the steelhead in this river system due to the two dams and the loss of the juvenile feeding floodplains.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

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LL-3	* That habitat restoration is very important, but the little the Army Corps is doing below the dam will not let the fish get up to the higher cooler water that they need to breed. * A fish passage project at Daguerre and Englebright will have long lasting benefits for salmon. Habitat restoration projects below Englebright are meager and can be "blown out" in a single storm. The snags you placed were blown out and are now useless. (I rafted down in that area this past fall.) * Letting our wild salmonids go extinct is like killing off the once millions of buffalo or passenger pigeon. Their essential biological nutrient input is irreplaceable in the watershed not to mention the economic effect on fisheries and the humans they support. Please lets come together and come up with creative solutions!! There is a lot of public enthusiasm for bringing back the salmonids. It is the Army Corps responsibility to be part of the solution.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
MM	I and am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn. Englebright Dam was supposed to be a temporary dam to keep sediment out of rivers that were being clogged by sediment from the mining industry and is no longer useful. If it were lower, the fish could get over it. It is too high. A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. Habitat restoration projects can be "blown out" in a single storm. Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

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NN-1	Thank you for the opportunity to provide comments on the proposed Yuba River Ecosystem Restoration Feasibility Study ("Project"). I represent landowner Roy Harris. Mr. Harris owns several properties adjacent to the Yuba River including much of the Parks Bar Property along the northside of the river to the west of the Highway 20 Bridge. Please see the attached Exhibits. While we generally support the goals of the Project, we believe that several issues remain vague and must be clarified in order to properly analyze the potential impacts of the Project. Our comments are as follows: The Project Documents indicate throughout that there will be some form of taking or other property-related acquisition as part of the Project. Appendix E in particular indicates that condemnation or the purchase of real property would be part of the Project including area of land owned by my client on Parks Bar. For example, the project documents state: The project would require the acquisition of land and associated mineral rights to restored areas to ensure that restored areas are protected in perpetuity; however, no operating permitted mining activities would be permanently impacted (Appendix E - Real Estate Plan). And yet, during public meetings, the Army Corps has informed the public (including my client) that no such acquisition or condemnation of private party would be associated with the Project. Further, the Project Documents (pg. ES-7) state that: In all cases, the potential adverse environmental effects would be reduced to a less-than significant level through project design, construction practices, preconstruction surveys and analysis, regulatory requirements, and best management practices. No compensatory mitigation would be required. How can the Project Documents conclude on the one hand that there is no need for compensatory mitigation when other portions of those same Documents provide that the Project "would require" acquisition of land and mineral rights? This apparent conflict needs to be clarified.	The Army Corps of Engineers signs a Project Partnership Agreement (PPA) with Yuba County Water Agency prior to construction of a authorized and appropriated project. Article III and Article 1V of the PPA discuss the lands, easements, and right of way, and explain that it is the responsibility of the federal partner in this case Yuba Co Water Agency to acquire the lands needed for construction, operation, maintenance and rehabilitation for the project in perpetuity. The Army Corps does not condemn unless Yuba County Water Agency is legally restricted from doing so and requests assistance from the Army Corps in writing. If approved by District, Division and HQ then the Army Corps can assist. This planning phase of the project is looking at another larger project footprint to develop a cost estimate at this time.

Comment	Comment Text	Response
	My client needs to be able to understand fully the potential impacts of the Project to his various properties along the river, including whether the Project will take portions of his properties in fee or as easements. As currently the Project Documents are presently prepared, however, this is not possible	
NN-2	Attached to this comment letter please find documents demonstrating my client's intent to modify and combine certain of his properties adjacent to the Yuba River at Parks Bar. Because the Army Corps has failed to specifically meet with adjacent property owners regarding the Project, and because of the vagueness regarding whether the Project will result in any takings, it is not possible for my client to determine whether his property will be adversely impacted. With respect specifically to mining and mineral rights, the term "operating permitted mining rights" is vague and may not mean what the Army Corps thinks it might mean. As the Army Corps may not be aware, a mining and mineral right can be a vested property right without an active mining operation or use permit. See Hansen Brothers Enterprises v. Board of Supervisors, 12 Cal. 4th 533 (1996). My client's property which extends onto Parks Bar has at least one mining lease with royalties due my client (see attached Title Report). Will the Project take or otherwise impact this lease, and if so, will my client be compensated for it?	The project is currently in the Feasibility stage (planning stage). The planning stage relies to a great extent on existing information including considerations of real estate and land conditions to develop and recommend a plan. Consideration of potential future real estate actions is by necessity limited, as it would be highly speculative to base decisions at this time on potential future conditions that may or may not be relevant at the time the project is constructed. Construction of the project has not been authorized, nor have funds been appropriated for construction at this time. At the time when the project is authorized by Congress and funded for design and construction, the Corps would move into the final design phase (preconstruction engineering and design), at which point project footprints would be refined and outreach to landowners would occur. All land owners will be compensated fair market value for lands needed for construction, operation, rehabilitation, and maintenance of the authorized project including subsurface rights.
NN-3	At the very least there needs to be a complete inventory of impacted properties and property rights including minerals, vested mining rights, and existing mining leases that could be impacted by the Project. The Project Documents then need to clarify whether there will be taking of private property for Project purposes. And if there will be takings, the Documents should identify funding sources to compensate landowners. The statement that there will be no compensatory mitigation appears to indicate that areas of the river used for Project staging, which includes my client's property at Park's Bar, will not be compensated monetarily. Is this true? We cannot tell from the information presently available.	A complete inventory of impacted properties and property rights including minerals was conducted and is included with the RE Plan. This information was used to inform cost estimates related to real estate. The inventory included surface owners and subsurface owners for each parcel and considered each full and partial take. The takes included fee title, temporary work area easements, and road easements. There is no requirement to complete site specific appraisals during a planning study. Site specific appraisal are completed by the non-Federal partner during the PED phase of the project. Implementation of the project would include compensation at fair market value for all partial and full real estate takes, include for takes associated with project staging.
NN-4	In general, the Project's hydrologic analysis of flood impacts and impacts to private water rights appears inadequate. The Project	The project does not intend to sever any existing riparian rights. Site specific appraisals would be completed by the non-Federal partner

Comment	Comment Text	Response
	Documents conclude there will be no impact from flooding but this appears to be a conclusion based primarily on circumstantial observations instead of on any specific hydrologic analysis and modeling. There appears to be no analysis of potential impacts to water rights. For example, would the Project in any way "sever" riparian water rights to properties (e.g. Park's Bar)? This analysis is critical as otherwise the Project is in fact taking property rights. The Army Corps and others involved in the Project should meet and confer with all private landowners along the Project with water rights to the Yuba River.	during the PED phase of the project, including an assessment of existing water rights.
NN-5	The potential impacts on Groundwater are one of the specifically stated Planning Considerations for the Project. And yet the study concludes there will be no impact without the existence of any specific hydrologic study or investigation whatsoever. There is no indication that the Army Corps is even aware of how many groundwater wells exist along the Yuba River and could be impacted by the Project. Instead, the conclusion of "no impact" appears based solely on speculation and unsupported conclusions.	The major factors driving ground water recharge would not be affected by the recommended plan. The recommended plan does not result in the addition, retention, or diversion of water or otherwise change the hydrologic regime of the lower Yuba River. The high permeability of the existing substrate would be retained in habitat measures.
	Finally, the Project Documents conclude that the Project would not adversely impact Recreation in large part because of limited public access to the Yuba River. However, once again, this is not necessarily the case. As noted, my client owns much of the Parks Bar property. The Project Documents indicate certain project activities will take place on Parks Bar including construction staging. As the Army Corps may not know, my client has been in the process of developing recreational access to the Yuba River at Parks Bar including rafting and fishing access. My client has an existing business plan that he would be happy to discuss with the Army Corps. It is unclear from the Project Documents whether the Project would somehow impact my client's plans for river access and recreation at Parks Bar (blockage from riparian habitat, severance from Project easements or other property acquisition). And if there are impacts, how would the Army Corps mitigate the impacts on my client's plans for recreational development at Park's Bar – especially in light of the Project Documents statement that there will be no compensatory mitigation?	Implementation of the project would include compensation at fair market value for all partial and full real estate takes, including for takes associated with project staging. The project is currently in the Feasibility stage (planning stage) and is based on existing land conditions. Construction of the project has not been authorized, nor have funds been appropriated for construction at this time. Project footprints and designs will be refined during PED. All land owners will be compensated fair market value for lands needed for construction, operation, rehabilitation, and maintenance of the authorized project including subsurface rights. Site specific appraisals and acquisitions are completed by the non-Federal partner during the PED phase of the project. Specific compensation cannot be discussed at this stage in the study.

Comment	Comment Text	Response
	Thank you for the opportunity to comment. We would very much like to meet with the Army Corp to further discuss the comments in this letter.	
OO-1	The California Sportfishing Protection Alliance (CSPA) respectfully submits comments on the Draft Feasibility Report/Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study (hereinafter, Report). CSPA has a longstanding engagement in the Yuba River watershed, including most recently FERC relicensing processes in the upper and lower watershed, the Yuba Salmon Forum, and the Yuba Salmon Partnership. The two authors of this letter have decades of personal engagement. Thomas Cannon is a salmonid fisheries ecologist with degrees from the University of Michigan in Fisheries Science and Biostatistics and 50 years of professional experience. Mr. Cannon has two decades of work on Yuba River fisheries and their habitats. He participated in Yuba River technical committees, the CalFed Yuba River Program, as a consultant to the Lake Wildwood Association, as a thesis advisor on a UC Davis master's program on the Yuba River, and as a team member on various Yuba River fisheries studies and technical committees. He has actively surveyed many habitat areas from Englebright Dam downstream to Marysville. He has participated in land acquisitions, trading, and easement negotiations. He has worked with various landowners, agencies, and non-profits involved with the Yuba River. He has spent many hours with Yuba fishing guides and anglers, and has spent hundreds of hours fishing the lower Yuba River over three decades. Mr. Cannon is uniquely qualified to review the US Army Corps of Engineers' (USACE) proposals for the lower Yuba River. Chris Shutes has been the lead for CSPA and a lead for various non-governmental organizations in the relicensing of the Yuba-Bear and Drum-Spaulding hydroelectric projects in the upper Yuba watershed and in the relicensing of the Yuba River Development Project in the middle and lower Yuba watershed. He was also one of the most active participants in the Yuba Salmon Forum, and more recently has represented CSPA in the Yuba Salmon Partnership. Mr. Shutes has fished the lower Yuba River at various times over the past two decades. Summary of Comments	Comment noted.

Comment	Comment Text	Response
	CSPA was pleased when the USACE chose the lower Yuba River as a focus for ecosystem improvement. The footprint of the USACE on the lower Yuba is large, and the opportunities are great and diverse. The Draft Feasibility Report, however, comes as a letdown. The "Tentatively Selected Plan" (preferred alternative for NEPA purposes) does not leverage the USACE's unique authorities and ability to improve its key infrastructure on the lower Yuba River. Instead, the Tentatively Selected Plan focuses on three sets of habitat improvements that, though worthwhile, are somewhat duplicative of ongoing habitat actions. These habitat improvements also do too little to restore broad ecosystem function in the lower Yuba River corridor. The USACE is well equipped by virtue of its expertise to undertake more systemic improvements, and has significant responsibility for the need to do so. We discuss these issues below.	
OO-2	Daguerre Point Dam The Report announces on page 43: At Daguerre Point Dam, the extent to which the presence of the dam creates ecological problems is at present poorly defined. … Additional study would be required to: • Better define and quantify specific ecological problems associated with longitudinal river connectivity within the study area; • Better define specific measures to address these specific ecological problems; and • Develop a methodology to quantify ecological outputs of specific measures. The USACE has had more than two years to address these issues. These issues, moreover, are not new. The 2012 Biological Opinion identified many of the details of ecological problems with Daguerre Point Dam. Even though that Biological Opinion was retracted for legal reasons, the objective conditions it identified certainly put the USACE on notice that there were problems with fish passage at this location. In 2007, the USACE's Biological Assessment for consultation on the operation of Daguerre and Englebright dams identified the need for a preliminary engineering design for fish passage improvements at Daguerre Point Dam. As noted in the current Report on page 14, the USACE produced	Please refer to the discussion of the major thematic concern "Daguerre Point Dam Fish Passage – Plan Formulation" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	a Preliminary Fish Passage Improvement Study as long ago as in 2001 regarding Daguerre Point Dam. To suggest that problems that have been known to the USACE for seventeen years require still further study is simply unacceptable. The USACE is under no requirement or deadline to initiate further study; who knows when or even if such a study will ever occur? If the problems at Daguerre Point Dam, which have been a subject in several USACE documents, are “poorly defined,” this begs the question, why did the USACE not better define the problems during the two years following the issuance of the “Draft Consolidated Measures”? The Daguerre Point Dam Step Pools measure is feasible, it is economic, and it will address known problems that have substantial impact on salmonid populations in the lower Yuba River.	
OO-3	In addition, the USACE, as owner of Daguerre Point Dam, is the only entity that can initiate the improvements that are needed there. The Final Selected Plan should include the Daguerre Point Dam Step Pools measure.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
OO-4	Fish Passage at Englebright Dam In March, 2015, CSPA and seven other non-governmental conservation organizations sent a letter to Colonel Michael Farrell regarding asking that the USACE’s Feasibility Study independently evaluate the feasibility and cost of “removing or lowering” Englebright Dam. The signatories to that letter did not necessarily agree on the answer to this issue. However, the eight organizations did agree that there would be great value in having the USACE bring its extensive engineering expertise to bear in independently evaluating removal or modification of Englebright Dam. Regrettably, the present Report does not include such an evaluation. CSPA believes that there would be value in completing such an analysis and including it in the final Report.	A detailed evaluation of the removal or lowering Englebright Dam was not required to determine that those measures would have higher costs and greater risks than other measures that were considered. Please review Chapter 3 of the FR/EA for a complete description of the plan formulation process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is beyond the scope of the feasibility study to continue detailed evaluation for measures that are not included in the final array of alternatives. For the purpose of this study, ‘nonviable’ does not confer a determination on the overall feasibility of a particular action, rather ‘nonviable’ refers to measures and alternatives that were determined to be ineligible for recommendation under this study through the plan formulation process. It is also important to note that the this study is an interim response to the authority to conduct ecosystem restoration in the Yuba River watershed and the recommended plan in no way

Comment	Comment Text	Response
		precludes future implementation of any other potential restoration actions in the watershed by any organization.
OO-5	The Collect and Transport above New Bullards Bar Dam measure ranks the quantity of habitat made available as the lowest possible. (Report, p.36) This evaluation does not align with the determinations made by the Yuba Salmon Forum, which found that the amount of habitat for spring-run Chinook salmon in the North Yuba River was greater than for other options upstream of Englebright Dam. The evaluation in the Report is based on an acreage calculation. However, acreage is not the best metric for habitat suitability. The final Report should review and likely adopt the metrics used in the Yuba Salmon Forum and re-evaluate as appropriate.	The criteria used to evaluate and screen measures were developed to allow a consistent set of criteria to be applied to all measures. The conversion of stream miles of accessible fish habitat to acres provides a common unit of measure by expressing ecosystem outputs for fish passage improvement measures in terms of equivalence to acres of habitat restoration. Efficiency factors were applied to acreage calculations to distinguish between different types of fish passage measures (i.e., nature like bypass channels, rock ramps, fish ladders). An efficiency factor of 0.6 was applied for collect and transport measures because of the limited degree of ecological connectivity that would be provided by those measures.
OO-6	The Report does not appear to have considered contribution by the USACE to projects for fish passage upstream of Englebright or New Bullards Bar that might be led by other entities. The final Report should consider such options.	While cooperative efforts are possible under USACE policy, USACE is the lead agency for studies specifically assigned to it.
OO-7	Lack of Comprehensive Plan for the Lower Yuba River The Tentatively Selected Plan identifies three areas of the lower Yuba River for physical habitat improvements and restoration actions. These actions, while worthwhile, fail to address underlying ecosystem functions that cause some of the problems that the habitat improvements seek to address. Habitat restoration must start with restoring natural processes, including sediment supply and geomorphology. High velocity and shear stresses are caused by tailings levees. Placing boulders and engineered logjams that reduce scour and protect banks will reduce some impacts, but the high velocity corridors will continue to cause problems and will likely lead to failure of boulder and logjam placements. The following photo provides an example of an underlying process that Action 3 in the Tentatively Selected Plan will address symptomatically but not systemically.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
OO-8	Here again, the USACE's Report fails to take into account the planned and potential future actions of other entities in the Yuba River watershed. The South Yuba River Citizens League (SYRCL) has restoration actions planned at the Long Bar site, and, importantly, is working with the operator of the gravel operations there to plan long-term improvements. In addition, SYRCL is working with the U.S. Fish and Wildlife Service's Anadromous Fish Restoration Program on funding and planning. The Report, however, views potential actions by USACE on a standalone, exclusive basis, with USACE as the initiator and driver of restoration actions. In the March, 2015 letter from eight conservation organizations that we reference above, we asked the USACE to work with stakeholders in the development of the Report. However, the USACE elected not to involve other stakeholders in the development of the Report. Now, the Report plans to have the USACE once again go it alone, except for funding, in the implementation of the Tentatively Selected Plan. This is regrettable and counter-productive. There are other responsible entities in the lower Yuba River, including gravel mining operators, the State Lands Commission that regulates these operators, Yuba County Water Agency, and irrigation diverters. The USACE should view these entities, along with conservation organizations and resource agencies, as potential partners to prioritize and implement restoration actions. All of these entities bring local knowledge and relationships, as well as resources, to the table in the effort to improve habitat conditions in the lower Yuba River. On a practical basis, they must also work together to coordinate land use.	Throughout the study, potential actions in the project area were identified and evaluated. Actions that were deemed likely to be constructed were classified as part of the Future Without Project condition and were considered appropriately. The standard for assuming projects are likely to be constructed was the existence of dedicated construction funds. Because the AFRP Long Bar project has not been funded through completion, the study did not assume that the project would be built. However, should the AFRP Long Bar project be completed or receive sufficient construction funding, USACE would reconsider proposed actions in the area and adjust the proposed plan accordingly. USACE appropriately engaged local stakeholders in throughout the development of the feasibility study, including through public scoping, review of existing proposed actions, and public review. In addition the Additional engagement with local interests during the PED phase could result in improved project implementation. These opportunities may include engaging local mining operators in the construction of the project or engaging local conservation groups in informing improved implementation techniques based on local expertise. The opportunity for engagement of local stakeholders in defining project implementation is limited at this stage in the feasibility process due to requirements under the Federal Advisory Committee Act as well as requirements associated with the development of cost estimates.
OO-9	Prioritization is key. Lower Yuba River planning should focus funding on actions that will improve long-term ecosystem conditions. This in turn will help ensure the durability of individual restoration actions. Of particular importance is a type of action that the USACE is uniquely suited to undertake: to expand hydraulic floodplain wherever possible by removing tailings from floodplains and river banks.	A large component of the recommended plan includes the removal of approximately 800,000 cubic yards of predominantly gravel and cobble-sized material from near bank floodplain areas.
OO-10	Conclusion In significant measure, Congress has made the USACE responsible for the remnants of hydraulic mining in the Yuba River watershed, not just for the dams that captures much of the legacy sediment. The USACE	The objective of the study was to evaluate and recommend a set of actions to address ecosystem degradation in the Yuba River watershed. The study objectives identified in Section 2.4 are landscape-level and watershed scale and the recommended plan

Comment	Comment Text	Response
	should revise the Report to focus on landscape-level improvements in the lower Yuba River watershed that more appropriately reflect the USACE's responsibilities, authorities, and extensive expertise. On the level of NEPA, an appropriate Final Selected Plan will likely require an Environmental Impact Statements rather than the present Environmental Assessment.	contributes toward meeting all study objectives. Although the recommended plan does not represent a complete response to the full scope of ecosystem degradation in the Yuba River watershed, it represents a significant contribution to the improvement of the Yuba River watershed ecosystem as demonstrated in the Final FR/EA and further evidenced by the existing, ongoing, and future planned restoration actions on the Lower Yuba River supported by various agencies and local stakeholders.
PP-1	The South Yuba River Citizens League (SYRCL) respectfully submits comments and recommendations for the Draft Feasibility Report/Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study (feasibility study). SYRCL is a 35-year-old organization with a mission to unite the community in protecting and restoring the Yuba River watershed. Since 1997, SYRCL has been actively involved in the planning of restoration projects both on the lower Yuba River, and throughout the watershed. SYRCL has been a regular participant in virtually all forums concerning ecosystem restoration in the Yuba River watershed, including the Yuba River Fisheries Technical Working Group, the Upper Yuba River Study Program, the Yuba Accord River Management Team, the Yuba Salmon Forum, the FERC relicensing process, and two Integrated Regional Watershed Management groups overlapping the Yuba River watershed. In recent years, SYRCL's Lower Yuba restoration program has grown from a 5-acre project at Hammon Bar to working on over 200 acres of floodplain restoration and spawning habitat projects at Hallwood, Long Bar, Rose Bar, and the Yuba River Canyon. We have greatly appreciated the insight and availability of Army Corps staff to discuss the feasibility study during the 45-day comment period. In these conversations, Army Corps staff have stated that they are unable to change the configuration or focus of the preferred alternative because the feasibility study is too far along in the planning phase. It is our understanding that Army Corps is required to address submitted comments (see Council on Environmental Quality (CEQ): 40 CFR 1503.4) by modifying the preferred alternative or further developing previously overlooked alternatives.	Regardless of verbal statements or interpretation of those statements made during public meetings, all public comments will be considered and appropriate responses shall be prepared in accordance with 40 CFR 1503.4. The regulation requires that USACE consider all comments individually and collectively and respond by one or more of the following means: (1) Modify alternatives including the proposed action. (2) Develop and evaluate alternatives not previously given serious consideration by the agency. (3) Supplement, improve, or modify its analyses. (4) Make factual corrections. (5) Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response.

Comment	Comment Text	Response
PP-2	We are pleased to see that the feasibility study acknowledges the importance of restoring habitat for salmon and steelhead in the Yuba River watershed. The study presents a preferred alternative (Alternative 5) that focuses on habitat restoration efforts in the Lower Yuba River. Local stakeholders are already engaged in this work, have completed planning documents similar to the feasibility study, and are set to complete over 200 acres of floodplain restoration work by 2020—for a fraction of the estimated cost proposed in the feasibility study. While SYRCL does not wish to discount the importance of the work proposed in Alternative 5 and would be supportive of the work if it is approved and funding is appropriated, focusing the feasibility study on habitat restoration work is redundant of work already in progress and completed by other stakeholder groups and federal agencies and is not the best use of the Army Corps unique authority, time, or funding.	Thank you for supporting the restoration benefits of the recommended plan, which would provide independent and significant ecosystem benefits to the aquatic and riparian habitats of the lower Yuba River. The scope of degraded ecosystem form, function, and processes in the lower Yuba River is severe and the need for restoration would not be exhausted due to the near term implementation of restoration by other entities. Additionally, USACE gives priority to restoration projects in areas where there is active participation in restoration by other Federal agencies.
PP-3	As the feasibility study anticipates, we are disappointed that projects to improve or provide for fish passage at either Englebright Dam or Daguerre Point Dam were not extensively studied during this process. The Army Corps is the only agency with the authority to address fish passage at both Daguerre Point Dam and Englebright Dam, which are identified in the feasibility study as projects that would improve longitudinal connectivity of the Yuba River watershed. SYRCL asks that alternatives for fish passage at Englebright Dam and Daguerre Point Dam are considered and studied more thoroughly as (1) the Army Corps is the only entity with the authority to work in these locations and (2) habitat restoration work is already being undertaken by local stakeholders with support from the United States Fish and Wildlife Service (USFWS) and Yuba County.	Fish passage measures at Englebright Dam and Daguerre Point Dam were considered in the feasibility study, but were eliminated through application of screening criteria. Please review Chapter 3 of the FR/EA for a complete description of the plan formulation process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is beyond the scope of the feasibility study to continue detailed evaluation for measures that are not included in the final array of alternatives. For the purpose of this study, 'nonviable' does not confer a determination on the overall feasibility of a particular action, rather 'nonviable' refers to measures and alternatives that were determined to be ineligible for recommendation under this study through the plan formulation process. It is also important to note that the this study is an interim response to the authority to conduct ecosystem restoration in the Yuba River watershed and the recommended plan in no way precludes future implementation of any other potential restoration actions in the watershed by any organization. The Chief of Engineers has authority to modify projects without further authorization from Congress within strictly defined limits, i.e.,

Comment	Comment Text	Response
		as long as the scope of the project, including the function and purpose of the project, and the area served by the project, is not materially changed. The original purpose of Daguerre Point Dam and Englebright Dam was to retain hydraulic mining debris to protect navigation in the Feather and Sacramento Rivers. Modifications outside the scope of the project would require specific authorization by Congress.
PP-4	Daguerre Point Dam SYRCL urges the Army Corps to reconsider a preferred alternative that will improve fish passage at Daguerre Point Dam. The Army Corps is the only entity with the authority to alter Daguerre Point Dam, which, if reconfigured, could revitalize fish populations by improving upstream and downstream passage for Chinook, steelhead, and sturgeon and reduce the potential for loss of life due to boating accidents over the dam. Given the extensive planning that has already occurred at Daguerre Point Dam by the Army Corps and others (see section 1.5.2 in feasibility study), waiting for the authorization of another feasibility study to deal directly with Daguerre Point Dam is not acceptable. Army Corps staff have suggested that there is insufficient data to prove that Daguerre Point Dam impedes fish passage. However, fish passage at Daguerre Point Dam has long been documented as an issue for Chinook salmon, steelhead, and sturgeon.	USACE does not currently have authority to modify the physical structure of Daguerre Point Dam. Structural changes to the dam by USACE would require specific authorization by Congress. Other entities could make changes to the dams after applicable approvals by USACE. This study seeks to recommend authorization of a new project for ecosystem restoration. Under USACE policy, the improvement of public safety cannot be the main justification supporting the recommendation of a new ecosystem restoration project. USACE found that currently available information regarding existing fish passage at Daguerre Point Dam (DPD) is not sufficient to demonstrate that any fish passage measure at DPD would result in a justified plan for ecosystem restoration. Although existing information indicates that modification of the dam could result in some improvement in fish passage, that information is not sufficient to support the recommendation of a USACE ecosystem restoration project. In particular, there is a lack of information needed to quantify the magnitude of impairment of salmonid passage at DPD. Quantitative information regarding the existing impairment of upstream passage is needed to estimate the potential improvement that could be achieved by measures at the dam. Please refer to the discussion of the major thematic concern "Daguerre Point Dam Fish Passage – Plan Formulation" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
PP-5	We think that the stated costs and risks associated with removal, partial removal, or other configurations at Daguerre Point Dam are too heavily weighted when measured against the benefits that salmon, steelhead,	The criteria used to screen measures were developed to allow a consistent set of criteria to be applied to all measures. The screening criteria were also guided by USACE's NER objective, which is to

Comment	Comment Text	Response
	sturgeon, and people would experience. We recommend the Army Corps reconsider a project that would maintain water deliveries, reduce the potential for loss of human life, continue to act as a barrier for predatory fish to the upstream reaches of the Lower Yuba River, and could benefit endangered Spring-run Chinook if engineered to function as a segregation weir.	maximize benefits relative to costs. Additionally, USACE policy does not allow the improvement of public safety or recovery of individual species to serve as the main justification to support the recommendation of a new ecosystem restoration project.
PP-6	Fish Passage at Englebright Dam Englebright dam has blocked the passage of salmon and steelhead to the upper Yuba River watershed since its construction in 1941. Since that time, salmon populations have declined significantly. As the feasibility study itself states, we are disappointed that passage options for Englebright Dam were not fully evaluated in the alternatives analysis. The Army Corps should review available studies developed by the Yuba Salmon Forum, the National Marine Fisheries Service, and others about the feasibility of implementing a passage project at Englebright Dam. The letter SYRCL submitted to the Army Corps during the scoping phase of the feasibility study (dated December 4, 2015, attached) gives an overview of our vision and asks that the Army Corps view Englebright Dam as a challenge to be solved. We ask that alternatives for passage, either volitional or assisted, be further developed at Englebright Dam to provide stakeholders with more accurate cost estimates and benefits analyses.	Fish passage at Englebright was considered in the feasibility study, but was eliminated through application of screening criteria. Please review Chapter 3 of the FR/EA for a complete description of the plan formulation process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is beyond the scope of the feasibility study to continue detailed evaluation for measures that are not included in the final array of alternatives. For the purpose of this study, 'nonviable' does not confer a determination on the overall feasibility of a particular action, rather 'nonviable' refers to measures and alternatives that were determined to be ineligible for recommendation under this study through the plan formulation process. It is also important to note that the this study is an interim response to the authority to conduct ecosystem restoration in the Yuba River watershed and the recommended plan in no way precludes future implementation of any other potential restoration actions in the watershed by any organization.
PP-7	Lower Yuba River Habitat Restoration Alternative 5 has overlapping footprints both geographically and in methodology to (1) projects that have been proposed and are funded by the United States Fish and Wildlife Service (USFWS) Anadromous Fish Restoration Project (AFRP), (2) draft project designs that are in development by cbec and SYRCL, and (3) the proposed habitat enhancements within the Yuba River Development Project through the Yuba River Development Project FERC (#2246) relicensing process. SYRCL and its partners will continue to make progress on habitat restoration projects in the Lower Yuba River. While the Army Corps	Throughout the study, potential actions in the project area were identified and evaluated. Actions that were deemed likely to be constructed were classified as part of the Future Without Project condition and were considered appropriately. Future without-project (FWOP) conditions are defined as the set of conditions most likely to take place at the time of project implementation. The standard for assuming projects are likely to be constructed was the existence of dedicated construction funds. Because the AFRP Long Bar project has not been funded through completion, the study did not assume that the project would be built. The level design for the proposed measures in this study is considered conceptual and is largely based

Comment	Comment Text	Response
	waits for funding to be approved by congress, local stakeholders will be restoring the river, chipping away at the proposed Army Corps investment in the Yuba River. In Habitat Increment 3a, the project at Bar A is overlapping the USFWS AFRP project at Long Bar. SYRCL, USFWS, The Long Bar Mine Company, Silica Resources, cbec, and Cramer Fish Sciences have been working on this project together since 2015 and at present 65% designs are nearly complete. SYRCL staff showed maps and discussed this project with Army Corps staff during the scoping period for the study, specifically during a meeting convened by Congressmen Garamendi on May 31, 2016. The USFWS Long Bar Project is mentioned in the feasibility study but a project at Bar A was still designed in the same location. The comments submitted by SYRCL during the scoping period reflected a desire to include the project at Long Bar in the feasibility study, however, now that the project has received funding and is moving forward it appears that including the Long Bar Project (Bar A) will only reduce the future investment in the Lower Yuba River. This is an unfortunate an unacceptable outcome for the final feasibility study given that the Army Corps is still in the planning phase. We urge ACOE to update the study to include a project in the Lower Yuba River that is not already in the planning phase by another federal agency. We understand that if Bar A remains in the feasibility study, funds will be returned to the federal government. It is duplicative and wasteful of taxpayer dollars for two federal agencies to both be planning projects at the same location. It is also unacceptable that a percentage of the projects planned in the study are not “feasible” at this draft stage and that funding, which would otherwise be used to benefit endangered and threatened species, would be returned to the federal government.	on information from existing reports. The amount of funding spent specifically on the refinement of designs to date is minimal. Should the AFRP Long Bar project be completed or receive sufficient construction funding prior to or during PED, USACE would reconsider proposed actions in the area and adjust the proposed plan accordingly. It is unlikely that USACE would expend a significant amount of dollars in the refinement of plans should the project be built. If the project is abandoned by AFRP, USACE would seek to adopt any designs developed to reduce the overall costs of PED. Given these considerations the cost risk associated with carrying the proposed measures forward in the recommend plan is overall low. Some habitat restoration features of the Recommended Plan have been adopted from the work of the Lower Yuba River Accord River Management Team, however these features or any other features of the Recommended Plan are not associated with the Yuba River Development Project FERC (#2246) relicensing process.
PP-8	SYRCL is also surprised by the cost of implementation for Alternative 5. Moving material is one of the most expensive aspects of floodplain restoration projects where large gravel must be removed to create habitat. There are multiple companies along the Lower Yuba River within the footprint of Alternative 5 where gravels could be processed. In addition, gravels could be moved to off channel areas adjacent to restoration areas and piled for later use. Instead, the feasibility study	Assumptions made in the development of costs are constrained by the requirement of USACE to comply with Federal contracting regulations. Ultimately contractors would need to competitively bid on the project and it is impossible to assume at this time that a particular local contractor would be able to execute portions of the project at a reduced cost.

Comment	Comment Text	Response
	estimates travel to processing facilities outside of the area. We suggest that the feasibility study should reevaluate these costs given these suggested alternatives. If the cost to implement is reduced through this exercise and Alternative 5 remains the preferred alternative, we suggest adding additional acreage to the preferred alternative to maintain the total investment in the Yuba River.	
PP-9	Errata SYRCL biologists surveyed Hammon Bar in 2017 and note that just over nearly 2,000 trees remain after the 2016-2017 flood events, not hundreds as noted in the feasibility study (pg. 12 of feasibility study)	The statement has been updated in the report to reflect this information.
PP-10	In closing, SYRCL suggests that the Army Corps incorporate stakeholders in this feasibility study process. Local stakeholders, like SYRCL and other active agencies, landowners, and nonprofits have a vested interest in outcomes for the Yuba River watershed and are willing partners with decades of experience working in the watershed.	The feasibility study included appropriate opportunities for public participation. Additional opportunities for public participation may be included in PED. Local landowners will be engaged with regard to potential acquisitions. Local stakeholders will likely be engaged to inform refinements in design.
QQ	[*blank email*]	Comment noted.
RR	I want to comment on the draft of the interim feasibility report and environmental assessment for the Yuba River ecosystem restoration feasibility study released by the Army Corps in January 2018. I live very near the north fork of Deer Creek in the Yuba River watershed. Although I have only lived here four years, I recognize the importance and contribution this river makes to the ecosystem. I have listened to my friends and neighbors who have studied the issue surrounding the salmon and the way it is connected to the health of the riparian ecosystem. I have also received some education on the damage dams have on salmon and the entire watershed through studies from dam removal on other rivers further north. I believe the loss of these wild genes will be detrimental. We must do our best to protect species that indeed could go extinct. I believe most studies now show it is not only possible but the best course of action to assure fish passage and preserve the genes. It is time to assess the actual contribution dam REMOVAL will bring to the salmon and the watershed.	Measures to improve fish passage at Daguerre Point and Englebright Dams were considered in the feasibility study, but were screened from consideration during formulation of alternatives because of high costs and risks relative to potential restoration benefits in comparison to other measures considered. Please review Chapter 3 of the FR/EA for a discussion of the plan formulation process. Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	The Army Corps is responsible for the fish passage at Englebright Dam and Daguerre Point dam. Please consider options that truely allow the fish to return to their historic spawning grounds on their own. Lets work together to find solutions.	
SS	The California Department of Water Resources (DWR) and Pacific Gas and Electric (PG&E) are pleased to provide comments on the Yuba River Ecosystem Restoration Feasibility Study. Habitat restoration is clearly needed In this stretch of the lower Yuba River where the ecosystem has been degraded by hydraulic mining and water resources development in the watershed. We believe that habitat restoration in the lower Yuba River would greatly benefit a variety of fish and wildlife species. We are particularly supportive of the features of the U.S. Army Corps of Engineers' Tentatively Selected Plan that will provide shallow, low velocity, rearing habitat and refugia for juvenile anadromous salmonids, and potentially increase benthic macroinvertebrate producing habitat. We believe these features will complement the Final Habitat Expansion Plan (HEP) that DWR and PG&E are proposing to Implement in the Englebright and Narrows reaches of the lower Yuba River below Englebright Dam. The Final HEP, which is referenced on page 14 of the feasibility report, would expand habitat in the Yuba River below Englebright Dam to support spawning, rearing, and adult holding of spring-run Chinook salmon and steelhead. We believe these complementary projects will greatly benefit these threatened species We wish your agency success in carrying out the feasibility study and the selected Habitat restoration plan.	Comment noted. Thank you for your support.
TT	I live and recreate in the Yuba River watershed and am the River Science Project Manager at SYRCL (The South Yuba River Citizens League). I am writing to provide comments on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by the Army Corps in January 2018. I am disappointed that the Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study does not address fish passage at Englebright and	Measures to improve fish passage at Daguerre Point and Englebright Dams were considered in the feasibility study, but were screened from consideration during formulation of alternatives because of high costs and risks relative to potential restoration benefits in comparison to other measures considered. Please review Chapter 3 of the FR/EA for a discussion of the plan formulation process. Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at

Comment	Comment Text	Response
	Daguerre Point Dams. The Army Corps is responsible for fish passage at Englebright Dam and Daguerre Point Dam. Yet, Englebright Dam blocks access for Chinook Spring-Run (an endangered species), fall-run, and steelhead (threatened) to the upper portions of the watershed to spawn and Daguerre Point Dam impedes fish passage for Chinook, steelhead, and sturgeon. The Army Corps is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams and this feasibility study is an opportunity for the Army Corps to take ownership of their ability to strengthen the likelihood of long term survival of Salmon in the Yuba River by addressing fish passage at Englebright and Daguerre Point Dams. Fish populations in the Yuba River watershed are struggling because they do not have access to their historic spawning grounds. Habitat restoration is very important, but the Army Corps should focus its efforts on improving the facilities it owns and is responsible for. A fish passage project at Daguerre and/or Englebright will have long lasting benefits for salmon. We have a responsibility to the ecosystems that connect us to the awe and wonder of the world and sustain us physically, economically, and socially. Salmon and Sturgeon are part of that ecosystem. Please take responsibility for what you can do for Salmon and Sturgeon by addressing fish passage at Daguerre and Englebright Dam.	the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
UU	As representatives of the conservation community we are pleased to see that the partnership between the Army Corps and Yuba County Water Agency has moved forward with the feasibility study and that a significant investment will be made in the Yuba River watershed. In previous comments, some of the signatories to this letter have stressed the importance of studying fish passage options at Englebright Dam. We are disappointed to see that the feasibility study did not investigate alternatives for passage at either Daguerre Point Dam or Englebright Dam, both under ownership by the Army Corps. We would like to stress that the feasibility study remains an opportunity to expand on concepts and preliminary planning	Fish passage at Englebright and Daguerre Point Dams was considered in the feasibility study, but were eliminated through application of screening criteria. Please review Chapter 3 of the FR/EA for a complete description of the plan formulation process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is beyond the scope of the feasibility study to continue detailed evaluation for measures that are not included in the final array of alternatives. For the purpose of this study, ‘nonviable’ does not

Comment	Comment Text	Response
	documents that were created by the Yuba Salmon Forum and Army Corps for Englebright Dam and Daguerre Point Dam. While important, choosing to only study floodplain habitat restoration alternatives is duplicative of work already occurring in the Lower Yuba watershed by the United States Fish and Wildlife Service and local partners. We ask that the Army Corps more thoroughly study fish passage at Englebright Dam to better understand the impacts on hydropower generation, recreation, trapped sediment, the aquatic community, and cost projections. Further, we encourage the Army Corps to draw on the extensive knowledge and expertise that local stakeholders can provide to move forward fish passage alternatives for this study. We respectfully request that the Army Corps consider these comments and reconsider your recommendations from the interim draft report in the selection of final project alternatives.	confer a determination on the overall feasibility of a particular action, rather 'nonviable' refers to measures and alternatives that were determined to be ineligible for recommendation under this study through the plan formulation process. It is also important to note that the this study is an interim response to the authority to conduct ecosystem restoration in the Yuba River watershed and the recommended plan in no way precludes future implementation of any other potential restoration actions in the watershed by any organization. Degradation of aquatic and riparian habitat in the Lower Yuba River is severe and the need for restoration would not be fully met by the near term implementation of restoration by other entities. USACE gives priority to restoration projects in areas where there is active participation in restoration by multiple organizations.
VV	Please ignore the two word documents in this email. The pdf is SYRCLs comment letter, the other two are word versions of comment letters. My apologies for sending all three.	Comment noted.
WW-1	American Rivers appreciates the opportunity to comment on the Draft Feasibility Report/Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study (Report). We have been actively engaged in Yuba River watershed restoration and protection efforts for nearly 20 years, including the Upper Yuba River Studies Program started in 2000, FERC relicensing processes, the Yuba Salmon Forum, North Yuba Reintroduction Program, and the Yuba Salmon Partnership Initiative. American Rivers was encouraged when the USACE initiated the Yuba River Ecosystem Restoration Feasibility Study, and we were hopeful the USACE would recognize its significant impact on the lower Yuba and embrace its considerable authority to design a restoration program of appropriate magnitude and focus. However, the results to date are disappointing; both because the USACE failed to adequately incorporate inputs from the multitude of stakeholders and because of the small bore nature of the "Tentatively Selected Plan" (TSP). If the USACE continues as proposed in this Report, it will fail in its stated mission of ecosystem restoration.	The feasibility study included appropriate opportunities for public and stakeholder participation. While the recommended plan does not fully address the scope of ecosystem degradation in the watershed, the plan would provide independent and significant ecosystem benefits to the aquatic and riparian habitats of the Lower Yuba River.

Comment	Comment Text	Response
WW-2	The three types of habitat restoration included in the TSP are necessary, but not sufficient for the USACE to fulfill its duty and accomplish its mission, for several reasons. First, the scale of the actions (178 acres) is not commensurate with the magnitude of the impact of USACE facilities and operations or the scope and scale of ecosystem restoration needs in the Yuba River. Second, the USACE's evasion of the issue of impaired passage is particularly frustrating given the universal recognition of the problem at both Daguerre Point Dam and Englebright Dam, and the immense amount of resources that many stakeholders have devoted to resolving the issue, including co-project lead Yuba County Water Agency. Finally, the Report and TSP do not an approach to evaluating the problem and developing solutions that adequately account for the ecological functions disrupted by USACE facilities and operations, including a functional relationship between the channel and frequently inundated floodplain habitat. As such, the TSP, while implementing useful projects, is unlikely to significantly improve long-term ecosystem conditions. We urge the USACE to revise the TSP to take a more ambitious and systematic approach to the project to achieve landscape level improvements and accomplish the USACE mission of ecosystem restoration.	The objective of the study was to evaluate and recommend a set of actions to address ecosystem degradation in the Yuba River watershed. The study was not conducted to recommend an action that is legally required of an existing USACE project or NMFS May 2014 Biological Opinion. The study objectives identified in Section 2.4 are landscape-level and watershed scale and the Recommended Plan meets the objective of a USACE ecosystem restoration project by restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Although the recommended plan does not represent a complete response to the full scope of ecosystem degradation in the Yuba River watershed, it represents a significant contribution to the improvement of the Yuba River watershed ecosystem as demonstrated in the Final FR/EA and further evidenced by the existing, ongoing, and future planned restoration actions on the Lower Yuba River supported by various agencies and local stakeholders. The scope of degraded ecosystem form, function, and processes in the lower Yuba River is severe and the need for restoration would not be exhausted due to the near term implementation of restoration by other entities. Additionally, USACE gives priority to restoration projects in areas where there is active participation in restoration by other Federal agencies. Fish passage measures at Englebright Dam and Daguerre Point Dam were considered in the feasibility study, but were eliminated through application of screening criteria. Please review Chapter 3 of the FR/EA for a complete description of the plan formulation process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is beyond the scope of the feasibility study to continue detailed evaluation for measures that are not included in the final array of alternatives. For the purpose of this study, 'nonviable' does not confer a determination on the overall feasibility of a particular action, rather 'nonviable' refers to measures and alternatives that were determined to be ineligible for recommendation under this study

Comment	Comment Text	Response
		through the plan formulation process. It is also important to note that the this study is an interim response to the authority to conduct ecosystem restoration in the Yuba River watershed and the recommended plan in no way precludes future implementation of any other potential restoration actions in the watershed by any organization.
XX	I am a native of the Northern Sierra, an educated environmental scientist, and an enthusiast of all things lotic. I am writing in order to comment on the Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study (Army Corps, 2018). My greatest concern is the lack of consideration for the longitudinal connectivity of habitat for anadromous fisheries. Englebright Dam interferes with the success of endangered and threatened species of anadromous fish by blocking passage to favored upper watershed spawning grounds. Daguerre Point Dam prevents Chinook, steelhead, and sturgeon from accessing historic spawning grounds. I believe that any action that does not include dam removal, or at least allow for fish passage beyond these dams, fails to meet the USACE's planning objective to "Improve longitudinal river connectivity" and there by does not do enough to meet the planning objective to "Improve the quantity, quality, and complexity of aquatic habitat". This report/assessment states, "Ecosystem restoration is one of the primary missions of the U.S. Army Corps of Engineers"; this statement lends to the belief that it is the purview of the USACE, when carrying out an "ecosystem restoration" project, to, first and foremost, restore the ecosystem. However, in this circumstance the USACE is seeking to pacify a concerned public, temporarily green wash a watershed, and perpetuate an augmented (not restored) ecosystem. Thank you for your time.	While there is no requirement that the recommended plan must satisfy every objective of the study, expansion and improvement of aquatic habitats along the Lower Yuba River will contribute to improved longitudinal river connectivity by reducing existing gaps between patches of higher quality habitats for migrating fish. USACE recognizes that Lower Yuba River Habitat Restoration will provide less of an improvement in longitudinal river connectivity than some of the other measures considered.
YY-1	We are disappointed that the feasibility study draft has ignored many comments and requests made in the attached document from December 2015. We ask that the Army Corps carry out additional study to assess these critical factors. While the floodplain habitat restoration work described in the current draft is important, it leaves many opportunities unexplored, notably	All comments received during the scoping phase were considered and incorporated into the feasibility study as appropriate. Volitional fish passage at Englebright and Daguerre Point dams was considered in the feasibility study, but was eliminated from detailed

Comment	Comment Text	Response
	with regards to Englebright and Daguerre Point Dams. Any effort that does not include providing volitional fish passage between the Feather River and headwater habitat upstream of Englebright Dam will not result in listed fish recovery or meet criteria for achieving self-sustaining populations. Preventing listed fish species from reaching headwater habitat currently blocked by the dam will similarly preclude ecosystem recovery from being achieved in the Yuba River watershed. It is imperative that volitional fish passage options be thoroughly assessed and considered.	evaluation because of high costs and risks relative to potential restoration benefits in comparison to other measures considered. Degradation of ecosystem form, function, and processes in the Lower Yuba River is severe and the recommended plan would provide significant habitat improvements for listed fish species in the Lower Yuba River. Many of the following comments (YY-2 through YY-13) provided by Patagonia during the 2015 NEPA scoping process concerned study requests that were found to be outside the overall purpose and scope of the feasibility study or were not necessary to identify a recommended plan under USACE's risk-informed planning process. The following general response applies to those study requests: The Yuba River Ecosystem Restoration Feasibility Study was not authorized or funded by Congress as a comprehensive, multipurpose watershed study. The purpose of the feasibility study is to determine if there is a plan for ecosystem restoration that can be recommended for Congressional authorization and USACE implementation consistent with applicable Federal laws, regulations, and policies, including USACE's planning policies. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is beyond the scope of the feasibility study to continue detailed evaluation for measures that are not included in the final array of alternatives. For the purpose of this study, 'nonviable' does not confer a determination on the overall feasibility of a particular action, rather 'nonviable' refers to measures and alternatives that were determined to be ineligible for recommendation under this study through the plan formulation process. It is also important to note that the this study is an interim response to the authority to conduct ecosystem restoration in the Yuba River watershed and the recommended plan in no way precludes future implementation of any other potential restoration actions in the watershed by any organization.

Comment	Comment Text	Response
YY-2	Multi-Species and Watershed-Scale Ecosystem Restoration Objectives As part of this study it is important to identify science-based objectives to guide and achieve effective Yuba River ecosystem restoration and recovery of umbrella species such as salmon, steelhead, and sturgeon. Study Requests: 1) Include the entire Yuba River watershed and floodplain within the geographic scope of the study. 2) Due to the Yuba River flood protection and ecosystem relationship and implications, please include consideration of the adjacent Feather River floodplain and existing flood protection issues and infrastructure, proposals, and identify potential alternatives that serve a dual purpose for Yuba and Feather floodplain restoration and flood protection. 3) Include out-of-basin water facilities receiving flows from the Yuba watershed, within the scope of the study. 4) Define ecosystem restoration and sensitive species and fisheries recovery objectives and metrics for success. Include improving nutrient cycling into and out of the Yuba River watershed and impacts on ecosystem/fishery health. For example, include an objective and define actions to restore the flow of ocean-derived nutrient, in the form of anadromous fish, to historically anadromous reaches of the watershed for ecosystem benefits. Similarly, identify objectives to safely restore the flow of beneficial watershed sediments and woody debris to deprived wetlands and ecosystems downstream in the Feather and Sacramento Rivers, delta, San Francisco Bay, and nearshore Pacific Ocean environment. 5) Define ecosystem restoration and fish recovery objectives and metrics for success. 6) Only pursue the assessment and consideration of projects that benefit self-sustaining, self-regulating, wild fisheries recovery and long-term adaptation and evolutionary requirements. 7) Determine when fish recovery actions and study alternatives are expected to achieve fish recovery and delisting objectives without the need for further ESA protections and human intervention.	The study objectives identified in Section 2.4 are multi-species and watershed scale. The Yuba River Ecosystem Restoration Feasibility Study has considered a wide range of improvements to the Yuba River watershed. Preliminary and initial measures included actions throughout the entire watershed as described in Section 3.4. Because flood protection is not an identified purpose of the study, selection of measures based on flood protection benefits would be outside the scope of the study. Because USACE's ecosystem restoration objective is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition, the study is not focused on the recovery of individual species. Reallocation of water from non-USACE projects as a primary measure is not within USACE's ecosystem restoration mission because the acquisition of water rights would be a non-Federal responsibility under USACE policy. Ecological success criteria are defined in the Monitoring and Adaptive Management Plan. The study's longitudinal river connectivity objective includes the movement of fish, water, sediment, and ocean nutrients. Climate change impacts are discussed at a level of detail appropriate for the needs of the study in Section 4.3.2 of the feasibility report.

Comment	Comment Text	Response
	8) Compare the short and long-term climate change impacts from various alternatives.	
YY-3	Study Requests: Thoroughly assess Englebright Dam modification, removal, and volitional fish passage alternatives, including the following: 1) Lowering the dam to near the accumulated sediment level in the reservoir and assessing various volitional fishway options around the dam. 2) 2) Lowering the dam to one or more elevations below the accumulated sediment level in the reservoir and combined with various upstream sediment management (stabilization, removal, pollution clean-up and downstream transport) and volitional fish passage options. 3) Removing the dam in combination with sediment management, flood protection, water supply, energy, and other alternatives. Assess multiple dam removal strategies, including various phased notching strategies over multiple years, gated orifice feature to improve sediment management options, removal following sediment and pollution management alternatives, and various hybrid alternatives. 4) Assess lowering the dam to near reservoir sediment level as an initial step with any removal or lowering alternative to limit additional sediment accumulation. Also assess project costs associated with subsequent steps and/or implementing other watershed projects to enable safe dam removal or modification alternatives. 5) As described later in this letter, and in the attached September 21 letter, we request that the study include robust and diverse volitional fish passage assessment efforts and not spend limited time and resources on 6) non-volitional alternatives that do not meet ESA "recovery" objectives. Accumulated Reservoir Sediment and Pollution Management Alternatives Study Requests:	As documented in Sections 3.4.2 and 3.4.2.1, removal or lowering of Englebright Dam, as well as a bypass channel or step dam, were considered in the study. The Englebright Dam removal and lowering measures considered in the study included sediment removal. A detailed evaluation of various sediment removal options was not necessary to determine that the dam removal and lowering measures would have high costs and risks relative to potential restoration benefits in comparison to other measures considered. Consequently, sediment removal was not evaluated in further detail because of the previously stated study constraints.

Comment	Comment Text	Response
	Identify and thoroughly assess alternatives to manage accumulated reservoir sediment and mining pollution behind Englebright Dam to facilitate modification or removal alternatives, including: 1) Sediment pollution sorting and disposal alternatives on and off sight. 2) Sorting, transport, and sale of commercially valuable aggregate and precious metal (i.e. gold) within accumulated reservoir sediments and potential to offset some project costs. 3) Assessment of reservoir sediment (and processing/cleaning) for use in associated river and floodplain restoration efforts, downstream flood protection features, and 'natural' transport downstream to benefit river, delta, and San Francisco Bay wetland health and restoration projects. Identifying potential cost sharing, including the current need for large amounts of sediment for delta/bay wetland restoration and climate change resilience efforts (including the need and use of river-derived sediments to restore, protect, and build up coastal wetlands in the face of sea level rise projections). Coordinate with USGS, USFWS, South Bay Salt Pond Restoration Project (of which the Corps is a partner) on sediment needs and potential cost sharing and funding opportunities. 4) Assess sediment management alternatives to facilitate dam lowering and dam removal alternatives, including temporary and permanent storage within and adjacent to the reservoir area, removal, downstream transportation, and combinations of the above.	
YY-4	Study Requests: Assess various modification, replacement, and removal alternatives for Daguerre Dam and off-stream water storage and use, including: 1) Replacement of the existing structure with a damless diversion facility that achieves diversion objectives while providing unimpeded passage for all salmon, steelhead, sturgeon, and other native aquatic species. Review and seek input from recently complete damless diversion projects (some include dam removal/replacement) on the Rogue, Elwha, Sacramento, Yellowstone, and other rivers. Coordinate with water agencies, utilities, and Corps leads on these successful	Several modification and removal measures were evaluated for Daguerre Point Dam. Class three cost estimates were developed for step pools, a fishway/bypass, and removal measures for Daguerre Point Dam. USACE does not operate or regulate the use of the existing water diversions at Daguerre Point Dam. Potential cost risks associated with existing water rights were considered during the evaluation of measures. A detailed evaluation of various water management options was not necessary to determine that the dam removal measures would have high costs and risks relative to potential restoration benefits in comparison to other measures considered. Consequently, water management options were not

Comment	Comment Text	Response
	projects and present a summary of the projects, grant funding used, and outcomes to Yuba stakeholders and water users. 2) Identify and assess potential alternatives for using a modified/replaced Daguerre diversion for benefits beyond existing agricultural uses, including high flow capture for downstream flood protection benefits, diversion to off-stream sites (for storage, groundwater recharge, wetlands, fish rearing, and floodplain restoration), and potential downstream and out-of-basin uses that could facilitate less Yuba River headwater diversions from upper Middle and South Fork diversions and increased flows and water quality in these tributaries and on the mainstem of the Yuba. 3) Identifying and assess potential off-stream water storage sites to partially offset and replace lost storage with Englebright reservoir removal. Identify potential uses for flood protection and high flow capture. Identify potential off-stream foothill storage locations south of the Yuba and the potential to tie into water systems to the south that are currently utilizing captured water from Yuba headwater dams. Identify potential alternatives to transfer some upper Yuba headwater diversion rights to a lower Yuba diversion point and facilities to transfer this water to users to the south.	evaluated in further detail because of the previously stated study constraints.
YY-5	Study Requests: Assess various modification, replacement, and removal alternatives for Our House and Log Cabin dams, including: 1) Assess the necessity of these dams and identify potential alternatives, including retirement and removal of one or both, expansion of Log Cabin diversion amount and removal of Our House Dam from the Middle Fork, dredging sediment from New Bullards Bar reservoir to offset and enable additional storage capacity and hydropower potential. 2) Assess volitional fish passage and dam replacement alternatives, including damless or submerged weir facilities that achieve diversion objectives while providing unimpeded passage for salmon, steelhead, and other native aquatic species.	Modification, replacement, or removal of Our House or Log Cabins dams would improve anadromous fish passage only if fish passage is also provided above Englebright Dam to the Middle Yuba River. The evaluated measure for collect and transport of fish above Englebright Dam assumed that fish would be transported above Our House Dam. The measures for dam removal, dam notching and fish ladder, or fish tramway at Englebright Dam each assumed that fish passage facilities would be provided at Our House Dam. Consequently, benefits from fish passage to the Middle Yuba above Our House Dam were considered in the measures screening process. Replacement or removal of Our House Dam would be more expensive than providing fish passage facilities at Our House Dam. All of the Englebright Dam fish passage measures were screened out from detailed evaluation because they would have lower efficiency and higher risks for design and construction complexity than other restoration measures that were evaluated. The watershed area above Log Cabin Dam is only about one fifth the size of the watershed above Our House Dam, so

Comment	Comment Text	Response
		restoration of fish passage at Log Cabin Dam would not significantly improve the efficiency of the Englebright Dam fish passage measures. Consequently, further consideration of modification, replacement, or removal of Our House or Log Cabin dams would not change the results of the measures screening process, and therefore they were not evaluated in detail because of the previously stated study constraints.
YY-6	Study requests: Assess alternatives to the existing hydropower facilities and flow releases, including: 1) Providing additional release of water, and improved water quality, immediately downstream of the New Bullards Bar dam to improve salmonid (and other native species) habitat conditions and suitability downstream on the North Fork and entire length of the mainstem Yuba. Assess the short and long-term alternatives to minimize non-native reservoir species impacts and dispersal downstream, provide sufficient recruitment of woody debris and beneficial sediments downstream for salmonids and ecosystem benefits, improve water quality within and released downstream from New Bullards Bar reservoir, and long-term volitional fish passage alternatives (50 year Habitat Conservation Plan scale timeframe). 2) Identify and assess alternatives to modifying or phasing out the New Colgate tunnel/powerhouse including, alternative energy sources and producing hydropower near New Bullards Bar dam with all or partial flow releases directly into the river downstream and mimicking the natural hydrograph upstream. Identify alternatives that could eliminate or reduce hydropower ramping flows downstream (and the stated need for a regulating dam like Englebright) with the use of a commercial-scale battery storage facility and/or use of on off-site battery storage facility within our out of the Yuba basin. Seek input from energy storage experts and recently funded and constructed commercial-scale, grid tied, battery storage facilities being built by the largest energy providers in the State as solutions to the increasingly utilized and irregular solar, wind, and other renewable energy production and storage.	Reallocation of water from non-USACE projects to increase flows is not appropriate for USACE's ecosystem restoration mission as a primary measure because the acquisition of water rights would be a non-Federal responsibility under USACE policy. Management of non-native fish species would also not be appropriate as a primary measure for USACE ecosystem restoration. USACE does not operate or control the operation of hydropower facilities on the Yuba River, so the assessment of alternatives to existing hydropower facilities is not appropriate for USACE's ecosystem restoration mission as a primary measure. These measures could be implemented by other agencies either separately or in addition to restoration measures implemented by USACE. The evaluation of the Englebright Dam removal and notching measures in this study assumed that reoperation of some existing water supply and hydropower facilities in the watershed would be required. However, a detailed evaluation of reoperation options and impacts was not required to determine that those measures would have higher costs and greater risks than other measures that were considered. Consequently, further consideration of alternatives to existing hydropower facilities and flow releases would not change the results of the measures screening process, and therefore they were not evaluated in detail because of the previously stated study constraints.

Comment	Comment Text	Response
YY-7	Study requests: Expand upon existing river hydrology, water quality, and diversion data to gain a more accurate and complete water budget for the Yuba basin. Comparing project alternatives and making informed decisions about ecosystem restoration effectiveness requires additional information, including: 1) Determining seasonal and annual reservoir evaporation rates throughout the watershed and impacts on reservoir releases, stream flows and water quality. 2) Assessing individual and cumulative water quality changes caused by Yuba basin dams and reservoirs. 3) Assessing potential modifications and selective removal of low value diversions, dams and reservoirs that could have a significant positive impact on stream flows (including reduced evaporation), water quality, and salmonid habitat quality and quantity downstream. Determine how the modification or removal of certain MF and SF Yuba headwater dams and reservoirs could improve salmonid habitat, suitability, productivity, and broader ecosystem objectives downstream.	As explained in the previous response, reallocation of water from non-USACE projects would not be an appropriate primary measure for a USACE ecosystem restoration feasibility study. Detailed river flow and water quality records were sufficient to identify the existing and the most likely future conditions in the watershed for the purposes of this study. Additional study of evaporation rates, water quality changes, and potential streamflow changes associated with existing dams and reservoirs was not necessary to identify a recommended plan consistent with the USACE policies explained in the feasibility report.
YY-8	Study Requests: Determine and compare the near and long-term climate change implications on ecosystem restoration and species recovery objectives for alternatives, including: 1) Estimate annual and long-term greenhouse gas emissions from Englebright, Our House, Log Cabin, New Bullards Bar, and South Fork and Middle Fork headwater reservoirs and dams. 2) Estimate the annual and long-term carbon capture/sequestration potential for alternatives that modify or remove dams and reservoirs, restore vegetation to former reservoir areas, enable carbon in accumulated reservoir sediment to be transported downstream to long-term estuarine and offshore sinks, and other carbon sequestration implications.	USACE’s ecosystem restoration mission is limited to aquatic ecosystem restoration. Estimating existing greenhouse gas emissions and investigating carbon sequestration and the effects of dam removal on coastal erosion are outside of the scope of this feasibility study. Climate change impacts are discussed at a level of detail appropriate for the needs of the study in Section 4.3.2 of the feasibility report.

Comment	Comment Text	Response
	3) Identify sediment transport benefits to San Francisco Bay/Delta wetlands in combatting sea level rise and meeting coastal resilience goals. 4) Use existing and updated climate change projections to estimate future salmonid habitat conditions (flows, reservoir evaporation, reservoir and stream water temperature/DO, algae blooms, etc.) and life history suitability (migration through reservoirs, reservoir release turbidity and algae/toxins, spawning gravel and woody debris recruitment, warmwater invasive species competition and predation, etc.) for each alternative and to at least 50 years out. 5) Determine short and long-term (50 year minimum) greenhouse gas emissions for operation and maintenance of alternatives and associated infrastructure. Determine energy and fuel consumption and emissions related to fish passage alternatives and operations.	
YY-9	Study requests: 1) Assess alternatives that could divert less water out of the Yuba River watershed; particularly from the Middle and South Fork headwaters. 2) Assess alternatives that could enable more water to flow down Yuba tributaries and mainstem and potentially be withdrawn from the lower river, Feather, or other alternatives. For example, assess the potential for water users to the south of the Yuba basin to receive some of their water from diversions on the lower river instead of headwater diversions that reduce flows and habitat quality along much of the Yuba basin. Such lower Yuba diversion could potentially occur at a modified or damless diversion facility near the existing Englebright and/or Daguerre dam locations and carry flows to out-of-basin users to the south and potentially tie into new offstream water storage, floodplain, and groundwater recharge and storage. 3) Assess alternatives that could modify or remove dams and reservoirs in Middle and South Fork headwaters to reduce reservoir evaporation and promote additional summer flows and improved water quality and salmonid habitat conditions downstream. 4) Assess dredging accumulated sediment from reservoirs, and potentially raising certain dams, in Middle Fork and South Fork headwaters (above historic anadromous salmonid reaches) to increase	USACE does not operate or control the operation of water diversions in the Yuba River watershed. Operation of existing water supply and hydropower facilities is the responsibility of the operating and regulating agencies. As explained in a previous response, reallocation of water supplies would not be an appropriate primary measure for a USACE ecosystem restoration feasibility study. Under USACE policies, flood protection and mining tailing remediation are not appropriate project purposes for a USACE ecosystem restoration feasibility study. Such measures could be considered in a more comprehensive watershed study.

Comment	Comment Text	Response
	storage capacity devoted to improving downstream flows, water quality, and habitat conditions. Assess dual function modifications that could potentially benefit lower river flood protection by capturing and storing peak flows from large storm and run-off events. 5) Assess high flow capture and groundwater recharge alternatives in the lower river that incorporate flood protection, wetland restoration, mining tailings remediation, biofiltration, and salmonid rearing habitat features and ecosystem restoration objectives. 6) Assess lower Yuba and Feather River confluence area flood protection alternatives that can also provide ecosystem benefits, including acquisition of key floodplain properties from willing sellers, floodplain expansion and high flow capture, improve or expand urban levees and/or bioengineered protection features, identify dual purpose potential floodwater bypass corridors around Yuba City/Marysville areas on the lower Yuba and Feather Rivers. Assess how such actions could be designed to meet other water, safety, habitat, and fisheries restoration goals along the lower Yuba, and broader Sacramento and S.F. Bay.	
YY-10	Study requests: 1) Define anticipated dam safety work, projected upgrades, retrofitting, dredging, potential emissions reduction measures and other maintenance actions and costs associated with New Bullards Bar, Englebright, Our House, Log Cabin, Daguerre, and other basin dams and water systems over the next 50 years. This is critical information to have in order to accurately compare alternatives and costs. 2) Determine average annual reservoir sedimentation rate, estimate longterm reservoir water storage capacity loss due to sedimentation, and sediment management and removal costs for Yuba basin reservoirs. 3) Summarize current dam safety and hazard classifications for Yuba basin dams as defined by the Army Corps, California Division of Safety of Dams and other entities or recent studies. 4) Summarize dam failure, downstream inundation area potential, pollution discharge, public safety, and ecosystem threats for basin dams.	Because of the previously identified study constraints, rough order of magnitude cost estimates were used to screen the initial measures. Lower Yuba River habitat restoration was estimated to be significantly more efficient than the other initial measures; therefore, it is unlikely that more detailed cost estimates for future dam maintenance or sediment management would change the results of the measures screening process. Under USACE policies, an ecosystem restoration project could not be recommended based on dam safety or public safety related to water quality. Because the Yuba River watershed represents less than 2% of the area of the San Francisco Bay/Delta watershed, it is unlikely that any of the Yuba alternatives would have a significant, quantifiable effect on San Francisco Bay/Delta wetland habitat replenishment, survival, sea-level rise or public safety. Impacts of the final alternatives on water quality and transportation are evaluated in the feasibility report/environmental assessment as required under the National Environmental Policy Act.

Comment	Comment Text	Response
	5) Compare the estimated annual and long-term (50+ year) traffic, public safety, and elevated road maintenance costs associated with alternatives. 6) Compare Englebright Reservoir sediment management and pollution clean up alternatives and costs with projected future costs of additional reservoir sediment accumulation and management (to at least 50 years into the future). 7) Discuss the contribution and relationship between Yuba River sediment transport downstream and San Francisco Bay/Delta wetland habitat replenishment, survival, sea-level rise, and public safety. Compile recent USGS, and other agency and academic studies, describing the impact of tributary dams on Bay wetland resiliency and survival in the face of sea level rise. Compare expected implications of Yuba alternatives on sediment transport downstream, Bay wetlands and ecosystem health, and Yuba salmonid and sturgeon habitat between the Yuba River and the Pacific Ocean. 8) Identify near and long-term water quality implications and projections for various alternatives. Identify existing and projected public safety and ecosystem threats for alternatives due to poor water quality within the watershed and reservoirs. Use existing climate change models to project future water quality changes with various alternatives, including reservoir eutrophication, algal blooms and dispersal downstream, water temperature, dissolved oxygen, and other parameters with significant implications to ecosystem restoration and fisheries recovery effectiveness.	
YY-11	In order to accurately assess and compare potential salmonid habitat conditions for various alternatives, a significant amount of additional analysis is needed. It is useful to have the existing data and analysis on current Yuba River stream reaches and salmonid habitat quality and quantity. However, the existing data and analysis is incomplete and is resulting in inaccurate and premature conclusions and statements about the suitability, extent, and productivity of salmonid habitat and recovery potential with various alternatives yet to be adequately assessed. As is noted in existing studies, salmonid habitat conditions in the Middle and South Forks of the Yuba are negatively impacted and limited in large part due to the significant modification and diversion of	The USACE planning process requires screening of measures based largely on existing information. Section 3.4.3 of the report explains the screening process in detail. In that screening process, the quantity of habitat was based on the estimated total area of habitat and, for fish passage measures, a fish passage efficiency factor. The quality and significance of the habitat restored by each measure was compared by assigning the measures to broad ranking categories for six factors: scarcity, connectivity, special status species, hydrologic character, geomorphic character, and self-sustainability. For hydrologic character, all measures were assigned to the lowest ranked category, except for dam removal measures, which were assigned to the highest

Comment	Comment Text	Response
	flows between and out of these two Yuba sub-basins and, in some cases, the Yuba River watershed entirely. In addition, multiple dams and reservoirs in the upper reaches of these two tributaries are also greatly impacting water quality and quantity to all reaches downstream. Upstream of New Bullard Bar Dam, the relatively free-flowing and minimally diverted North Fork Yuba is in a far more natural state than the MF and SF Yuba. Not surprisingly, studies of existing conditions have found that the relatively intact upper North Fork has higher salmonid habitat conditions than the highly modified Middle and South Forks. To date there has been limited, and in some cases, no habitat assessments carried out to assess alternatives that could significantly alter and improve salmonid habitat quality and quantity within the MF and SF, and throughout the watershed. In order to qualitatively analyze and compare the impact of various alternatives on ecosystem restoration and salmonid recovery objectives, it is critical that additional studies be carried out in a manner that enables application and direct comparison to existing study results and models. As a Yuba River "ecosystem restoration" study, the whole point of the effort is to identify actions that can improve degraded habitat conditions, not accept existing degraded conditions and try to move species into the less impacted habitats. Study Requests: 1) Build upon existing salmonid habitat studies and analysis to identify projected habitat quality and quantity resulting from alternatives that would result in increased flows and habitat quality and quantity on the Middle and South Forks (far beyond the limited assessment to date of minimal flow releases from existing headwater dams). 2) Build upon existing salmonid habitat studies to assess and compare outcomes for all alternatives that could significantly increase the amount and quality of flows downstream of existing facilities and with modification and/or removal of some of these facilities. This should be carried out in several incremental flow release scenarios above the minimal release projection carried out to date. This should include assessment of various alternatives that can be employed to modify or eliminate some headwater dams and reservoirs to improve water quality, quantity, woody debris and beneficial sediment transport, riparian restoration, and reduce non-native species impacts. This	ranked category. Consequently, adding restoration of a more natural flow regime to the measures would not change the habitat quantity or quality scoring for the dam removal measures, and would equally increase the hydrologic character scoring for the other measures, including the selected Lower Yuba Habitat Restoration measure. Therefore, the final result of the measures screening process would not change as a result of the addition of a more natural flow regime to the measures. Modification or elimination of non-USACE dams, or changes in flow regimes, could be pursued by the responsible operating or regulating agencies separately from the plan recommended by this feasibility report. Potential effects of climate change on the recommended plan are addressed in the final feasibility report.

Comment	Comment Text	Response
	assessment must include projections for how the restoration and/or increase in sediment transport in sediment deprived reaches below dams, could improve hyporheic flows, reduce water temperatures, improve water quality and quantity, facilitate riparian revegetation and increased canopy cover and woody debris, increase spawning substrate conditions and increase salmonid habitat quality and quantity. 3) Assess headwater dam and reservoir evaporation amounts, seasonal timing of evaporation, and impacts to downstream flows and water users. Identify lower value headwater dams and reservoirs that could be removed or modified to reduce or eliminate evaporation, increase low water stream flow rates, improve water quality and determine downstream salmonid habitat quality and quantity responses. 4) Build upon existing salmonid habitat studies to assess and compare habitat outcomes with the modification or removal of Englebright Dam and restoration possibilities for additional river channel quantity through the reservoir area. Determine the projected water quality and salmonid habitat changes (quality and quantity) downstream from Englebright Dam resulting from various modification and removal alternatives. Extend salmonid habitat analysis and projections for all alternatives downstream on the Yuba River to at least the confluence of the Feather River. These additional salmonid habitat quality projections must include water quality changes due to the reduction or elimination of Englebright Reservoir, resumption of some or all sediment transport downstream under various alternatives, elimination or reduction of warmwater reservoir habitat and non-native species dispersal downstream, and identifying potential increases in low flow conditions with the reduction or elimination of evaporation from Englebright Reservoir. Compare existing salmonid habitat data results with the above additional alternative results along the full extent of the Yuba River and tributaries. We also request that sturgeon habitat quality and quantity projections and recovery implications be developed. 5) Carry out the above additional salmonid and sturgeon habitat projections for other alternative actions including various floodplain restoration and expansion alternatives, modification or removal/replacement of Daguerre, Our House, Log Cabin dams, and modification of New Bullards Bar Dam releases and Colgate Powerhouse operations, and other alternatives assessed that	

Comment	Comment Text	Response
	significantly alter salmonid habitat conditions and recovery potential within the watershed. 6) Input climate change projection data for alternatives to assess salmonid habitat conditions and objectives looking out a minimum of 50 years.	
YY-12	Study requests: We request that a Technical Advisory Committee (TAC) consisting of agency experts, independent scientists, and academia knowledgeable in fisheries recovery, Yuba water operations, geomorphology, flood protection, pollution clean up, engineering, and dam modification and removal be created. The Corps has effectively utilized and participated in such a TAC for the Matilija Dam Ecosystem Restoration Project. This TAC should carry out several tasks, including developing science-based objectives to achieve ecosystem restoration within the Yuba River watershed, identifying data gaps, developing the study scope of work, assessing and commenting on preliminary study findings and results, and recommending preferred alternatives that meet ecosystem objectives. We request that the Corps review and reference the reports, TAC formation and utilization, and study findings for the Corps-led Matilija Dam Ecosystem Restoration Project found at http://www.matilijadam.org. We request the opportunity to recommended suitable experts for consideration to serve on such a TAC for the Yuba River Ecosystem Restoration Feasibility Study. We request that the Corps and YCWA, with a Yuba study Technical Advisory Committee, identify and reach out to potential study partners at the national, state, and local level to help carry out the studies identified in this letter. We request that a Technical Advisory Committee identify potential study partners as soon as possible and help to contact and develop scopes of work with these entities and identify potential external cost sharing and/or funding to carry out these studies. For example, the National Science Foundation, USGS, U.C. Davis, local research institutes, agency research groups, NGO's, and others could provide important data, analysis, and funding on a coordinated and parallel path with the Feasibility Study process. We believe such partnerships will be essential to carrying out the needed studies to provide an adequate assessment and well-informed	The Technical Advisory Committee (TAC) for the Matilija Dam project was formed after the Matilija Dam feasibility study was completed in 2004. The purpose of the TAC is to provide input into the implementation of the project that was authorized based upon the feasibility report. We will consider forming a TAC with our non-federal sponsor to support design of the Yuba River ecosystem restoration project after the recommended plan has been approved and the design phase has been funded.

Comment	Comment Text	Response
	comparison of alternatives. We also believe that such partnerships will be critical to ensuring that NEPA/CEQA requirements for a resulting project proposal are met and to gain permitting and funding support in the future.	
YY-13	The Feasibility Study will be analyzing and considering various alternatives to provide fish passage and ecosystem benefits within the Yuba River watershed. As part of any resulting project, the Corps will be required to consult with NOAA and obtain a Biological Opinion for the project. Both NOAA and the Corps will ultimately have to comply with the procedural requirements of the National Environmental Policy Act (NEPA) prior to funding or implementing any restoration activities on the Yuba River. Pursuant to NEPA, federal agencies must consider alternatives to the proposed action. To date, a comprehensive fish passage alternatives study, which thoroughly assesses the multiple dam modification / removal, reservoir sediment management, flood protection and basin water management alternatives, has not been carried out. The Council on Environmental Quality, which has issued regulations implementing NEPA's requirements, refers to the alternatives analysis as the "heart" of the environmental impact statement. We are very concerned that the recently announced Yuba Salmon Partnership Initiative (YSPI) appears to be trying to decide on the future direction of recovery efforts on the Yuba River before the federal government has engaged in the public analysis and comprehensive review procedures required by federal law. By announcing a substantive decision to pursue non-volitional fish passage in the context of a framework for a "settlement agreement," before thorough analysis has been conducted of other alternatives, NOAA, CDFW, and YCWA have put the cart before the horse and threaten to undermine the legitimacy of its decision and future efforts, including the Corps Feasibility Study. The Ninth Circuit Court of Appeals has warned that NEPA's procedures "must be timely . . . and not as a subterfuge designed to rationalize a decision already made." The California Environmental Quality Act (CEQA) includes similar requirements. The Yuba County Water Agency and California Department of Fish and Wildlife must adhere to these and other requirements. Both of these agencies have similarly signed onto the	Comments noted. USACE is not a participant in the Yuba Salmon Partnership Initiative (YSPI). USACE considers the YSPI proposed project to be tentative at this time, so it was not assumed to be part of the future without-project condition for the feasibility study. During the feasibility study, USACE considered collection and transport ("trap and haul") of fish as a measure, but it is not included in the plan recommended by this report. The formulation and selection of the recommended plan were not affected by the YSPI proposed project. It is expected that any YSPI project would be independent from the recommended plan. In concept, collection and transport of fish to and from the upper watershed would not conflict with USACE's recommended plan and would likely increase the benefits of the recommended plan by increasing fish populations in the lower Yuba River. This feasibility report is not intended to guide or limit the actions of any entity other than USACE. It is not within USACE's purview to ask other public agencies to withdraw from the YSPI agreement. USACE encourages other government and non-government entities to address problems within USACE's mission areas whenever they are able to do so. If the YSPI project requires regulatory and/or real estate approvals by USACE, those actions will need to comply with NEPA and the Endangered Species Act, as applicable.

Comment	Comment Text	Response
	YSPI and will be deeply involved in the Yuba River Ecosystem Restoration Feasibility Study. We direct the Army Corps and these agencies to both the California Natural Resources Agency and CDFW website pages outlining the CEQA requirements: http://resources.ca.gov/ceqa/ https://www.wildlife.ca.gov/Conservation/CEQA/Purpose The YSPI is making decisions on the direction of recovery efforts on the Yuba River without having considered and fully analyzed all the available alternatives, which should include an investigation of other ways to ensure effective fish passage and recovery in the watershed. We cannot understand why the YSPI would announce a framework for a "settlement agreement" among six parties, with the National Marine Fisheries Service as the only participating federal entity, when the Army Corps of Engineers is moving forward, at the same time, with a $3 million feasibility study with the Yuba County Water Agency, commencing with a "charette, a collaborative design and planning session to determine the project's scope." A select group of entities should not be preemptively supporting an unsustainable fish enhancement effort in the Yuba River, particularly when the federal government is preparing a feasibility study through a collaborative process to assess a range of recovery options at the exact same time. There is a clear conflict of interest and improper procedure in this case that threatens the integrity and legality of the Corps Feasibility Study. Any project that results from the YSPI process will require YSPI partners to seek one or more permits from the Corps (and consultation from NMFS) to be implemented. By formally and publically endorsing a preferred Yuba fisheries restoration alternative before the Corps carries out an alternatives study, NMFS cannot be expected to carry out its consultation requirements to assess and fairly consider all reasonable alternatives in a scientific and unbiased manner. NMFS is the lead federal agency for the YSPI. By convening a pre-emptive advisory committee and reaching agreement behind closed doors on a preferred alternative that relies upon trap and haul to reintroduce listed species to the North Yuba River upstream of New Bullards dams, NMFS has seriously jeopardized the integrity and legality of the process. These problems threaten to infect the integrity	

Comment	Comment Text	Response
	of the Army Corps' feasibility study to the extent that trap and haul is considered as an alternative or a component of an alternative in that process. Any outcome from the feasibility study that incorporates the outcomes of the YPSI will be viewed by many stakeholders as illegitimate and a result of the inherent conflicts of interest that NMFS has created by reaching agreement on the YSPI terms before fulfilling its obligations under Section 7 of the ESA as a consulting agency for the Army Corps ecosystem-based recovery planning process. Therefore, we ask that the Army Corps request that the YSPI signatory groups set aside its agreements and instead that those parties participate, as all other stakeholders are expected to do, in the Army Corps feasibility study. It is expected that NMFS will remain a consulting, expert agency under Section 7 of the ESA. The Yuba Salmon Partnership Initiative is an "advisory committee" established and utilized by the National Marine Fisheries Service (NMFS) in the interest of obtaining advice or recommendations and is therefore subject to the public disclosure requirements of the Federal Advisory Committee Act (FACA). NMFS has not complied with these requirements. FACA's purpose is to assess the need for and ensure the transparency of various advisory committees established and utilized by the President and officers and agencies of the executive branch. Federal Advisory Committee Act, § 2, 5 U.S.C. App. 2 (2012); see also Public Citizen v. U.S. Dept. of Justice, 491 U.S. 440 (1989). Under FACA "advisory committee means any committee, board, commission, council, conference, panel, task force, or other similar group, or any subcommittee or other subgroup thereof . . . which is . . . established or utilized by one or more agencies, in the interest of obtaining advice or recommendations." § 3(2) (emphasis added). Committees that are "composed wholly of full-time, or permanent part-time, officers or employees of the Federal Government" are exempt. Id. FACA places a number of obligations on the federal government that apply to the establishment and operations of advisory committees, including a detailed charter, giving advance notice in the Federal Register for meetings, generally holding open public meetings, having an office or employees of the federal government preside over or attend every meeting, making records available to the public, and having the	

Comment	Comment Text	Response
	committee itself be "fairly balanced in terms of the point of view represented and the functions to be performed" and not being "improperly influenced by the appointing authority or any special interest." 5 U.S.C. App. 1 §§ 5, 9, 10. Here, the YSPI is an "advisory committee" established by the National Marine Fisheries Service (NMFS) for the purposes of giving advice on how to address fish passage issues on the Yuba River. The initiative clearly fits within the plain meaning of the terms "advisory committee" and was established by NMFS, in conjunction with other groups, and is currently being utilized "to collaboratively develop, fund and implement a cost-effective program that expands the Yuba River Basin's contribution to recovery of anadromous salmonids in California's Central Valley." Yuba County Water Agency, Yuba Salmon Partnership Initiative Technical Summary (2015), http://www.ycwa.com/res/docs/YSPI-technical-summary-5-4-2015.pdf. Indeed, NMFS acknowledges that the committee will "contribute to the recovery of spring run Chinook salmon" in direct support of NOAA Fisheries' 2014 Central Valley Recovery Plan. NFMS, Partners Set in Motion Historic Venture to Reintroduce Salmon to the Yuba River (2015) http://www.westcoast.fisheries.noaa.gov/stories/2015/06_05062015_yuba_agree ment.html. Clearly, the group was formed to collaborate and provide advice on a specific project. Finally, NMFS has established the committee in order to avoid litigation on relicensing the dams held by the Yuba County Water Agency, a party to the Initiative, and the local lead agency for the Corps Feasibility Study. See Andrew Creasey, New Pact to Aid Yuba River Salmon, Appeal Democrat, http://www.appeal-democrat.com/news/new-pact-to-aid-yuba-riversalmon/ article_f370946c-f54b-11e4-96fb-1f7e77ac5c29.html. Further, the committee's structure and purpose have been formalized by the term sheet, which outline a potential settlement agreement. See Term Sheet for Framework of Settlement Agreement Yuba Salmon Partnership Initiative, https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=99529&inline. As a result, the Initiative is an advisory committee because it has a fixed membership, an organized structure, and a specific purpose. In short, the federal government has run afoul of FACA procedures since the very formation of the YSPI. We are concerned that it is a violation	

Comment	Comment Text	Response
	of federal law for NMFS to organize a committee comprised of narrow special interests to advise it on the recovery of listed species within the Yuba River watershed all under the auspices of “settling” a future dispute that has not manifested itself in any form of litigation or even any concrete federal action or proposal. That is precisely the type of advisory committee that must be managed as such under FACA, with meetings that are open to the public and with membership that does not reflect any improper influence from the appointing authority or influence from any special interest. We request that the Corps ask NMFS, CDFW and YCWA, to formally withdrawal from the YSPI agreement and request that the YSPI signatory groups formally disband so that the outcomes of that illegitimate process do not impact the outcomes and legitimacy of the Army Corps Feasibility Study process. Similarly, we request that the Corps not utilize or adopt incomplete and premature conclusions made within YSPI documents and press releases. By eliminating this conflict of interest, NMFS could remain an unbiased consulting agency under Section 7 (and YCWA under similar State requirements) as opposed to an agency that has convened limited stakeholders to make a premature and substantive decision and public announcements ahead of the Corps Feasibility Study. Attached, please include previous comments sent in a September 21, 2015 letter to YSPI members within our comments here for the Corps Feasibility Study. As noted in the letter, we object to the YSPI process and to the use trap and haul as a suitable action to achieving “recovery” of self-sustaining, self-regulating, and wild fish populations as defined by the Endangered Species Act and Federal and State resource agency documents, policies, and reports. Trap and haul also fails to achieve ecosystem restoration in order to enable fisheries recovery. The “Endangered Species Consultation Handbook” states “recovery is the process by which species’ ecosystems are restored and/or threats to the species are removed so self-sustaining and self-regulating populations of listed species can be supported as persistent members of the native biotic community” (FWS & NMFS 1998). Additional, NMFS states, “We agree that the intent of the ESA is to conserve natural self-sustaining populations and functioning ecosystems” (NMFS 2005). Therefore, by not achieving effective ecosystem restoration or fisheries	

Comment	Comment Text	Response
	recovery policies, we request that the Feasibility Study not consider or spend limited resources on assessing non-volitional fish transportation alternatives, or artificial propagation efforts. Moreover, we are concerned that the YSPI is making decisions based on the direction of recovery efforts on the Yuba River without having considered and fully analyzed all the available alternatives, which should include an investigation of other ways to ensure effective fish passage and recovery in the watershed. We cannot understand why the YSPI would announce a framework for a "settlement agreement" among six parties, with the National Marine Fisheries Service as the only participating federal entity, when the Army Corps of Engineers is moving forward, at the same time, with a $3million feasibility study with the Yuba County Water Agency, commencing with a "charette, a collaborative design and planning session to determine the project's scope." A select group of entities should not be preemptively supporting an unsustainable fish enhancement effort in the Yuba River, particularly when the federal government is preparing a feasibility study through a collaborative process to assess a range of recovery options at the exact same time. Both NOAA and the Corps will ultimately have to comply with the procedural requirements of the National Environmental Policy Act (NEPA) prior to funding or implementing any restoration activities on the Yuba River. Pursuant to NEPA, federal agencies must consider alternatives to the proposed action. To date, a comprehensive fish passage alternatives study, which thoroughly assesses the multiple dam modification / removal, reservoir sediment management, flood protection and basin water management alternatives, has not been carried out. The Council on Environmental Quality, which has issued regulations implementing NEPA's requirements, refers to the alternatives analysis as the "heart" of the environmental impact statement. We are very concerned that the recently announced Yuba Salmon Partnership Initiative (YSPI) appears to be trying to decide on the future direction of recovery efforts on the Yuba River before the federal government has engaged in the public analysis and comprehensive review procedures required by federal law. By announcing a substantive decision to pursue non-volitional fish passage in the context of a framework for a "settlement agreement," before	

Comment	Comment Text	Response
	thorough analysis has been conducted of other alternatives, NOAA, CDFW, and YCWA have put the cart before the horse and threaten to undermine the legitimacy of its decision and future efforts, including the Corps Feasibility Study. The Ninth Circuit Court of Appeals has warned that NEPA's procedures "must be timely . . . and not as a subterfuge designed to rationalize a decision already made." In addition, the YSPI plan sets a very concerning precedent for use of trap and haul projects on other rivers in California and elsewhere that shift attention and resources away from self-sustaining, volitional fish passage, as well as other wild salmon recovery actions. The performance record for existing trap and haul programs is inconsistent and replete with problems. Mechanical failures, stress and mortality to fish, and even unanticipated impacts to water quality and macro invertebrate populations from large juvenile fish collection facilities are among them. While engineers are certainly willing and capable of building newer facilities with better performance, any facilities designed to collect and remove fish from the river are inherently prone to both mechanical and biological complications. The California Department of Fish and Wildlife's own Steelhead Restoration and Management Plan cites "the history of failure of trap-and-truck operations," and features a paper from the journal Conservation Biology that calls the use of such technological solutions, "techno-arrogance." Among the causes of biological issues, the artificial conditions and stress of concentrating and handling fish are known to be particularly problematic. The Oregon Department of Fish and Wildlife has noted that trap and haul programs can cause long-term evolutionary and population persistence problems as they "impose an artificial selective force and generally reduce fitness." Climate change studies carried out by leading wildlife experts have identified unimpeded wildlife migration, national selection and adaptation as high priorities to ensure long-term species survival in the face of changing environmental conditions. The more natural resource managers and regulatory agencies try to engineer solutions on dynamic living systems like rivers, the more opportunities there are for unexpected costs, ineffectiveness, and unforeseen impacts on aquatic communities and their habitat.	

Comment	Comment Text	Response
	Furthermore, trap and haul programs do not meet criteria for recovery under the Endangered Species Act of support California Department of Fish and Wildlife goals for "wild" and "self-sustaining" populations. Guidance documents for implementation of the ESA make it clear that delisting (the official goal of recovery actions) requires adequate wild and self-sustaining populations. NMFS acknowledged in the Public Draft Recovery Plan for Central Valley Salmonids that "allowing for volitional fish passage to the upper watershed is the only way to establish a self-sustaining population", and the Final Plan Recovery Implementation Principles, indicate that "…priority will be given to measures that, once implemented, are self-sustaining." More broadly, trap and haul programs present a terribly unsatisfactory solution from the standpoint of environmental stewardship. There is nothing benign about removing fish from rivers to move them along their way in trucks. Not least among these problems is that there are climatic change implications from the high energy use and greenhouse gas emissions that result from such operations. Ultimately, trap and haul fails to adequately address- and in fact, diverts attention away from—any of the root causes of the decline in wild salmonid populations and watershed health, including the effects of dams. The recovery of Central Valley Spring-run Chinook, steelhead, and sturgeon requires that these fish populations gain access to historic habitat upstream of Englebright Dam and other barriers, as well as protection and restoration of adequate flows and habitat conditions below other diversions within the watershed. Re-locating adult salmon from the lower Yuba River to the North Yuba River, and juvenile salmon from the North Yuba to the lower Yuba does not truly connect existing habitat to historic habitats but rather bypasses 40 miles of river through an artificial system of fish collection and transport. YSPI's plan apparently involves no restoration of the watershed bypassed by trap and haul and pre-empts regulatory processes that may require restoration of those reaches between and below dams for the purpose of recovering fish and improving watershed health and fisheries suitability. We request that YSPI parties return to the pursuit of detailed studies investigating volitional fish passage options for the Yuba. The process of determining the best actions on the Yuba River for recovery of wild	

Comment	Comment Text	Response
	salmon and steelhead should occur in an open process, with significant input from diverse local and regional stakeholders, instead of an exclusive group bound by confidentiality agreements. Furthermore, the studies should be coordinated with the $3million Army Corps of Engineers feasibility study for fish passage at Englebright Dam and Daguerre Point Dam so that results of both processes will be based on adequate assessment and evaluation of long-term, watershed-scale options. Accordingly, we request that YSPI suspend negotiations focused on a premature and pre-emptive plan for trap and haul on the Yuba and refocus efforts on conducting adequate alternatives assessment studies with required stakeholder collaboration. We support the portions of the YSPI plan calling for sustainable restoration of fish habitat in the lower Yuba River. We welcome collaboration in achieving shared goals on this river, the broader San Francisco Bay ecosystem, and sustainable West Coast fisheries recovery in general. Volitional fish passage is the only way to achieve true recovery of wild and self-sustaining fisheries and watershed function in the Yuba River and throughout the country. Non-volitional fish passage projects like trap and haul lock us into costly ongoing programs which divert resources and energy away from more effective and sustainable solutions. This concept is underlined in the conclusion of the California Department of Fish and Wildlife's Steelhead Restoration and Management Plan where technological solutions are discussed, stating "…the real danger with this philosophy is that it can divert attention, and forestall real, long-term solutions."	
ZZ-1	Thank you for this opportunity to Comment on the Draft Interim Feasibility Report and Environmental Assessment (FREA) prepared as part the Yuba River Ecosystem Restoration Study Program by the US Army Corps of Engineers (USACE). The Sierra Fund has participated in public forums on this topic in the past and has carefully reviewed the FREA. The Sierra Fund is a 501 (c) (3) non-profit organization dedicated to restoring resiliency to the ecosystems and communities of the Sierra Nevada. We have spent the last dozen years building a comprehensive understanding of the impacts of the Gold Rush on our region, including	Comment noted. Specific comments summarized here are addressed in responses ZZ-2 through ZZ-46 below.

Comment	Comment Text	Response
	the significant adverse impacts in the Yuba River Watershed during this era. Notable impacts of 19th century hydraulic mining include the introduction of mercury to aquatic ecosystems and the construction of debris control dams (DCD) to prevent the transport of mining debris. Our comments are intended to support a project on the Yuba River that will help restore ecosystem resiliency, fish passage, water quality and economic opportunity and facilitate watershed-wide recovery from impacts and disturbances that are over a century in the making. The Sierra Fund believes that the FREA, while detailed and well presented with beautiful charts and maps, is significantly flawed in several key ways that we in detail in these comments. We believe that these flaws lead to the choice of a Tentatively Selected Plan (TSP) that does not best serve the purposes of the USACE Yuba River Ecosystem Restoration program. These flaws are detailed under the headings of the four overarching comments as listed below: COMMENT I: The FREA relies on inaccurate and out-of-date information to draw inaccurate scientific and economic conclusions and develop ill-advised proposals for action. COMMENT 2: Alternatives to the proposed action do not adequately explore the opportunities, benefits and costs of modification of the USACE facilities Englebright and Daguerre Dams (both of which block fish passage for listed species), or the impacts of failure to do so. COMMENT 3: The scope of the FREA should have included the larger issue of fish passage as a central focus of this ecosystem project. COMMENT 4: The USACE partner, Yuba County Water Agency (YCWA), may have a conflict of interest related to their Narrows Dam project and other management priorities.	
ZZ-2	We document that that the FREA proposes activities that cost nearly $100 million to restore 176 acres of riparian and riverine habitat using methods that could increase mercury methylation. Yet this project will contribute very little to the urgent need to restore fish habitat or reduce mercury discharge from this region to the San Francisco Bay and Delta. If the proposed Lower Yuba River restoration activities are going to	Comment noted. The potential for release of contaminants will be addressed through pre-construction characterization, monitoring during construction, and adaptive controls. Additional avoidance, minimization, and mitigation measures, including monitoring protocols were adopted for the recommended plan (Section 4.3.7). Prior to construction, Mercury and Methylmercury will be tested for

Comment	Comment Text	Response
	move forward, at a minimum they must require significantly more substantial mitigation measures for mercury impacts of the proposed projects including: adherence to water quality assurance project plan (QAPP) for trace metal mercury sampling; adoption of best management practices and protocols based on accurate data and currently understood standards for both sediment and mercury; and extensive monitoring for many years after the project is implemented. In addition, we urge USACE to postpone implementation of any ecosystem restoration projects in the lower Yuba River until fish passage is restored to the upper watershed.	during PED phase site characterizations and monitored in the river during construction. A 401 Water Quality Certification will be obtained during PED in coordination with the Central Valley Regional Water Quality Control Board to ensure that the project is compliant with CWA requirements. Section Appendix C, section C-10. Construction Procedures and Water Control Plan discusses some potential controls and Best Management Practices (BMPs) to mitigate risks from contaminant releases during construction. Contaminant concentrations that may be environmentally relevant will be addressed through characterization, monitoring and adaptive controls through the 401 Certification process. Appendix C, section C-21 Special Studies puts forth possible means of mitigating encountered hazardous and toxic materials. It is possible that based on Special Studies, site-specific water quality criteria for mercury will be used to address potential methylmercury effects.
ZZ-3	Our work demonstrates that there could be another much more practical and economically viable method to reconnect the floodplain to salmon rearing habitat, and simultaneously restore volitional fish passage and habitat for multiple species of fish including salmon and sturgeon, improve water quality, and improve public safety. We propose a FREA that looks directly at the accurate costs and benefits of modifying the USACE debris control dams on the Yuba River, Daguerre and Englebright Dams, and restoring volitional fish passage.	The screening analysis described in Section 3.4.3 identified habitat restoration on the lower Yuba River as the most efficient cost and the NER plan which reasonably maximizes benefits compared to cost. Fish passage measures were eliminated from consideration through application of screening criteria. Please review Chapter 3 of the FR/EA for a complete description of the plan formulation process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is beyond the scope of the feasibility study to continue detailed evaluation for measures that are not included in the final array of alternatives. For the purpose of this study, ‘nonviable’ does not confer a determination on the overall feasibility of a particular action, rather ‘nonviable’ refers to measures and alternatives that were determined to be ineligible for recommendation under this study through the plan formulation process. It is also important to note that the this study is an interim response to the authority to conduct ecosystem restoration in the Yuba River watershed and the recommended plan in no way precludes future implementation of any

Comment	Comment Text	Response
		other potential restoration actions in the watershed by any organization.
ZZ-4	As a result of our analysis of the FREA, we respectfully request that the USACE not approve the National Environmental Restoration (NER) plan (Alternative 5) as the Tentatively Selected Plan (TSP). We believe that this report has flaws that run too deep to allow it to move forward as a decision document. Instead, we ask that the USACE either significantly revise this report, or design and implement a new process to develop a program that maximizes ecosystem restoration benefits in the Yuba River watershed relative to costs.	The FR/EA has undergone several internal reviews and has been determined to be in compliance with established policy principles and procedures and verified that assumptions are justified and valid. This included review of: assumptions, methods, procedures, and material used in analyses, alternatives evaluated, the appropriateness of data used and level obtained, and reasonableness of the results.
ZZ-5	We also ask that that the USACE find a different local partner for the ecosystem study activities. The current partner, Yuba County Water Agency, is inappropriate to play this role.	The Yuba County Water Agency (YCWA) has studied the Yuba River since the agency was founded in 1959. They have a wealth of local knowledge and data to support the study. Additionally, by signing the Feasibility Cost Share Agreement, YCWA has agreed to study the river in accordance with applicable Federal laws, regulations, and policies, including for example, the Engineering Regulation 1105-2-100 which defines the National Ecosystem Restoration objective for planning studies.
ZZ-6	COMMENT I: The FREA relies on inaccurate and out-of-date information to draw inaccurate scientific and economic conclusions and adopt ill-advised proposals for action including the selected Tentatively Selected Plan. The document does not address scientific and economic cost assessments accurately or adequately and does not reference the most relevant and latest research. By relying on outdated studies for the FREA, mistakes and shortcomings made in previous studies are propagated forward in this analysis.	The best available existing data informed the feasibility study. In some cases where detailed technical evaluations were not possible due to previously mentioned time and funding constraints, evaluations were made based on professional judgment.
ZZ-7	Mercury: The document does not address mercury contamination accurately or adequately and does not reference the most relevant and latest research. The Lower Yuba River has been placed on the Clean Water Act Section 303 (d) list due to mercury levels that exceed water quality standards. Water bodies on the 303 (d) list are also referred to as "impaired" waters. Yet this study does not succinctly discuss this	The document was revised to appropriately identify the status of the Lower Yuba River as an impaired water body (Clean Water Act Section 303 (d) list) due to mercury levels that exceed water quality standards. As recommended, Avoidance, minimization, and monitoring measures have been adopted from the Biological Assessment and Essential Fish Habitat Assessment for the Yuba River Canyon Salmon Habitat Restoration Project (section 4.3.7). Furthermore, the

Comment	Comment Text	Response
	listing nor appropriate measures to limit release of mercury into the environment. The most significant flaw in the FREA is the outdated science used to describe mercury fate and transport in the Yuba River Watershed. The FREA relies on old data, inaccurate data and sometimes utilizes no data to address the issue of mercury, creating a serious problem with many aspects of the proposal actions. Thirty years ago it was assumed that the dams were holding back the mercury because when mercury was referenced it was assumed to be liquid elemental mercury. New science has changed what is now known and understood about mercury, specifically, it is now understood that mercury attached to fine silts and clays travels long distances and can methylate when settled in aquatic environments with amenable conditions (Fleck et al., 2011; Marvin -DePasqualle et al., 2011). Particulate bound mercury is suspended when stirred up by earth moving equipment, whether it is for sediment removal efforts in reservoirs or for river restoration efforts that take place in hydraulic mining debris. Activities such as these are proposed as part of the FREA project designed to reconnect the river to the floodplain and create backwater channels. The use of outdated science to describe issues associated with mercury is found on many pages and tables contained within the FREA. See Cost/Uncertainty Due to Potential for Mercury Contamination: Table 3-6, page(s) 39, 45; Impact Analysis, Water Quality: Section 5.3.3, page 14; Efficiency of Measures: Table 3-5, page 42. To rectify these flaws, The Sierra Fund recommends that the following concepts, protocols and information be incorporated into the FREA:	Corps will obtain a 401 WQC from the CVRWQCB during the PED phase which will ensure that the project is in compliance with the CWA. The potential for release of contaminants will also be addressed through pre-construction characterization, monitoring during construction, and adaptive controls. Section Appendix C, section C-10. Construction Procedures and Water Control Plan discusses some potential controls and Best Management Practices (BMPs) to mitigate risks from contaminant releases during construction. Contaminant concentrations that may be environmentally relevant will be addressed through characterization, monitoring and adaptive controls through the 401 Certification process. Appendix C, section C-21 Special Studies puts forth possible means of mitigating encountered hazardous and toxic materials. It is possible that based on Special Studies, site-specific water quality criteria for mercury will be used to address potential methylmercury effects. Please refer to the discussion of the major thematic concern "Potential Impacts Related to Mercury" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
ZZ-8	• Monitoring for mercury should be done according to EPA 1669 Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (1996). The FREA needs to be specific about and qualify the use of methods and practices identified to address the potential for metals to be mobilized by the activities contemplated by the project. The timing of these practices and the monitoring that should take place to evaluate the impacts, as a part of the creation of	As recommended, Avoidance, minimization, and monitoring measures have been adopted from the Biological Assessment and Essential Fish Habitat Assessment for the Yuba River Canyon Salmon Habitat Restoration Project (section 4.3.7). Furthermore, the Corps will obtain a 401 WQC from the CVRWQCB during the PED phase which will ensure that the project is in compliance with the CWA. The potential for release of contaminants will also be

Comment	Comment Text	Response
	turbidity in mercury contaminated sediment deposits, is not currently included in the USACE document. The FREA should require that protocols for monitoring of mercury follow trace metal sampling protocols outlined in USEPA guidelines 1669 and should develop a comprehensive QAPP that uses these protocols.	addressed through pre-construction characterization, monitoring during construction, and adaptive controls. Section Appendix C, section C-10. Construction Procedures and Water Control Plan discusses some potential controls and Best Management Practices (BMPs) to mitigate risks from contaminant releases during construction. Contaminant concentrations that may be environmentally relevant will be addressed through characterization, monitoring and adaptive controls through the 401 Certification process. Appendix C, section C-21 Special Studies puts forth possible means of mitigating encountered hazardous and toxic materials. It is possible that based on Special Studies, site-specific water quality criteria for mercury will be used to address potential methylmercury effects. Please refer to the discussion of the major thematic concern "Potential Impacts Related to Mercury" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
ZZ-9	• Earth moving equipment in hydraulic mine debris can cause the release of hazardous mercury into the aquatic environment and needs to be minimized and monitored using best available practices. Previous reports by USGS on a hydraulic mine deposit in Deer Creek found that erosion of river banks resulted in the release of 350 cubic meters of mercury-contaminated sediment to the creek between 2011 and 2013 (Howle et al., 2016). Best management practices (BMPs) that incorporate the current understanding about mercury fate and transport need to be included in the planning and execution of earth moving activities in the Lower Yuba, which is primarily made up of hydraulic mining debris. BMPs may include reducing the disturbance of fine sediments, and avoiding the creation of low flow anoxic conditions. As an example, on November I, 2016 the U.S. Fish and Wildlife Service provided to the National Marine Fisheries Service a Biological Assessment and Essential Fish Habitat Assessment for the Yuba River Canyon Salmon Habitat Restoration Project. This assessment included BMPs developed in conjunction with the Regional Water Quality Control Board as part of the water quality certification under Section 40 I of the Clean Water Act. We recommend that USACE develop	As recommended, Avoidance, minimization, and monitoring measures have been adopted from the Biological Assessment and Essential Fish Habitat Assessment for the Yuba River Canyon Salmon Habitat Restoration Project (section 4.3.7). Furthermore, the Corps will obtain a 401 WQC from the CVRWQCB during the PED phase which will ensure that the project is in compliance with the CWA. The potential for release of contaminants will also be addressed through pre-construction characterization, monitoring during construction, and adaptive controls. Section Appendix C, section C-10. Construction Procedures and Water Control Plan discusses some potential controls and Best Management Practices (BMPs) to mitigate risks from contaminant releases during construction. Contaminant concentrations that may be environmentally relevant will be addressed through characterization, monitoring and adaptive controls through the 401 Certification process. Appendix C, section C-21 Special Studies puts forth possible means of mitigating encountered hazardous and toxic materials. It is possible that based on Special Studies, site-specific water quality criteria for mercury will be used to address potential methylmercury effects.

Comment	Comment Text	Response
	similar mercury release minimization measures through Section 7 consultation with NMFS as well as incorporation of appropriate minimization provisions as a condition in the 40 I permit from the Regional Water Quality Control Board.	Please refer to the discussion of the major thematic concern "Potential Impacts Related to Mercury" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
ZZ-10	• The creation of low flow channels may increase mercury methylation in the Lower Yuba and needs to be carefully monitored. In the Lower Yuba River mercury is a remnant of 19th century hydraulic mines. Mercury is particulate bound and prevalent in the restoration area. Testing for mercury prior to creation of side channels, (See description on page 144), would not be an indicator of the methylation potential of any given side channel created. Hydraulic mining debris containing elemental mercury may settle into side channels after equipment operation on the Lower Yuba River and the methylation of this mercury may be promoted by the shallow low-oxygen conditions of side channels. As stated on page 39, "anaerobic conditions increase the likelihood of methylated mercury, and fine grain sediments more favorably partition methylated mercury for transport and deposition downstream." By accounting for mercury contamination behind Englebright Dam, and not accounting for mercury methylation potential in side channels and mercury contamination in the Lower Yuba River, efficiency scores in Table 3-5, page 42, are not accurate and need to be revised.	The specific concentration of Mercury in any given location or potential Mercury related risk from construction of a feature is unknown. Technical evaluations and site characterizations for all proposed measures were not possible within the scope of the study due to previously mentioned time and funding constraints, therefore, evaluation of Cost Risk/Uncertainty related to potential mercury contamination were made based on professional judgment. The FR/EA has undergone several internal review and has been determined to be in compliance with established policy principles and procedures and verified that assumptions are justified and valid. This included review of: assumptions, methods, procedures, and material used in analyses, alternatives evaluated, the appropriateness of data used and level obtained, and reasonableness of the results. Please refer to the discussion of the major thematic concern "Potential Impacts Related to Mercury" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
ZZ-11	The creation of backwater and side channels for juvenile anadromous fish, described on page 98 of the USA CE FREA, should include adequate mercury monitoring for the effects of mercury fate and transport. (Creation of backwater area: page 44, 98; Critical habitat: page I IO; juvenile fish habitat in backwater area: page 44, 98; Quantity of Habitat: Table 3-3, page 36.) Methylmercury is readily incorporated into biological tissue and is the most toxic form of mercury to humans (Alpers et al., 2005). Inorganic mercury is methylated by sulfate-reducing bacteria and other microbes that tend to thrive in low dissolved oxygen conditions (Fleck et al., 2016). Low oxygen conditions are more prevalent in slow moving, warm water, while water moving quickly, even shallow water, and has a higher dissolved oxygen content. Protocols for monitoring for methylmercury must be described in the FREA as an overarching objective and created	As recommended, Avoidance, minimization, and monitoring measures have been adopted from the Biological Assessment and Essential Fish Habitat Assessment for the Yuba River Canyon Salmon Habitat Restoration Project (section 4.3.7). Furthermore, the Corps will obtain a 401 WQC from the CVRWQCB during the PED phase which will ensure that the project is in compliance with the CWA. The potential for release of contaminants will also be addressed through pre-construction characterization, monitoring during construction, and adaptive controls. Section Appendix C, section C-10. Construction Procedures and Water Control Plan discusses some potential controls and Best Management Practices (BMPs) to mitigate risks from contaminant releases during construction. Contaminant concentrations that may be environmentally relevant will be addressed through characterization,

Comment	Comment Text	Response
	specifically for each of the projects as they are implemented and also post project.	monitoring and adaptive controls through the 401 Certification process. Appendix C, section C-21 Special Studies puts forth possible means of mitigating encountered hazardous and toxic materials. It is possible that based on Special Studies, site-specific water quality criteria for mercury will be used to address potential methylmercury effects. Please refer to the discussion of the major thematic concern "Potential Impacts Related to Mercury" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
ZZ-12	Fish: The document does not address habitat in any other area of the watershed besides the Lower Yuba, and it references reports that do not accurately represent the habitat upstream of Englebright Reservoir. Critical habitat for anadromous fish in the Yuba River watershed is only considered for the Lower Yuba River in the FREA (See page 110). New studies continue to document the importance of habitat outside of designated critical habitat, including non-natal tributaries, for growth and survival to juvenile salmon that need to escape high flows, temperatures and sediment inflows from main channel flows (Phillis et al., 2018). The tributaries along with the South, Middle and North Yuba Rivers, provide these benefits but are not considered designated habitat in this analysis. The estimated quantity of habitat gained with the removal of Englebright Dam is underestimated in the FREA. The FREA uses EC I 1-2-206 as a reference for calculating quantity of habitat gained, which was superseded by EC I 1-2-208 (page 35). River lengths measured using the measure tool in ArcGIS I 0.5, show habitat above Englebright Dam is double the habitat below it in the Lower Yuba. Since fish can still access the Lower Yuba River below Englebright Dam with the removal of Englebright Dam, this habitat should be included in overall calculations of habitat available after removal. Adding this habitat, the quantity of habitat is much greater with the removal of Englebright Dam. The FREA should be corrected to reflect this more accurate information.	Section 4.3.6.4 of the report correctly states that critical habitat for steelhead, salmon and green sturgeon, as designated by NMFS, is limited to the lower Yuba River. The report recognizes that the Yuba River watershed was historic habitat for these species. The quantity of habitat available upstream from various dams was specifically considered in the evaluation of fish passage measures. Preliminary and initial restoration measures considered in the study included actions throughout the entire Yuba River watershed as described in Section 3.4. A common unit of measurement is necessary to compare fish passage improvement measures to habitat restoration measures. The conversion of stream miles of accessible fish habitat to acres, as described in section 3.4.3, allows for such a comparison. Habitat quantity formulas were adopted from Engineer Circular 11-2-206 and provided an unbiased and logical approach to converting river length and connectivity factors into a single acreage metric. Although EC 11-2-206 has been superseded by subsequent annual budget guidance, the ranking methodology for proposed ecosystem restoration projects has not been superseded by any more recent version. The area calculation method multiplied the entire width of the river immediately above Englebright Reservoir by the entire length of the river to account for tributaries. Englebright Dam Removal received the highest score for quantity of habitat restored (Table 3-3, Quantity Ranking). In the screening process, project benefits were measured as the difference between the without-project conditions and the with-project conditions, as required by USACE policy. Therefore, existing habitat on the lower Yuba River was not

Comment	Comment Text	Response
		counted as a project benefit, because it will continue to exist whether or not any restoration project is implemented by USACE.
ZZ-13	Previous studies have not accurately represented the habitat available in reaches above Englebright Dam. Previous studies by the Yuba Salmon Forum (2012) summarized the available habitat upstream of Englebright using temperature sensors. A limited number of temperature sensors were placed in easy to access areas with large distances between them for this study. Using these data, the Yuba Salmon Forum (YSF) came to the premature and likely incorrect conclusion that temperatures in the South, Middle and North Yuba Rivers upstream of Englebright were too warm for the survival of anadromous fish. Specifically, these previous studies evaluated temperature data from temperature sensors that were placed in easy to access locations that were not classified as "optimal habitat," thus providing data for warmer stretches of water that aren't used as holding habitat for anadromous fish. For example, one temperature sensor location (Marysville Gage) in the lower Yuba River, used for the habitat analysis was described as "relatively wide and flat, with very little cover or shade" (HOR, 2007). Although providing temperature data for the Yuba River, this sensor was not placed in an area that Salmon would use as refugia, inadequately representing habitat used by Salmon. The spatial and temporal coverage of temperature sensors in previous studies was inadequate to determine the thermal refugia available as holding habitat for salmonids if they were returned to the upper watershed. The extent and quality of holding habitat upstream of Englebright can be assessed by reconsidering the locations of temperature sensor placement and their representation of thermal refugia. Without this analysis the error and limitation of previous studies will continue to propagate and lead to the premature conclusion that there is no or inadequate holding habitat upstream on Englebright. In 2017, The Sierra Fund began a study evaluating anadromous fish holding habitat in the Yuba River Watershed. This study focuses on holding habitat in pools (~10 feet deep) for spring-run Chinook salmon on stretches of the North, Middle and South Yuba Rivers above Englebright Dam. Previously collected data in Addley et al., 2013, along with additional data collected by The Sierra Fund (2017-2020)	Suitability of habitat related to temperature was not used to support habitat quantity calculations in the feasibility report. The screening exercise described in section 3.4.3 used simplified assumptions adopted from Engineering Circular 11-2-206 to estimate potential benefits of management measures. These Habitat quantity formulas utilized the full length of the mainstem river to the uppermost impassible barrier and a representative width to estimate potential benefits associated with fish passage in terms of area gained.

Comment	Comment Text	Response
	will be analyzed to assess holding habitat upstream and its viability for Spring Run Chinook Salmon and other anadromous fish. Studies to characterize the habitat suitability in the upper Yuba River watershed should be based on comprehensive data collections efforts that represent conditions that fish use over the time periods that fish use them. The FREA needs to evaluate habitat and conditions in the Upper Yuba appropriately and not use flawed studies to support the claim that there is not sufficient habitat upstream of Englebright to warrant its removal for threatened and endangered species.	
ZZ-14	The FREA does not reflect the statutory and regulatory requirements of USACE or Environmental Protection Agency protocols and practices. The evaluation for removal of sediment behind Englebright Dam used in the USACE FREA is outdated and improperly represented. The cost estimates for sediment removal does not use the Environmental Dredging techniques developed by USACE in 2008. By using newer techniques described in the USACE 2008 report, a more accurate assessment for removal techniques and associated costs for removal of Englebright Dam can be established. Furthermore, the FREA report doesn't use USACE protocols and standards to evaluate sediment management opportunities for Englebright. In addition, as shown above, proposals for monitoring for mercury do not include appropriate protocols as a condition, including EPA 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (1996). The timing of sediment removal activities and the monitoring that should take place, as a part of the creation of turbidity in mercury contaminated sediment deposits, is not currently included in the FREA document. Monitoring of mercury should follow trace metal sampling protocols outlined in EPA 1669. The FREA should be revised to reflect these federal protocols.	Cost estimates for sediment removal behind Englebright Dam were sourced from "Assessment of Infrastructure and Related Items to Support Anadromous Fish Passage to the Yuba River Watershed" by the Yuba Salmon Forum, March 2013. This estimate was determined to be an adequate basis for a Class IV cost estimate. Avoidance, minimization, and monitoring measures have been adopted from the Biological Assessment and Essential Fish Habitat Assessment for the Yuba River Canyon Salmon Habitat Restoration Project (section 4.3.7). Furthermore, the Corps will obtain a 401 WQC from the CVRWQCB during the PED phase which will ensure that the project is in compliance with the CWA. The potential for release of contaminants will also be addressed through pre-construction characterization, monitoring during construction, and adaptive controls. Please refer to the discussion of the major thematic concern "Potential Impacts Related to Mercury" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
ZZ-15	COMMENT I: SUMMARY •The FREA must be done again using accurate, up-to-date information on available fish habitat and mercury fate and transport. •The FREA needs to specify that all ecosystem restoration projects moving gravels and sediments in the Lower Yuba River region must	Consideration of fish habitat and potential effects related to Mercury have been considered at an appropriate level of detail to support plan formulation, plan selection, and plan evaluation. As recommended, avoidance, minimization, and monitoring measures have been adopted from the Biological Assessment and Essential Fish Habitat Assessment for the Yuba River Canyon Salmon Habitat Restoration Project (section 4.3.7). Furthermore, the Corps will obtain a 401

Comment	Comment Text	Response
	require scientifically rigorous pre- and post-project monitoring for mercury discharge. •The FREA needs to specify that creation of backwater and side channels for juvenile anadromous fish should include adequate mercury monitoring for the effects of mercury fate and transport. •The FREA should be updated to include more accurate information on fish habitat above Englebright Dam including incorporating new data that has been recently collected in the field.	WQC from the CVRWQCB during the PED phase which will ensure that the project is in compliance with the CWA. The potential for release of contaminants will also be addressed through pre-construction characterization, monitoring during construction, and adaptive controls.
ZZ-16	COMMENT 2: Alternatives to the proposed action do not adequately explore the opportunities, benefits and costs of restoring volitional fish passage through modification of Englebright and Daguerre Dams.	Fish passage and dam modification measures were considered in the feasibility study, but were eliminated through application of screening criteria. Further detailed evaluations of fish passage and dam modification measures are not necessary to determine that those measures would have high costs and risks relative to potential restoration benefits in comparison to other measures considered. Please review Chapter 3 of the FR/EA for a complete description of the plan formulation process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is beyond the scope of the feasibility study to continue detailed evaluation for measures that are not included in the final array of alternatives. For the purpose of this study, ‘nonviable’ does not confer a determination on the overall feasibility of a particular action, rather ‘nonviable’ refers to measures and alternatives that were determined to be ineligible for recommendation under this study through the plan formulation process. It is also important to note that the this study is an interim response to the authority to conduct ecosystem restoration in the Yuba River watershed and the recommended plan in no way precludes future implementation of any other potential restoration actions in the watershed by any organization.
ZZ-17	USACE is the only entity with jurisdiction or authority to address fish passage at Englebright and Daguerre Point Dams. USACE is responsible for fish passage at Englebright Dam and Daguerre Point Dam. Fish populations in the Yuba River watershed are struggling	Under USACE policy, the objective of a USACE ecosystem restoration project is to identify the plan that maximizes benefits compared to costs.

Comment	Comment Text	Response
	because they do not have access to their historic spawning grounds because these two dams mark the present upstream limit of access. USACE should prioritize its efforts on improving the facilities it owns and is responsible for over doing habitat restoration activities elsewhere. A fish passage project that encompasses Daguerre Point and Englebright Dams will have long lasting benefits for salmon and sturgeon. Habitat restoration projects can be "blown out" in a single storm.	Please refer to the discussion of the major thematic concern "US Army Corps of Engineers Study Authority and Responsibilities" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments. Also, please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
ZZ-18	Instead of leveraging this historic opportunity to restore volitional fish passage to the Yuba Watershed, the FREA relies on inaccurate information documented in these comments to dismiss any serious evaluation of the impact of restoring volitional fish passage. The FREA states vaguely (page ES8) that some future study should examine the potential for restoring fish passage. This is not acceptable. The FREA needs to be redone to include an accurate analysis based on scientifically rigorous information about the costs and benefits of modifying the two USACE projects, Englebright Dam and Daguerre Point Dam, which serve as the primary blocks to volitional fish passage.	The objective or priority of a USACE ecosystem restoration project is to identify the National Ecosystem Restoration plan that maximizes benefits compared to costs. The study was not conducted as a legal requirement of an existing USACE project or current biological opinion. The best available existing data informed the feasibility study. In some cases where detailed technical evaluations were not possible due to previously mentioned time and funding constraints, evaluations were made based on professional judgment. Fish passage and dam modification measures were considered in the feasibility study, but were eliminated through application of screening criteria. Further detailed evaluations of fish passage and dam modification measures are not necessary to determine that those measures would have high costs and risks relative to potential restoration benefits in comparison to other measures considered. Please review Chapter 3 of the FR/EA for a complete description of the plan formulation process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is beyond the scope of the feasibility study to continue detailed evaluation for measures that are not included in the final array of alternatives. For the purpose of this study, ‘nonviable’ does not confer a determination on the overall

Comment	Comment Text	Response
		feasibility of a particular action, rather ‘nonviable’ refers to measures and alternatives that were determined to be ineligible for recommendation under this study through the plan formulation process. It is also important to note that the this study is an interim response to the authority to conduct ecosystem restoration in the Yuba River watershed and the recommended plan in no way precludes future implementation of any other potential restoration actions in the watershed by any organization.
ZZ-19	Modification of Englebright Dam should be explored to provide fish passage. Englebright Dam blocks access for spring-run Chinook (an endangered species), fall-run Chinook, and steelhead (threatened) to the upper portions of the watershed to spawn. However, the FREA did not carefully evaluate modification of Englebright Dam for fish passage or mercury discharge from the dam. It is important to note that the report ONLY considered "removal" of Englebright instead of examining a variety of alternatives such as "notching" the dam. This left only dam removal, the most expensive alternative, on the table for consideration. Further, the document wrongly promotes outdated and misguided assumption that Englebright Dam is holding back legacy mercury leftover from gold mining operations, preventing it from going further downstream. This is incorrect, and in fact the Englebright Dam is discharging particulate bound mercury every time it spills water over its edge, especially during winter flooding conditions. This particulate bound mercury can remain suspended in water and travel long distances - as far downstream as the San Francisco Bay, Delta and estuary. Another outcome of overlooking mercury and the potential to remove mercury from the Yuba Watershed (by treating and removing contaminated sediments behind Daguerre Point and Englebright Dams) is that the potential economic benefits of removing this neurotoxin from the watershed is not mentioned. The potential for mercury contaminated sediment removal in the upper watershed to produce cleaner water and sediment discharge to the lower system is not monetized or mentioned. It is also worth noting that the costs of removing the Englebright Dam were evaluated in the report but evaluation of the economic benefit of restoring volitional fish passage was entirely absent. Englebright Dam modification or removal would have a higher average overall efficiency ranking in the alternatives analysis if more accurate estimates were used to evaluate the costs of	Lowering or notching of Englebright Dam was considered and screened as described in section 3.4.2.1. The study assumes that the material behind Englebright Dam is contaminated by legacy mercury. Per Engineering Regulation 1105-2-100 and consistent with the guidance in Engineering Regulation 1165-2-132, USACE feasibility studies will not recommend clean up of materials regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or by the Resource Conservation and Recovery Act (RCRA). Assessments during the feasibility phase to determine the nature and extent of such materials within the project area shall be cost shared. The cost of clean up of materials not covered by CERCLA and RCRA will be considered when determining if the proposed project is justified. While measures to improve water quality parameters may be included in projects with an ecosystem restoration component, the ecosystem restoration portion of these projects should not principally result in treating or otherwise abating pollution or other compliance responsibility. The benefits of ecosystem restoration measures in a USACE study are not monetized. Instead habitat units are developed to evaluate and compare measures. It is not possible to develop extensive technical studies of each measure under previously mentioned time and funding constraints. Cost categories with $200 million dollar ranges were used because of the high degree of uncertainty in the rough order of magnitude cost estimates.

Comment	Comment Text	Response
	sediment removal, and the benefits-costs analysis was conducted per section 905(b) including consideration of the economic benefit of restoring volitional fish passage. See Cost limitations: section 3.4.3, page 34, 35.	
ZZ-20	The cost estimates for sediment removal and treatment in the FREA are not supported. The cost estimates for the removing sediment from behind Englebright are not supported by factual information in the FREA. The Sierra Fund can demonstrate that the cost estimates included in the USACE FREA, for sediment removal behind Englebright dam included in Table 3.2 (page 35), are overestimated. The Sierra Fund will provide under separate cover our cost estimates for this operation (Wallace and Monohan, 2018). With the USACE's very high cost estimate in the FREA, removal of Englebright Dam's average overall efficiency drops significantly. These cost estimates must be evaluated and potentially revised.	Per Engineering Regulation 1105-2-100 and consistent with the guidance in Engineering Regulation 1165-2-132, USACE feasibility studies will not recommend clean up of materials regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or by the Resource Conservation and Recovery Act (RCRA). Assessments during the feasibility phase to determine the nature and extent of such materials within the project area shall be cost shared. The cost of clean up of materials not covered by CERCLA and RCRA will be considered when determining if the proposed project is justified. While measures to improve water quality parameters may be included in projects with an ecosystem restoration component, the ecosystem restoration portion of these projects should not principally result in treating or otherwise abating pollution or other compliance responsibility. The benefits of ecosystem restoration measures in a USACE study are not monetized. Instead habitat units are developed to evaluate and compare measures. It is not possible to develop extensive technical studies of each measure under previously mentioned time and funding constraints. Cost categories with $200 million dollar ranges were used because of the high degree of uncertainty in the rough order of magnitude cost estimates.
ZZ-21	The cost estimate for sediment removal does not use the Environmental Dredging techniques developed by USACE, 2008. In a 2008 document written by US Army Corps of Engineers, guidelines are provided for evaluating environmental dredging as a prospect for sediment removal (Palermo et al., 2008). This document specifically describes technical aspects of environmental dredging, transporting contaminated dredged materials and directly related tasks associated with environmental dredging (i.e. monitoring before, throughout and after dredging, risks, conditions, etc.) (Palermo et al., 2008). Although written by the USACE, the 2008 document is not used in evaluating environmental	Cost estimates for sediment removal behind Englebright Dam were sourced from "Assessment of Infrastructure and Related Items to Support Anadromous Fish Passage to the Yuba River Watershed" by the Yuba Salmon Forum, March 2013. This estimate was determined to be an adequate basis for a Class IV cost estimate."

Comment	Comment Text	Response
	dredging behind Englebright Dam in the FREA. The evaluation parameters for removal of sediment behind Englebright Dam used in the FREA are outdated and improperly represented. By basing analysis on the newer techniques described in the USACE 2008 report, a more accurate assessment for removal techniques and associated costs for removal of Englebright Dam can be established. The FREA should be revised to include the methods described in USACE 2008, along with a more accurate estimate of the costs of these techniques.	
ZZ-22	The costs estimates for sediment removal do not consider the potentially substantial off sets of sellable aggregate and gold or the potential use of some of these materials for restoration activities. Based on our preliminary estimates, not included in the FREA, gold recovery from sediment removal from behind Englebright Dam could be used to partially offset the cost of the operation (Wallace and Monohan, 2018). Sand and gravel production could also be used to further offset the cost of sediment removal (Wallace and Monohan, 2018). In addition to the potential for commercial sales of these construction materials, sand and gravel from the operation could be used for gravel augmentation activities that would be needed to restore fish passage. The FREA needs to be revised to reflect this potential source of income from the project.	While the sale of aggregate or other valuable resources could offset project costs, it is not within the authority of the Corps to sell materials or otherwise profit from the recommended action. Furthermore, given uncertainty in quantities of materials and potential market value, it would be highly speculative to assume any potential offset to costs, therefore, for the purpose of the feasibility study the cost estimates did not include consideration of potential cost savings. The opportunity to improve the efficiency of project implementation through creative means will be explored during PED.
ZZ-23	A USACE-led pilot dredging and sediment management project should be developed to determine the viability of dredging sediment from an existing reservoir as a precursor to fish passage. The purpose of a Section 905(b) analysis, also known as a reconnaissance report, is to address the requirements of Section 905(b) of the Water Resources Development Act of 1986. The purpose of this 905(b) analysis was to determine whether there is a Federal interest in participating in a cost-shared feasibility FREA to investigate ecosystem restoration in the Yuba River Watershed in the interest of water resource development opportunities. Based on consistency with Army and budgetary policies and the likelihood of a project meeting criteria for Federal participation in implementation, the USACE recommended continuing with a feasibility FREA. Based on USACE benefit-cost guidelines, the USACE did not include sediment removal prior to dam modification as	Please refer to the response to comment ZZ-19 and ZZ-22.

Comment	Comment Text	Response
	an option to be considered in the feasibility FREA. However, the USACE benefit-cost guidelines did not take into account the economic value of gold and aggregate which may offset project costs. Furthermore, the potential benefits to ecosystems that dam removal or lowering may have for anadromous fish in the form of volitional passage opportunities and access to habitat was not taken into account. The FREA should be revised to recommend development of this pilot project between the USACE Sacramento District Office and the USACE Environmental Laboratory in Vicksburg, Mississippi. This project could establish practices and technologies to minimize impacts on water quality, explore options for sediment management, and provide data for a detailed feasibility FREA and benefit-cost analysis.	
ZZ-24	The removal or modification of Englebright Dam would double the amount of habitat available, providing a higher carrying capacity for the Yuba River Watershed, thus allowing more fish to migrate to the watershed. (Studies (Yuba Salmon Forum Summary Habitat Analysis): section 1.5.2, page 12.) Englebright Reservoir represents the current upstream boundary for anadromous fish due to its impassable dam (Gathard Engineering Consulting, 2014). Approximately 30 miles of habitat would be restored with the Yuba River Restoration efforts by USACE. Anadromous fish, specifically federally endangered spring-run Chinook salmon, are limited by the amount of available, suitable habitat. With the removal of Englebright Dam, a minimum of 60 additional miles of habitat become available, without removing any additional facilities. The FREA must be revised to reflect this more accurate information about the amount of fish habitat above Englebright Dam.	Please refer to the response to comment ZZ-12.
ZZ-25	The economic benefit estimates for Englebright Dam removal are not described. Because the modification of Englebright Dam to provide volitional fish passage is dismissed as too expensive, the economic benefits of a restored volitional fish passage are not calculated. The potential for this restoration to provide enormous benefits to the immediate region as well as the larger Sacramento watershed should have been a central part of this analysis. The FREA must be revised to include the economic benefits of restoring of volitional fish passage to	Although economic benefits and impacts may factor into the overall cost of a project, ecosystem restoration projects do not directly consider economic benefits in the justification of recommended plan. Instead habitat units are developed to evaluate and compare measures.

Comment	Comment Text	Response
	the entire Sacramento watershed as well as the economic benefit of reducing mercury discharge from Englebright Dam to downstream water users.	
ZZ-26	The cost of doing nothing with regard to Englebright Dam will eventually result in long term operation and maintenance costs due to the sediment building up behind the dam. These costs are not considered in the FREA. The FREA fails to look at the long term economic and ecosystem impact of NOT modifying Englebright Dam. Englebright Reservoir continues to be operated although it provides little benefit. Englebright Dam was installed as a debris control dam (DCD), to contain hydraulic mining sediment and prevent it from being flushed downstream (James, 2005). Englebright Reservoir was not created for flood control, water storage, or power generation. Englebright Reservoir contains 21 million cubic yards of sediment deposited since its completion, reducing its overall capacity by 25% (Alpers et al, 2006). The sedimentation rate is high compared to other lakes and reservoirs; it is accumulating sediment at approximately 0.5 meters per year (Alpers et al., 2006). Sediment continues to be contained in Englebright Reservoir. By leaving Englebright Dam in place, operation and maintenance of the facility will need to be continued (e.g. gravel augmentation below Englebright Dam to provide proper gravel sizes for spawning salmon (Pasternack, 20 I 0), Habitat Studies for Threatened and Endangered Species (Pejchar and Warner, 200 I), and others, adding cost yearly. While there is habitat below Englebright Reservoir, there is limited area for migrating fish. Without adding quantity to the amount of quality habitat available to anadromous fish, the carrying capacity of habitat will be limited to below the reservoir, allowing a finite number of fish in the available stretch. The FREA should be revised to reflect Englebright Reservoir long-term operation and maintenance costs as one "cost savings" in removing or modifying the Englebright Dam.	Englebright Dam continues to serve its purpose as a debris dam by preventing legacy mining debris from washing downstream. Ongoing operation and maintenance costs associated with Daguerre Point Dam are insignificant in comparison to the overall cost of dam removal and would not change the outcome of the plan formulation as described in chapter 3 of the FR/EA.
ZZ-27	Daguerre Point Dam must be removed or modified. It is killing fish. (Cost risk/uncertainty due to potential for mercury contamination: page 39. Unresolved Ecological Problem: section 3.4.4, page 43.) Daguerre Point Dam on the Yuba River impedes fish passage for Chinook, steelhead, and sturgeon. It no longer functions as intended and USACE	Daguerre Point Dam continues to serve its purpose as a debris dam by preventing legacy mining debris from washing downstream. The assertion by Pejchar and Warner (2001) that 40% of anadromous fish are blocked by Daguerre Point Dam is not supported by reference to

Comment	Comment Text	Response
	should take action now to fix this obstacle to fish. Daguerre Point Dam was installed during the Gold Rush era as a catchment basin for mining debris (Pejchar and Warner, 200 I). Daguerre Point Dam is 6.4 meters tall, enough to block approximately 40% of anadromous fish migration (Pejchar and Warner, 200 I). Without a functional fish ladder, fish have trouble navigating through Daguerre Point Dam (Yoshiyama et al., 200 I). The area behind the dam is full of mining sediment, and thus the dam is no longer able to catch substantial sediment (Pejchar and Warner, 2001).	specific data and studies. There are presently two functioning fish ladders at Daguerre Point Dam.
ZZ-28	Sediment from behind Daguerre should be removed now before restoration efforts begin. The FREA should require that the sediment behind Daguerre Point Dam should be removed before lower river restoration efforts begin. By removing the mercury contained in the sediment behind the Daguerre Point Dam, re-introduction and methylation into the water system would be reduced. This option should be fully explored in a revised FREA.	Please refer to the response to comment ZZ-19
ZZ-29	This is especially true if construction of fish ladders is proposed to get around the Daguerre Point Dam. Fish ladder modifications could release sediment. Thus removing the sediment trapped behind this old dam prior to beginning ecosystem restoration is crucial.	The Recommended Plan does not propose construction of fish ladders at Daguerre Point Dam.
ZZ-30	In order for fish passage to occur using fish ladders, modification of existing ladders are needed (Hunerlach et al., 2004). With these modifications, sediment behind the dam could be released, possibly introducing contaminants into the River (Hunerlach et al., 2004). In order to improve habitat in the Lower Yuba River, passage over Daguerre Point Dam will be needed to maximize quantity of habitat to the upstream limit, Englebright Dam.	Under current conditions, fish successfully pass through the ladders at Daguerre Point Dam and access upstream habitat.
ZZ-31	The removal of Daguerre should be considered in the revised FREA, not just modifications and associated fish ladders.	Daguerre Point Dam Removal was considered in the study. The measure is described in section 3.4.2. The measure was screened in the screening process described in section 3.4.3.
ZZ-32	The cost of doing nothing at Daguerre Point Dam is creating operation and maintenance problems and costs due to the sediment building up behind the dam. These costs are not considered in the FREA. The FREA should be revised to reflect the cost of doing nothing at	Ongoing operation and maintenance costs associated with Daguerre Point Dam are insignificant in comparison to the overall cost of dam removal and would not change the outcome of the plan formulation as described in chapter 3 of the FR/EA.

Comment	Comment Text	Response
	Daguerre Dam Point in terms of long-term operation and maintenance costs.	
ZZ-33	If modification of the Englebright and Daguerre Point Dams is pursued AFTER the Lower Yuba River is restored, all the Lower Yuba restoration efforts could be lost and the investment wasted. Throughout the FREA, Englebright Dam and Daguerre Point Dam removal remains a possibility, following an undefined future "in-depth examination." Dam removal investigation may advance in the near future in part because of the environmental benefits, shown in Table 3-4 of the USACE FREA (i.e. fish passage for threatened and endangered spring-run Chinook salmon, removal of contaminated sediment captured behind the dam, etc.). Although risk and cost of Englebright Dam and Daguerre Point Dam removal appears to be overestimated in Tables 3-5 and 3-6 (page 39 under risk and uncertainty regarding efficiency ranking), its ecological benefits are too great to be ignored. Since the removal of Englebright/ Daguerre remains a possibility to restore river connectivity, restoration efforts below Englebright/ Daguerre dam should be done POST removal of either or both dams. This should be a key finding of the FREA.	Daguerre Point and Englebright Dam Removal measures assumed that sediments behind the dam cannot be transported downstream by the river after dam removal. All sediments would be excavated to pre-dam topography before dam removal and disposed of at a dry site above the reservoir. Complete sediment removal is required due to known contamination, including methyl mercury, and the sheer volume of sediment that would raise downstream river bed levels, increase flood risk, and impact habitat.
ZZ-34	COMMENT 2: SUMMARY • The FREA must be revised to reflect a vigorous evaluation of the costs and benefits of restoring fish passage through the USACE dams at Daguerre Point and Englebright including the costs of the removal and treatment of sediment; the downstream economic benefit of reducing mercury discharge from these two failing debris control dams; the Sacramento Valley-wide economic value of restoring fish passage; as well as the cost of doing nothing at Daguerre Point Dam and Englebright Dam. The FREA should evaluate and address the problems associated with pursuing Lower Yuba River restoration prior to modification of the upstream Daguerre Point and Englebright Dams.	Fish passage measures at Englebright Dam and Daguerre Point Dam were considered in the feasibility study, but USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. It is not possible to develop extensive technical studies of each measure under previously mentioned time and funding constraints. It is not necessary to conduct a detailed technical evaluation of dam removal and treatment of sediment to determine that the those measures would have high costs and risks relative to potential restoration benefits of other measures considered. Additionally, the benefits of ecosystem restoration measures in a USACE study are not monetized. Instead habitat units are developed to evaluate and compare measures. Daguerre Point and Englebright Dam Removal measures assumed that sediments behind the dam cannot be transported downstream by

Comment	Comment Text	Response
		the river after dam removal. All sediments would be excavated to pre-dam topography before dam removal and disposed of at a dry site above the reservoir. Complete sediment removal is required due to known contamination, including methyl mercury, and the sheer volume of sediment that would raise downstream river bed levels, increase flood risk, and impact habitat.
ZZ-35	COMMENT 3: The scope of the FREA should have included the larger issue of fish passage as a central focus of this ecosystem project. As noted in the FREA, the Authority for USACE to pursue projects for flood control and allied purposes including ecosystem restoration was granted in Rivers and Harbors Act of 1962, P.L. 87- 874. Section 209 specifically targets rivers and streams in northern California draining into the Pacific Ocean for the purposes of developing multiple-purpose water resource projects (emphasis added), particularly those which would be eligible under the provisions of title Ill of Public Law 85-500. PL 85-500 Section 301(b) provides that "reasonable value may be taken into account in estimating the economic value of the entire project (emphasis added)." Further, Congress authorized investigation into ecosystem restoration opportunities in the Sacramento River Basin and streams in northern California draining into the Pacific Ocean, including the Yuba River watershed.	The primary purpose of the study is ecosystem restoration. The objective of ecosystem restoration it so restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. The study is not focused on the recovery of individual species, however a wide range of improvements were considered, including fish passage measures.
ZZ-36	As part of this process the following objectives were defined as part of ecosystem restoration: • Improve the quantity, quality, and complexity of aquatic habitat. • Improve the quantity, quality, complexity, and connectivity of riparian habitat. • Improve longitudinal river connectivity. • Improve lateral connectivity of the river to its floodplain. The generous nature of the enabling statues allows the projects to look broadly at benefits of watershed restoration throughout the whole Sacramento Watershed and in more detail at the Yuba River. In contrast to this broad authority, the analysis in this FREA leaves out both ecological and economic cost benefit analysis of the proposed	Preliminary and initial measures included actions throughout the entire Yuba River watershed as described in Section 3.4. The recommended plan is a suite of habitat restoration measures that address the study goals in an efficient manner. It is not feasible to solve all problems within the watershed.

Comment	Comment Text	Response
	project for the whole Yuba watershed and the larger Sacramento Valley. As noted in the Executive Summary, the FREA does not address the entire scope of its authority. Instead, it has narrowed its focus to a fraction of the Yuba, especially in calculating both the potential economic benefits of restoration and its costs. We believe that this narrowness of focus does not serve the spirit of the statutory authorities.	
ZZ-37	The Yuba Watershed encompasses 1,340 square miles on the western slopes of the Sierra Nevada Mountain Range. The FREA proposes 179 acres for restoration (0.28 of a square mile or .00002 percent of the Yuba River Watershed) for a price of approximately$ 100 million. As documented above, the price of this option is likely under estimated because this project has hazards and expenses that are not documented in this FREA. In addition, the costs of alternatives such as modification of dams to restore fish passage, were incorrectly assessed as well.	comment noted
ZZ-38	The cost of the restoration project is significant. Yet it will result in very limited, though important habitat restoration. Furthermore, the project is being implemented in the wrong order of operation. Because the scope of the study is incorrect, it puts the Lower Yuba River restoration activities ahead of fish passage restoration. The ecosystem activities proposed here may waste time and money by not first pursuing activities suggested in these comments such as removing sediment from behind Daguerre Point Dam prior to beginning restoration in the Lower Yuba River.	Removal of dam and habitat restoration measures are separable elements. Future dam removal actions would be required to give consideration to effects on downstream habitat in any condition. Please refer to the response to comment ZZ-33.
ZZ-39	Due to the limited scope of the project, the economic benefits of a broader study that would address the USACE ecosystem restoration activities, such as the impact of improved water quality and restored fish passage, are not considered. In addition, the multiple benefits of a broader project including the generation of marketable products such as sand, gravel and gold are not considered. These oversights fail to consider the economic benefits of the modification of Daguerre Point Dam and Englebright Dam in developing the cost benefit analysis for the project.	comment noted

Comment	Comment Text	Response
ZZ-40	The FREA itself notes on page 43 that the FREA has "unresolved ecological problems." As proposed this FREA does nothing to restore fish passage, and actually recommends an additional FREA to solve this problem. Why not address all ecological problems now with a defensible and holistic FREA? We have demonstrated that much of the underlying science and evaluation of project costs and benefits that are used to make a decision in the document are incorrect. This means that the conclusion that the preferred project reasonably maximizes ecosystem restoration benefits in the Yuba River Watershed relative to costs is incorrect. And, this means that the document does not meet statutory requirements.	The FR/EA has undergone several internal reviews and has been determined to be in compliance with all laws, regulations, and policies.
ZZ-41	COMMENT 3 SUMMARY: • The FREA must be revised to take a broader look at the ecosystem restoration opportunities, especially fish passage, which USACE has specific obligations to protect.	The purpose of this ecosystem restoration study is to consider a wide range of improvements to the Yuba River Watershed. The recommended plan may not include an action that is legally required of another entity or is included as O&M of an existing USACE project, e.g., mitigation requirements of FERC licenses or NMFS May 2014 Biological Opinion.
ZZ-42	COMMENT 4: The USACE partner, Yuba County Water Agency, may have a conflict of interest related to their Narrows Dam project and other management priorities. The USACE partner, Yuba County Water Agency (YCWA), may have a potential conflict of interest in promoting and financially supporting an ecosystem restoration project selection that entirely ignores modification of existing USACE dams including the Englebright and Daguerre Point Dams. As noted in the report, USACE initiated the Yuba River Ecosystem Restoration Feasibility Study in 2015 at the request of the Yuba County Water Agency (YCWA), the non-Federal sponsor for the study. The USACE and the Yuba County Water Agency (YCWA) are the lead agencies in the Feasibility Study and share the cost of the study equally, pursuant to the Feasibility Cost Sharing Agreement executed by the parties on June 2, 2015 and amended July 31, 2017. The result of that contact is this FREA. This FREA looks at the feasibility of reducing the impacts to listed salmonids WITH EXISTING PROJECT CONDITIONS. That would	Contrary to the comment, there was no decision to exclude the impact of USACE dams. Additionally, The recommended plan may not include an action that is legally required of another entity or is included as O&M of an existing USACE project, e.g., mitigation requirements of FERC licenses or NMFS May 2014 Biological Opinion.

Comment	Comment Text	Response
	include Englebright and Daguerre Point Dams protected in place. This is important for YCWA, the non-federal sponsor on the study, as they prepare for the relicensing of the Yuba River Development Project under FERC No. 2246. YWCA has a vested interest in protecting the potential Narrows Dam site in place for hydroelectric generation, and Daguerre protected in place for water deliveries through Hallwood and Brophy Canals. This is made clear with the description of the Future Without Project Condition assumption (Main Report page 26) that described a future that will continue to be overshadowed by the presence of large dams blocking fish passage in the Yuba River Watershed. This is not a watershed approach as would be appropriate under a 905(b) reconnaissance study. In addition, the YCWA is currently undergoing review of their FERC license on the New Bullards Bar Dam, including looking for ways to mitigate the impact of their dam on fish habitat and fish passage. While it is clearly stated in the FREA that the final project cannot pay for actions that are legally required of another entity or that are included as Operation and Management costs of an existing USA CE project (e.g. mitigation requirements of FERC licenses, N MFS May 2015 Biological Opinion) it seems at least possible that YCWA may be able to use this project as potential mitigation for their FERC relicensing requirements. The decision to exclude the impact of USACE dams on the Yuba River was made as part of the FERC relicensing process on the New Bullards Bar Dam, a decision justified at the time because Englebright construction preceded the construction of New Bullards Bar. However, there is no scientific or policy justification for the exclusion of the alternative to modify Daguerre Point and Englebright Dams from the USACE FREA and only look at the Lower Yuba River restoration. This decision to confine the bounds of the FREA may have been unduly influenced by YCWA's interests and needs. Lower river restoration project described in the FREA provides many real benefits for YWCA customers and constituents. However, YCWA should not be in position to partner on a USA CE project where they have such a demonstrated conflict of interest.	

Comment	Comment Text	Response
	This conflict of interest could and should have been avoided by both parties. USACE should have never agreed to enter into this contract with YWCA Section 1506.S(c) under NEPA prohibits a person or entity entering into a contract with a federal agency to prepare an EIS when that party has at that time and during the life of the contract pecuniary or other interests in the outcomes of the proposal. This issue of a potential conflict of interest is also addressed directly under the Council for Environmental Quality (CEQ) "40 Questions." Question 23a addresses the issues that arise when there are conflicts between a federal proposal with land use plans, policies or controls. It asks: How should an agency handle potential conflicts between a proposal and the objectives of Federal, state or local land use plans, policies and controls for the area concerned? (See Sec. 1502.16(c). Answer: The agency should first inquire of other agencies whether there are any potential conflicts. If there would be immediate conflicts, or if conflicts could arise in the future when the plans are finished, the EIS must acknowledge and describe the extent of those conflicts. If there are any possibilities of resolving the conflicts, these should be explained as well. The EIS should also evaluate the seriousness of the impact of the proposal on the land use plans and policies, and whether, or how much, the proposal will impair the effectiveness of land use control mechanisms for the area. Comments from officials of the affected area should be solicited early and should be carefully acknowledged and answered in the EIS. COMMENT 4 SUMMARY: • YCWA has a conflict of interest in decisions regarding the restoration of fish passage on the Lower Yuba River. The USACE needs to find a new partner for their work on ecosystem restoration projects in the Yuba River watershed.	
ZZ-43	Conclusions and Final Recommendations We believe that the FREA needs to be rejected in its entirety. The opportunity to restore fish passage must be explicitly evaluated and not just mentioned as an issue needing "future study." After more than two decades of debate, this is the study that needs to take on the big issue of fish volitional passage restoration. By leaving this important element	Fish passage measures were considered in the feasibility study, but USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. Extensive study of each measure is not possible under the time and funding limits mandated by Congress in

Comment	Comment Text	Response
	out of the study the huge economic benefits of restoring this vital ecosystem to allow anadromous fish passage for species including salmon and green sturgeon is entirely omitted.	Section 1001 of the Water Resources Reform and Development Act of 2014.
ZZ-44	We request that the USACE not approve the National Environmental Restoration (NER) plan (Alternative 5) as the Tentatively Selected Plan (TSP). Instead, we ask USACE to identify a new local partner to fund the effort; and	comment noted
ZZ-45	2. Revise the Yuba River Ecosystem draft FREA to propose a plan actually restores ecosystem health and fish passage for the Yuba River Watershed. The USACE needs to redo the FREA to examine methods to restore fish passage and reconnect flood plain fish to upper watershed habitat. The FREA project should restore the Yuba River Watershed and specifically the fisheries in our state by modifying Daguerre Point Dam and Englebright Dam to accommodate fish passage. The economic benefits of these activities should include the impact of volitional fish passage to restore vital fish species including spring-run Chinook salmon and green sturgeon, as well as the downstream impact of reducing mercury discharge from this region.	Fish passage measures were considered in the feasibility study, but USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. Extensive study of each measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014.
ZZ-46	The California Gold Rush greatly benefited our nation. It is time to give back to the communities and ecosystems still blighted by the impacts of this era. Financial gain from gold mining in the Sierra Nevada directly benefited the Nation as a whole (Richards, 2008). The United States was able to expand trading opportunities and finance the Civil War and the Mexico - United States War because of the Gold Rush. Yet the Gold Rush left the Sierra Nevada region severely degraded with scars and pollutants from hydraulic and hard rock mining (Richards, 2008). The region from which so much was gained remains degraded. Financial assistance to help restore the Sierra Nevada should be provided by our nation which benefited from its damage. The Federal Government should financially assist removing Gold Rush produced mercury contaminated materials, captured by Englebright Dam and Daguerre Point Dam. The USACE has done some truly incredible restoration projects in the past, such as the work done at Lake Isabella in the southern Sierra	Comment noted.

Comment	Comment Text	Response
	Nevada. This project needs to be improved to meet the standards we know USACE is capable of. The time to restore the Yuba River watershed and ecosystem is NOW.	
AAA-1	Ecosystem Restoration Feasibility Report and Environmental Assessment, January 2018. Friends of the River has long advocated for improving fish passage and restoring habitat in the Yuba River and is extremely disappointed that the Corps has failed to include any fish passage measures in its Tentatively Selected Plan. In 1999, Friends of the River published Rivers Reborn-Removing Dams and Restoring Rivers in California. The report featured more than 30 dams that could be removed to benefit fisheries and improve fish passage, including Englebright and Daguerre Point Dams on the Yuba River. Friends of the River was also actively involved in the CALFED Restoration Program that studied removal of these Yuba River dams. Friends of the River has also been a plaintiff in federal court lawsuits that resulted in National Marine Fisheries Service (NMFS) biological opinions requiring the Corps to study and implement Yuba River fish passage improvements. Many members of Friends of the River visit the Yuba River for its outdoor recreation opportunities including class I-V boating (rafting, kayaking, canoeing), hiking backpacking, camping, fishing, and wildlife viewing.	Comment noted. The current 2014 NMFS biological opinion does not require USACE to study and implement Yuba River fish passage improvements.
AAA-2	Numerous studies have determined that Daguerre Point Dam impedes migration of up to 60% of threatened salmon and steelhead and is a complete impediment to the migration of threatened green sturgeon. Englebright Dam completely blocks upstream migration of all fish species in the Yuba. The Corps report fails to offer a solution to achieve the goal of restoring the Yuba River ecosystem because the report fails to address fish passage. Even the report acknowledges Daguerre Point Dam fish passage as an "Unresolved Ecological Problem" (pg. 43).	The goal of the Yuba River Ecosystem Restoration Study is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. The Recommended Plan would achieve that goal through habitat restoration measures on the Lower Yuba River. The report also considered a number of fish passage improvements. USACE has consulted with local fish biologists through YCWA, NMFS, and USFWS throughout the study. None of them has identified recent data that supports the statement that "…Daguerre Point Dam impedes migration of up to 60% of threatened salmon and steelhead…"
AAA-3	Fish Passage Measures Must Be Included in the Ecosystem Restoration Project. The Army Corps of Engineers has the discretion and authority to modify Englebright and Daguerre Point Dams to benefit spring run	The feasibility study considered a wide range of restoration measures in the watershed, including many fish passage measures. During the course of the study the fish passage measures were screened from detailed evaluation due to high costs and risks relative to potential restoration benefits in comparison to other measures, as documented

Comment	Comment Text	Response
	Chinook salmon, steelhead, and green sturgeon, the three species in the Yuba River listed as threatened under the Endangered Species Act. Congress appropriated funds for the Corps to develop plans for a project that would improve fish passage past these dams to avoid the high risk of extinction the listed fish species are facing as a result of the dams blocking access to historical spawning habitat. It is disgraceful that the Corps has squandered millions of taxpayers' dollars on a plan that fails to include the fish passage improvements that Congress directed the Corps to study, and instead proposes habitat restoration measures that other agencies are already doing. It appears the Corps may have violated the Appropriations Clause of the Constitution by spending money that Congress has not appropriated for a habitat restoration project. Congress authorized and funded a Yuba River Fish Passage Improvement Study and mandated that the Corps not deviate from the work plans for that study that the Corps submitted to Congress. The Appropriations Clause of the Constitution has a fundamental and comprehensive purpose to assure that public funds will be spent according to the letter of difficult judgments reached by Congress as to the common good, and not according to the individual favor of government agents. The statement in the Feasibility Report that in 2015 the Corps "initiated the Yuba River Ecosystem Restoration Feasibility Study at the request of the Yuba County Water Agency (YCWA)" is erroneous. (pg. ES-1). As the Corps and the public are well aware, the Corps initiated a Yuba River Fish Passage Improvement Study because it was a requirement in NMFS biological opinions issued to the Corps in 2002, 2007, and 2012. Yuba River populations of spring run Chinook salmon, steelhead and green sturgeon have been decimated by the dams blocking or impairing fish passage to prime spawning habitat and NMFS concluded that fish passage improvements at the dams are necessary to avoid jeopardizing the ongoing existence of these fish species. Although the Corps has decided its operation and maintenance of Englebright and Daguerre is no longer subject to the Endangered Species Act, a policy decision that Friends of the River has challenged in court, the Corps cannot unilaterally decide that it need not follow	in Section 3.4.3 of this report. Degradation of ecosystem structure, function, and process on the Lower Yuba River is severe and warrants the restoration efforts of multiple agencies. The recommended plan does not include restoration work that has already been funded for implementation by other agencies. As described in Section 1.2 of this report, the feasibility study was initiated under the authority of Section 209 of the Rivers and Harbors Act of 1962, which authorized various studies for flood control and allied purposes. The reconnaissance report approved in October 2014 found that the feasibility study would need to address ecosystem restoration, rather than fish passage alone, to be consistent with USACE planning policy, which does not support studies that are focused exclusively on the recovery of individual species. In early 2015, USACE's supporting documentation for the President's FY2016 budget informed Congress that the proposed feasibility study would not be limited to fish passage. USACE's Notice of Intent and public scoping meeting announcements in October 2015 likewise identified the feasibility study's purpose as ecosystem restoration. In addition, a Senate Committee Resolution in April 2016 specifically requested that the study investigate ecosystem restoration opportunities. The Feasibility Cost Share Agreement signed 2 June 2015 by YCWA and USACE formally initiated the feasibility study. Previous NMFS biological opinions were superseded by the 2014 NMFS biological opinion and have no bearing on the feasibility study. USACE's discretionary operations and maintenance activities at Englebright and Daguerre Point dams are subject to the Endangered Species Act, and USACE is in full compliance with the Act. USACE has been given authority and funding to conduct this feasibility study, but has not requested or received authority or funding to implement a fish passage improvement project or other restoration project on the Yuba River.

Comment	Comment Text	Response
	strict instructions from Congress on how the funds appropriated for the Yuba River Fish Passage Improvement Study are to be spent. Although there is no longer a NMFS biological opinion requiring the Corps to implement a Yuba River fish passage improvement project the fact remains the Corps went to Congress asking for funds for a fish passage improvement project and that is the project that Congress funded. The record shows that the Corps is adamantly opposed to making any significant modifications to Englebright and Daguerre and has acted in bad faith in carrying out the Feasibility Study. Over the course of several years, while the Corps was still subject to the biological opinions mandating that the Corps study and implement fish passage improvements, the Corps' budget proposals to Congress urged appropriations of funds for a fish passage improvement study. Congress finally appropriated funds to initiate the study in January 2014. Corps staff began work on the fish passage improvement study shortly thereafter. However, in May 2014 the Corps succeeded in persuading NMFS to issue a new biological opinion without a mandate for a fish passage improvement project. Corps documents that Friends of the River has obtained through Freedom of Information Act requests clearly show that after that mandate was removed Corps staff who had begun work on the fish passage study were told to redirect the focus of the study away from fish passage and instead to focus on ecosystem restoration measures. A 2016 Senate Committee on Environment and Public Works provision that requested that the Corps include ecosystem restoration in the Feasibility Study fails to excuse the Corps' noncompliance with the Appropriations Acts' requirement that the Corps stick to the fish passage study that Congress funded. One committee in one house of Congress does not have the power to lift a congressionally-imposed restriction on the use of appropriated funds.	
AAA-4	Further evidence of the Corps' bad faith is its failure to heed the overwhelming number of public comments urging that the feasibility study focus on fish passage improvements. Instead of a good faith effort to follow the mandates of Congress and sincerely consider the public's comments, an analysis of the methodology the Feasibility Study used to determine which measures warranted full investigation	In addition to Lower Yuba River Habitat Restoration, the study considered nine fish passage measures, including removal of Daguerre Point and Englebright dams. The criteria used to screen measures were developed to allow a consistent set of criteria to be applied to all measures. The screening criteria were also guided by USACE's NER objective, which is to maximize benefits relative to

Comment	Comment Text	Response
	shows improper bias against fish passage measures. While the Feasibility Report/Environmental Assessment put on a show of considering fish passage measures equally with habitat restoration measures the scale was weighted in favor of the latter. Friends of the River expressed concern in its scoping comments that the Feasibility Study process might be tainted by bias. A red flag was raised when the Corps removed the California Department of Water Resources (DWR) as the study cost share partner without explanation and put Yuba County Water Agency (YCWA) in DWR's place. The move signaled that dam removal was not an option that would receive fair consideration in the study because YCWA is opposed to dam removal. The Feasibility Report/Environmental Assessment now reveals that no fish passage measures were given fair consideration in the study. The Corps' determination that none of the fish passage measures considered is feasible is arbitrary and capricious. There have been numerous studies by the Corps, NMFS, and by other resource agencies over the past two decades concluding that fish passage improvements on the Yuba River are not only feasible but necessary for the listed species' survival and recovery. Further, there are numerous instances of dams on other rivers successfully being removed or modified, reaping major benefits for listed fish species. However, the Corps failed to adequately consider this information before reaching its arbitrary and capricious decision that Yuba River fish passage measures are not feasible. The Corps selection of $97 million in habitat restoration measures to the exclusion of fish passage improvements is based on Corps ideology and not on scientific merit. NMFS is the federal agency with the scientific expertise to determine which measures would provide the most cost-effective benefits to the Yuba River's listed fish species. However, the Corps arbitrarily and capriciously failed to invite NMFS to be a cooperating agency in the NEPA process or in any way coordinate with NMFS during the Feasibility Study. As with many other aspects of its Feasibility Study process the Corps has not explained why it did not draw upon NMFS' expertise. However, it appears to be another example of improper Corps bias against fish passage measures. Friends of the River notes that, while no longer	costs. The screening process found that dam removal measures had the highest scores for the quality and quantity of habitat restored, but also received the highest scores for cost and risk to cost certainty. As a result, the dam removal measures did not compare well with other, more efficient measures. DWR expressed interest in serving as the non-Federal sponsor for this study but never submitted a formal request or signed an agreement. YCWA also expressed interest and signed the Feasibility Cost Share Agreement on 2 June 2015. USACE has consulted with NMFS throughout the study and has considered NMFS's comments on the draft feasibility report/EA. NMFS will also have the opportunity to comment on the final feasibility report during the State and Agency review process.

Comment	Comment Text	Response
	requiring it, NMFS continues to recommend that the Corps develop a fish passage project to restore spring run Chinook salmon and steelhead to historic habitats in the Yuba watershed.	
AAA-5	The Corps is the only agency in the Yuba River with the authority to modify Englebright and Daguerre to provide volitional fish passage. The Corps should use that authority to make the structural changes necessary to restore connectivity to the listed species' spawning habitat above Englebright and Daguerre rather than propose a project for habitat restoration work that is already being undertaken by local stakeholders with support from the U.S. Fish and Wildlife Service (FWS) and Yuba County. Friends of the River urges the Corps to reconsider its Tentatively Selected Plan, and in a revised report, fully address the ecological advantages and safety benefits to kayakers and river rafters if Daguerre Point Dam is removed.	USACE does not currently have authority to modify Englebright and Daguerre Point dams. Structural changes to the dams by USACE would require specific authorization by Congress. Other entities could make changes to the dams after applicable approvals by USACE. The recommended plan does not include restoration work that has already been funded for implementation by other agencies.
AAA-6	The Corps should give serious consideration to the following fish passage alternatives and recommend a plan to the Chief Engineer that enables volitional passage of spring-run Chinook and steelhead to historical habitat above Englebright and green sturgeon to historical habitat above Daguerre: Daguerre Point Dam 10% bypass; Daguerre Point Dam removal; Englebright Dam fish ladder; Englebright Dam bypass; and Englebright Dam removal. Daguerre Point Dam step pools is not an adequate fish passage solution because green sturgeon are not able to navigate step pools and their upstream migration would continue to be blocked by the dam.	The study considered all measures mentioned in the comment as documented in Chapter 3 of the FR/EA.
AAA-7	The Proposed Project Would Duplicate Habitat Restoration Measures Already In Process. While Friends of the River supports the incremental ecological restoration improvements discussed in Alternative 5 we cannot fully support this alternative because it duplicates restoration efforts already in the works. Alternative 5 has overlapping footprints both geographically and in methodology to (1) projects that have been proposed and are funded by the FWS Anadromous Fish Restoration Project (AFRP), (2) draft project designs that are in development by cbec and the South Yuba River Citizens League (SYRCL), and (3) the proposed habitat enhancements within the Yuba River Development Project through the Yuba River Development Project FERC (#2246)	For this study, the standard for including other restoration projects in the future-without-project condition was the existence of dedicated construction funds. Because the SYRCL/AFRP Long Bar project has not received construction funding, the study did not assume that the project would be built. However, should the SYRCL/AFRP Long Bar project receive construction funding before the USACE project is authorized and funded, USACE will omit or attempt to relocate the proposed features at that site. Because USACE has not received authority or funding to implement restoration on the Yuba River, and therefore has no set budget, including Bar A in the recommended plan

Comment	Comment Text	Response
	relicensing process. SYRCL and its partners will continue to make progress on these habitat restoration projects in the Lower Yuba River while the Corps waits for funding for a nearly identical project to be approved by Congress. In Habitat Increment 3a, the project at Bar A is overlapping the FWS AFRP project at Long Bar. SYRCL, FWS, The Long Bar Mine Company, Silica Resources, cbec, and Cramer Fish Sciences have been working on this project together since 2015 and at present 65% designs are nearly complete. SYRCL staff showed maps and discussed this project with Corps staff during the scoping period for the study, specifically during a meeting convened by Congressmen Garamendi on May 31, 2016. The FWS Long Bar Project is mentioned in the feasibility study but a project at Bar A was still designed in the same location. Including the Long Bar Project (Bar A) in a Corps project will only reduce the future investment in the Lower Yuba River. This is an unfortunate and unacceptable outcome for the final feasibility study given that the Corps is still in the planning phase. Friends of the River urges the Corps to revise the Tentatively Selected Plan to include a habitat restoration project in the Lower Yuba River that is not already in the planning phase by another federal agency. We understand that if Bar A remains in the feasibility study, funds will be returned to the federal government. It is duplicative and wasteful of taxpayer dollars for two federal agencies to both be planning projects at the same location. It is also unacceptable that a percentage of the projects planned in the study are not "feasible" at this draft stage and that funding, which would otherwise be used to benefit endangered and threatened species, would be returned to the federal government.	does not result in the exclusion of any other restoration measure. The non-Federal sponsor is aware that the proposed project may not include any action that is legally required of another entity, including by FERC licenses, as described in Section 2.5 of the report. Degradation of aquatic and riparian habitat in the Lower Yuba River is severe and the need for restoration would not be fully met by the near term implementation of restoration by other entities. USACE gives priority to restoration projects in areas where there is active participation in restoration by multiple organizations.
AAA-8	In closing, Friends of the River urges the Corps to implement all of the measures that are necessary to restore the ecosystem and ensure that the survival and recovery of threatened Yuba River fish species are no longer in jeopardy.	Comment noted
BBB-1	I live and recreate in the Yuba River watershed and am writing to provide comments (attached) on the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study released by	The objective of a USACE ecosystem restoration study is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Although the study is not

Comment	Comment Text	Response
	the Army Corps in January 2018. Although it is well documented that the current conditions of Chinook Spring-Run (an endangered species) and fall-run, and steelhead (threatened) habitat are significantly degraded within the Yuba River watershed, and no doubt the tentatively selected plan would benefit juvenile recruitment success and holdover opportunities for these species in the Lower Yuba River, I believe that unimpeded upstream passage will continue to be a critical issue for the long-term conservation and to the ongoing recovery effort of these species. As such, I cannot approve the tentatively selected plan as the environmentally preferred plan that effectively meets the ecosystem restoration goals established in the 905(b) Analysis. Key points that I request for consideration :	focused on the recovery of individual species, dam removal and fish passage measures were considered in the study.
BBB-2	This commenter questions the appropriateness of a limited feasibility study when the problems (and opportunities) regarding ecosystem restoration within the Yuba River Watershed suggest that a more comprehensive systems planning effort, including watershed and river basin planning, would significantly improve the opportunities to make sound water resource management decisions	The feasibility study is both landscape-level and watershed scale as described by the objectives identified in Section 2.4 and wide range of actions included in the preliminary and initial measures as described in Section 3.4.
BBB-3	The dam modification/fish passage measure was not fully explored, evaluated, and addressed in the feasibility study as stated in the 905(b) Analysis, and was removed from consideration without public comment opportunity	USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014.
BBB-4	The information used for the determination of the significance of ecosystem outputs did not fully take into account the significant institutional and public recognition of the dam modification/fish passage measure which was not considered due to the "minimal additional habitat restored" and the suggestion that "it would not be efficient"	The significance of ecosystem outputs are not quantified in a USACE feasibility study. Fish passage at Daguerre Point and Englebright Dams were eliminated from detailed evaluation because of high costs and risks relative to potential restoration benefits in comparison to other measures considered. A detailed evaluation of dam modification and fish passage measures was not required to determine that those measures would have higher costs and greater risks than other measures that were considered.

Comment	Comment Text	Response
BBB-5	The decision to complete a CEQA compliant environmental analysis after Congressional authorization and funding suggests the appearance of an irreversible or irretrievable commitment of resources	Compliance with CEQA is the responsibility of the non-Federal sponsor and although the completion of a compliant analysis would be required prior to construction, the timing of that analysis is at the discretion of the non-Federal sponsor. It is the intention of the non-Federal sponsor to implement analysis and consultation under the California Environmental Quality Act (CEQA) after Congressional authorization and before the PPA is signed.
BBB-6	There is the perception of bias with the selection of the tentatively selected plan and interests of the non-federal sponsor with the outcomes of the proposal	The criteria used to screen measures were developed to allow a consistent set of criteria to be applied to all measures. Screening process which lead to the recommended plan was determined to be appropriate and consistent with USACE planning policy. The public comment period was an opportunity for the public and other resource agencies to review and comment on the fidelity of the screening criteria and in turn the identification of the recommended plan.
BBB-7	The determination of quantity of habitat restored appears radically skewed in that it does not subjectively account for the immense ecological benefits of upstream fish passage	The screening exercise described in section 3.4.3 used simplified assumptions adopted from Engineering Circular 11-2-206 to estimate potential benefits of management measures. These Habitat quantity formulas provided a fair and equitable method for evaluating proposed measures with fundamental different metrics by which ecosystem benefits would be most appropriately measured (i.e., stream miles for fish passage vs. acres for riparian restoration).
BBB-8	Comment 1. Appropriateness of Limited Feasibility Study with watershed issues. The ER 1105-2-100 Planning Guidance Notebook, in the Watershed Study Description, page 3-37 states: "Watershed studies are planning initiatives that have a multipurpose and multi-objective scope and that accommodate flexibility and collaboration in the formulation and evaluation process. Possible areas of investigation for a watershed study include water supply, natural resource preservation, ecosystem restoration, environmental infrastructure, recreation, navigation, flood management activities, and regional economic development. This multi-purpose approach is recommended since numerous entities within the boundaries of any watershed must agree with and support watershed improvement and management initiatives in order to successfully implement effective	The Yuba River Ecosystem Restoration Feasibility Study considered a wide range of improvements in the Yuba River watershed. It is described as an interim study because it will not fully satisfy the study authority (Rivers and Harbors Act of 1962, Section 209). The study was funded as a single purpose, ecosystem restoration investigation (not a multi-purpose watershed study). The NMFS 2014 Biological Opinion on the Operation and Maintenance of Daguerre Point Dam and Fish Ladders supersedes the 2012 biological opinion referenced in the comment. The study was conducted in accordance with the USACE planning policy and all applicable laws and regulations.

Comment	Comment Text	Response
	system-wide solutions. The outcome of a watershed study will generally be a watershed resources management plan which identifies the combination of recommended actions to be undertaken by various partners and stakeholders in order to achieve the needs and opportunities identified in the study. The watershed resources management plan may or may not identify further Corps studies or implementation projects." ER 1105-2-100 on page E-151 further states: "Consideration of ecosystems within (or encompassing) a watershed provides a useful organizing tool to approach ecosystem-based restoration planning. Ecosystem restoration projects that are conceived as part of a watershed planning initiative or other regional resources management strategy are likely to more effectively meet ecosystem management goals than those projects and decisions developed independently. Independently developed ecosystem restoration projects, especially those formulated without a system context, may only partially and temporarily address symptoms of a chronic systemic problem. Not all restoration studies will be "watershed studies", but all Corps studies should have a watershed perspective." ER 1105-2-100 on Page E-228 further states: "Watershed planning takes a systems view of water resources and opportunities over a large hydrologic region commonly called a river basin or a watershed. Watershed studies will usually be multiple purpose and multiple objective investigations. Watershed studies will likely involve participation of other Federal, State and local agencies and groups with interests and authorities to address problems and opportunities beyond the Corps missions. It is fundamental to the planning process to investigate the full range of solutions to problems, and to develop multiple purpose solutions to problems. Comprehensive systems planning, including watershed and river basin planning will improve our opportunity for sound water resource management." Why was a watershed approach not taken into account for the Yuba River Ecosystem Restoration Feasibility Study? Also, as stated by the Corps in the 03 July 2012 U.S. Army Corps of Engineers, Sacramento District Itemized Comments on the NMFS'	

Comment	Comment Text	Response
	February 2012 Final Jeopardy Biological Opinion on the Lower Yuba River: "If reintroduction of anadromous salmonids into the Upper Yuba River Watershed is the objective, then the appropriate process would be to identify a number of potential alternatives/components, potential effects resulting from implementation of various alternatives, and to identify the most efficacious means of accomplishing reintroduction in the Upper Yuba River Watershed." Why did the Corps not follow their own recommendations necessary to utilize a watershed approach for identification of the most efficacious means of facilitating the long-term conservation and recovery of the affected species?	
BBB-9	Comment 2. The dam modification/fish passage measure was not fully explored, evaluated, and addressed in the feasibility study as stated in the 905(b) Analysis, and was removed from consideration without public comment opportunity. In the 03 July 2012 U.S. Army Corps of Engineers, Sacramento District Itemized Comments on the NMFS' February 2012 Final Jeopardy Biological Opinion on the Lower Yuba River, the Corps stated: "With respect to fish passage at Englebright Dam and improved fish passage at Daguerre Point Dam, the Corps has initiated the process for studying fish passage options. As NMFS is aware, the Corps has requested Congressional approval and funding of a reconnaissance study which is the first step in developing a plan for fish passage. A reconnaissance study typically takes one year to complete. If a nonfederal sponsor is identified during the reconnaissance phase, the next step is to prepare a feasibility study and environmental impact statement. The Corps' current policy is to complete the feasibility phase within 3 years. After the feasibility report is completed, the Corps would be able to submit a report to Congress to obtain further authorization and funding for project implementation." The 905(b) Analysis, Environmental Impacts, stated on the bottom of page 42:	USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. Extensive study of every measure is not possible under the time and funding limits mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. Fish passage was considered as part of the ecosystem restoration study, but was eliminated from detailed evaluation due to high costs and risks relative to potential restoration benefits in comparison to other measures considered. The NMFS 2014 Biological Opinion on the Operation and Maintenance of Daguerre Point Dam and Fish Ladders supersedes the 2012 biological opinion referenced in the comment. The 905(b) report was approved by USACE HQ on the condition that the feasibility study focus more holistically on ecosystem restoration, with fish passage/fish "recovery" as just one of several habitat components or potential beneficiaries. The rationale for this decision is because in addition to loss of habitat connectivity, important stressors affecting anadromous salmonids include physical habitat alternation, loss of riparian habitat and instream cover, loss of natural river morphology and function, and loss of floodplain habitat.

Comment	Comment Text	Response
	"Modifications to Englebright Dam would likely affect hydroelectric facilities, so those effects would have to be fully explored, evaluated, and addressed during the feasibility study." Then, in the Main Report of the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study, page ES-8, the anticipated direction of the study appears to have changed: "A significant ecosystem problem that was considered in this study would not be resolved by the Tentatively Selected Plan. Specifically, the TSP would not resolve the problem of blocked and impaired fish passage and altered hydrologic and sediment transport regimes caused by existing dams. Additional investigation of this unresolved problem could be addressed in a future study under the same authority." In the Main Report, Measures Not Considered In Detail, on page 32: "Daguerre Point Dam Fish Ladder: It is not possible to accurately quantify that improvement in terms of ecosystem outputs because (1) there is insufficient quantitative information on the degree to which upstream migration remains impeded despite the existing fish ladders, (2) the degree to which a new ladder would improve upstream migration is not known, and (3) there is no existing USACE-approved ecosystem model that would quantify ecosystem outputs from improved fish migration for direct comparison to ecosystem outputs from the other restoration measures considered, including aquatic and riparian habitat restoration. This measure was not carried forward for further consideration because it cannot be shown to be effective or efficient based on information that can be obtained within the scope of this study. Lower Englebright and Install Fish Ladder: This measure retains high technical complexity, high operations and maintenance costs, and high technical and cost uncertainty with minimal additional habitat restored; therefore, it is not carried forward for further consideration because it would not be efficient." What was the rational for this significant change in direction? Was it an authority issue? As stated repeatedly in the 03 July 2012 U.S. Army Corps of Engineers, Sacramento District Itemized Comments on the	

Comment	Comment Text	Response
	NMFS' February 2012 Final Jeopardy Biological Opinion on the Lower Yuba River: "The Corps has no discretionary authority or control over the continued existence of Englebright or Daguerre Point Dams and has no discretion to remove (or modify) the dams. The (NMFS's) BO acknowledges that the Corps has no authority or discretion for dam removal (or modification), so it is unclear why the continued existence of the dams is analyzed as part of the effects of the Corps' action." However, 40 C.F.R. 1502.14(c); Forty Questions No. 2(b) has determined that an alternative may be considered reasonable even if it is outside the legal jurisdiction of the lead agency. A potential conflict with local or federal law does not necessarily render an alternative unreasonable although such conflicts must be considered. An alternative that is outside the scope of what Congress has approved or authorized may be evaluated in an EIS because the EIS may serve as the basis for modifying congressional approval in light of NEPA's goals and policies. Was the rational for this significant change in direction an issue based upon potential significant impacts to hydropower or water conveyance managed by the non-federal sponsor? As stated in the Howard "Chip" Wilkins' letter to NMFS dated February 28, 2012, page 7; see also Curt Aikens' letter to NMFS dated February 28, 2012, pages 3-4 with regards to the 03 July 2012 U.S. Army Corps of Engineers, Sacramento District Itemized Comments on the NMFS' February 2012 Final Jeopardy Biological Opinion on the Lower Yuba River: "While the Narrows II Powerhouse was constructed to take advantage of the existence of Englebright Dam, which had been constructed many years earlier, the Yuba River Development Project could continue to operate without Englebright Dam or Daguerre Point Dam as explained in the February 28,2012 Curt Aikens letter. For example, while the Narrows II Powerhouse provides approximately 10% of the power generated by the Project, the remaining 90% of the generation, which occurs at the New Colgate Powerhouse, could continue without Englebright Dam. Similarly, while Daguerre Point Dam provides the hydraulic head for two facilities that divert water from the Lower Yuba	

Comment	Comment Text	Response
	River, these facilities could be replaced with other facilities that did not depend on Daguerre Point Dam. Also, the removal of Daguerre Point Dam would not affect any water rights to, or long term water delivery contracts for, Yuba River water." I believe that it is the responsibility of the action agency to then fully and accurately quantify ecosystem improvements in terms of outputs in order to allow comparison of a full range of measures that meet the purpose and need for the study, whether current authorities exist or not. Section 1506.5(c) prohibits a person or entity entering into a contract with a federal agency to prepare an EIS when that party has at that time and during the life of the contract pecuniary or other interests in the outcomes of the proposal.	
BBB-10	Comment 3. The information used for the determination of the significance of ecosystem outputs did not fully take into account the significant institutional and public recognition of the dam modification/fish passage measure which was not considered due to the "minimal additional habitat restored" and the suggestion that "it would not be efficient." ER 1105-2-100 Planning Guidance Notebook, Significance of Ecosystem Outputs, on page E-159 states: "Along with information from cost effectiveness and incremental cost analyses, as well as information about acceptability, completeness, and effectiveness, information on the significance of ecosystem outputs will help determine whether the proposed environmental investment is worth its cost and whether a particular alternative should be recommended. The significance of restoration outputs should be recognized in terms of institutional, public, and/or technical importance. This basically means that someone, some entity, some law/policy/regulation, or scientific evidence indicates that a particular resource is important." With regard to institutional recognition, is the importance of a modified dam and upstream fish passage acknowledged in the laws, adopted plans, and other policy statements of public agencies, tribes, or private groups? I would say that it is well documented to be of significant importance.	Statements of significance provide qualitative information to help decision makers evaluate whether the value of the resources of any given restoration alternative are worth the costs incurred to produce them. Resource significance was described and considered for this study in sections 2.1 and 8.1.2. As described in the response to comment BBB-4, significance of resources are considered but recommended plans of ecosystem restoration studies are justified by quantifiable habitat improvements.

Comment	Comment Text	Response
	With regard to public recognition, does some segment of the general public recognizes the importance of a modified dam and upstream fish passage, as evidenced by people engaged in activities that reflect an interest or concern for that particular resource? I would say that it is well documented to be of significant importance. In summary, the case can be made that environmental resources are significant based on institutional, public, and technical recognition when, within a specified geographic range, those resources are either scarce; are representative of their respective ecosystems; will improve connectivity or reduce fragmentation of habitat; represent limiting habitat for important species; will improve or increase biodiversity; or trends indicate that the health of the resource is imperiled and declining, but can be recovered through human intervention. As such, I suggest that the Corps consider the institutional and public recognitions of the modified dam and upstream fish passage measure as significant criteria in order to move it forward for further consideration	
BBB-11	Comment 4. Is the Tentatively Selected Plan the Environmentally Preferred Alternative? Section 1505.2(b) requires that, in cases where an EIS has been prepared, the Record of Decision (ROD) must identify all alternatives that were considered, ". . . specifying the alternative or alternatives which were considered to be environmentally preferable." The environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in NEPA's Section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources. The Council recognizes that the identification of the environmentally preferable alternative may involve difficult judgments, particularly when one environmental value must be balanced against another. The public and other agencies reviewing a Draft EIS can assist the lead agency to develop and determine environmentally preferable alternatives by providing their views in comments on the Draft EIS. Through the identification of the environmentally preferable alternative, the decision maker is clearly faced with a choice between	USACE determined that the preparation of an Environmental Assessment was appropriate for this action and has followed NEPA guidelines in the preparation that document. Under NEPA, the identification of the environmentally preferable plan is required for the preparation of an EIS and ROD only. Therefore, the FONSI prepared for this study does not include an identification of the environmentally preferable plan.

Comment	Comment Text	Response
	that alternative and others, and must consider whether the decision accords with the Congressionally declared policies of the Act. Has the Corps identified the Tentatively Selected Plan as the Environmentally Preferred Alternative out of the array of all alternatives developed during the feasibility phase?	
BBB-12	Comment 5. The decision to complete a CEQA compliant environmental analysis after Congressional authorization and funding suggests the appearance of an irreversible or irretrievable commitment of resources. As stated in the Main Report Executive Summary and Public and Agency Scoping section on page 16: "YCWA, the lead agency under the California Environmental Quality Act (CEQA), is expected to complete a CEQA compliant environmental analysis after Congressional authorization." In accordance with CEQA guidance, NEPA and CEQA promote informed decision making by requiring an environmental review process (i.e., analyses and documentation) before a final decision on whether and how to proceed. As such, I am concerned that there may be the appearance of pre-decision and an irreversible or irretrievable commitment of resources if Congressional authorization precedes a CEQA compliant environmental analysis.	Compliance with CEQA is the responsibility of the non-Federal sponsor and although the completion of a compliant analysis would be required prior to construction, the timing of that analysis is at the discretion of the non-Federal sponsor. It is the intention of the non-Federal sponsor to implement analysis and consultation under the California Environmental Quality Act (CEQA) after Congressional authorization and before the PPA is signed.
BBB-13	Comment 6. There is the perception of bias with the selection of the tentatively selected plan and interests of the non-federal sponsor with the outcomes of the proposal. On 05 January 2018, the Corps provided a News Release no. 18-003 regarding release of the draft feasibility report and environmental assessment, and public meeting scheduled. It stated that: "The Sacramento District initiated the Yuba River Ecosystem Restoration Feasibility Study in 2015 at the request of its non-federal sponsor, the Yuba County Water Agency." Also, on the bottom of page 4, Main Report of the Draft Interim Feasibility Report and Environmental Assessment for the Yuba River Ecosystem Restoration Feasibility Study:	The Yuba County Water Agency (YCWA) has studied the Yuba River since the agency was founded in 1959. They have a wealth of local knowledge and data to support the study. Additionally, by signing the Feasibility Cost Share Agreement, YCWA has agreed to study the river in accordance with applicable Federal laws, regulations, and policies, including for example, the Engineering Regulation 1105-2-100 which defines the National Ecosystem Restoration objective for planning studies. The FR/EA has undergone several internal review and has been determined to be in compliance with all laws, regulations, and policies.

Comment	Comment Text	Response
	"USACE and the Yuba County Water Agency (YCWA) are the lead agencies in the Feasibility Study and share the cost of the study equally, pursuant to the Feasibility Cost Sharing Agreement executed by the parties on June 2, 2015 and amended July 31, 2017." Under 40 CFR 1506.5 - Agency responsibility, a person or entity is prohibited from entering into a contract with a federal agency to prepare an EIS when that party has at that time and during the life of the contract pecuniary or other interests in the outcomes of the proposal. In the CEQ 40 Questions - conflict of interest: "23a. Conflicts of Federal Proposal With Land Use Plans, Policies or Controls. How should an agency handle potential conflicts between a proposal and the objectives of Federal, state or local land use plans, policies and controls for the area concerned? See Sec. 1502.16(c)." Answer: The agency should first inquire of other agencies whether there are any potential conflicts. If there would be immediate conflicts, or if conflicts could arise in the future when the plans are finished (see Question 23(b) below), the EIS must acknowledge and describe the extent of those conflicts. If there are any possibilities of resolving the conflicts, these should be explained as well. The EIS should also evaluate the seriousness of the impact of the proposal on the land use plans and policies, and whether, or how much, the proposal will impair the effectiveness of land use control mechanisms for the area. Comments from officials of the affected area should be solicited early and should be carefully acknowledged and answered in the EIS. 23b. What constitutes a "land use plan or policy" for purposes of this discussion? Answer: The term "land use plans," includes all types of formally adopted documents for land use planning, zoning and related regulatory requirements. Local general plans are included, even though they are subject to future change. Proposed plans should also be addressed if they have been formally proposed by the appropriate government body in a written form, and are being actively pursued by officials of the jurisdiction. Staged plans, which must go through phases of development such as the Water Resources Council's Level A, B and C	

Comment	Comment Text	Response
	planning process should also be included even though they are incomplete. The term "policies" includes formally adopted statements of land use policy as embodied in laws or regulations. It also includes proposals for action such as the initiation of a planning process, or a formally adopted policy statement of the local, regional or state executive branch, even if it has not yet been formally adopted by the local, regional or state legislative body. 23c. What options are available for the decision maker when conflicts with such plans or policies are identified? A. After identifying any potential land use conflicts, the decision maker must weigh the significance of the conflicts, among all the other environmental and non-environmental factors that must be considered in reaching a rational and balanced decision. Unless precluded by other law from causing or contributing to any inconsistency with the land use plans, policies or controls, the decision maker retains the authority to go forward with the proposal, despite the potential conflict. In the Record of Decision, the decision maker must explain what the decision was, how it was made, and what mitigation measures are being imposed to lessen adverse environmental impacts of the proposal, among the other requirements of Section 1505.2. This provision would require the decision maker to explain any decision to override land use plans, policies or controls for the area." Does the YCWA have pecuniary or other interests in the outcomes of this feasibility study? If so, then the Corps may need to find another partner.	
CCC-1	My property abuts the gravel bar that is slated for modification/gravel removal. Not only do I have deeded access across the bar but, my road is the road that is being proposed for access to the bar and nobody has even made a request for right of way. I'm concerned that my road was not engineered for the kind of heavy equipment that the gravel removal effort will require. There is underground conduit to each parcel off our road and the likelihood of damage is great. Not to mention that the road comes down to a 20' tall bluff above the bar at its closest point on my property and road construction for access to the bar will be unsightly at best.	Implementation of the project would include compensation at fair market value for all partial and full real estate takes, including for takes associated with project staging. The project is currently in the Feasibility stage (planning stage) and is based on existing land conditions. Construction of the project has not been authorized, nor have funds been appropriated for construction at this time. Project footprints and designs will be refined during PED. All land owners will be compensated fair market value for lands needed for construction, operation, rehabilitation, and maintenance of the authorized project including subsurface rights. Site specific appraisals and acquisitions are completed by the non-Federal partner during the

Comment	Comment Text	Response
		PED phase of the project. Specific compensation cannot be discussed at this stage in the study. All access roads will be improved as necessary prior to use, maintained during construction, and restored to pre-construction conditions following construction.
CCC-2	Moreover, the bar is private and quiet, unlike the public space across the river. We do not want there to be public access in the future because motorcycles, mining and shooting are counterproductive to the habitat restoration goals of the Yuba River Eco Study. I'm also concerned that the value of my property will diminish with new public access right in front of my future house.	Comment noted. The recommended plan does not include any recreational components (i.e., public access).
DDD	There are 2 roads indicated on the North bank of the river. As the owners of both of those roads, we wish to point out that the easterly road is constructed as a residential road unlikely to serve well for construction. The westerly road is the haul road for the existing gravel facility and is preferred. This road is owned by Long Bar Mine LLC and could provide access to the Lower Gilt Bar restoration area to the east.	The preferred westerly road will be identified as the proposed haul route as per the commenter's recommendation.
EEE-1	Wilbur Ranch supports the project as a whole but believes portions of the Habitat Increments that have been eliminated should be included to protect aquatic and riparian habitat along the lower Yuba River. The Wilbur Ranch consists of numerous parcels, but the parcels located adjacent to the Yuba River are APN 018-140-011, 018-140-015, and 018-240-041.	Comment noted. Thank you for your support.
EEE-2	According to the report, Habitat Increment 5C has been eliminated from the study. We would like to request at a minimum that the upper 7,000 feet of the left bank of Habitat Increment 5C be included as part of the study and project. This 7,000 feet of the left bank of the Yuba River has been experiencing ongoing bank erosion and degradation. There is an Oxbow (39°09'47.50" N, 121°33'11.61" W) located in the middle section of this 7,000 feet section that lost over twelve (12) acres and 650,000 cubic yards of material into the Yuba River. A majority of this erosion occurred over a five (5) month period from October 2016 to April 2017. This erosion continues to be ongoing and can be	Habitat Increment 5c was eliminated due to substantial geomorphic changes during the winter of 2016-2017. USACE policy requires consideration of nature-based features that work in concert with natural processes or mimic as closely as possible conditions which would occur in the area absent human changes to the landscape or hydrology. Because natural morphological processes are apparent at Habitat Increment 5c, further restoration would provide limited ecosystem restoration benefits compared to the other increments being evaluated.

Comment	Comment Text	Response
	observed in the Google Earth Aerial taken May 18, 2017. In this aerial, the turbidity in the water is noticeable from just upstream of this Oxbow downstream to the Feather River (see exhibit attached of the Yuba River which highlights the area of concern). Using Google Earth historic aerials, the change in the river and loss of bank (Oxbow) from August 22, 2016 to May 18, 2017 is substantial. The erosion of the bank started in early 2016 but accelerated during the winter of 2016/17. The Wilbur Family has farmed this property for over sixty (60) years and previously worked with the California Debris Commission (CDC) to install bank protection, channelization features (rip rap training spurs), tree plantings, rock slope protection, and other features along their ranch to help protect the bank and maintain the Yuba River Channel alignment. Wherever possible, Wilbur Ranches will not farm to the river bank but instead allow trees and other riparian habitat to develop along the bank. They have found this helps stabilize the bank and provide a wave/flow buffer to their ranch. In many locations this buffer has been lost, and in some locations there is active erosion of their orchard lands. Wilbur Ranch owns other lands along one of the old river channels and is concerned that if the Yuba River left bank is left unprotected, flows into the old river channel will become more common thereby resulting in further damage to riparian habitat located along the old river channel.	Although there may be benefits to existing habitat associated with erosion protection, the process of erosion is largely a natural ecosystem function. Bank armoring measures installed for the purpose of flood risk management, are generally viewed as a move away from natural conditions and often are conducted under a different authorized purpose (i.e. flood risk management, which is not an authorized purposed of the feasibility study) and in many cases require mitigation to account for disruption to existing vegetation and/or disruption to natural processes (erosion/deposition).
EEE-3	Wilbur Ranch would be willing to work with the USACE and YCWA to extend Habitat Increment 5B downstream about 1.35 miles (upper 7,000 feet of Habitat Increment 5C on left bank).	Project designs will be refined during the Preconstruction Engineering and Design phase with the intention of improving effectiveness and efficiency of measures and to accommodate any natural changes that may occur between completion of the feasibility study and authorization and appropriation of funding.
FFF-1	COMMENTS TO REQUEST FOR REVIEW FOR THE DRAFT YUBA RIVER ECOSYSTEM RESTORATION FEASIBILITY STUDY, YUBA COUNTY Pursuant to the United States Army Corps of Engineers' 5 January 2018 request, the Central Valley Regional Water Quality Control Board (Central Valley Water Board) has reviewed the Request for Review for	Avoidance, minimization, and monitoring measures have been adopted from the Biological Assessment and Essential Fish Habitat Assessment for the Yuba River Canyon Salmon Habitat Restoration Project (section 4.3.7). Furthermore, the Corps will obtain a 401 WQC from the CVRWQCB during the PED phase which will ensure that the project is in compliance with the CWA. The potential for release of contaminants will also be addressed through pre-

Comment	Comment Text	Response
	the Draft Yuba River Ecosystem Restoration Feasibility Study, located in Yuba County. Our agency is delegated with the responsibility of protecting the quality of surface and groundwaters of the state; therefore our comments will address concerns surrounding those issues. Mercury and Methylmercury Production In regards to impacts related to mercury/methylmercury production, the Central Valley Water Board is generally supportive of the environmental analysis presented within the Yuba River Ecosystem Restoration Draft Interim Feasibility Report & Environmental Assessment (FR/EA), specifically within 4.3.7.2.2 Basis of Significance. The FR/EA identifies all of the major rivers in the Yuba River watershed as water bodies on the California's Clean Water Act Section 303(d) List; and fish tested for mercury in the tributaries of the Yuba River were the highest in the state (Yuba County, 2015). In regards to the determination of no significant impact on environmental resources, Central Valley Water Board staff does not see sufficient mitigation measures to ensure no significant impact and recommend consideration of additional mitigation measures. Additionally, the FR/EA contains statements contradicting other findings within the report. Specifically, within Section 3.4.3, Cost Risk/Uncertainty Due to Potential for Mercury Contamination, the FR/EA states there is " ... uncertainty regarding concentration and location of mercury contamination ... " However, Section 4.3.4.1 Affected Environment directly cites estimated background concentrations from Western Aggregate Reclamation Plan as well as three other citations for modern sediment concentrations. Additionally, large amounts of fish mercury data exists in publically accessible databases (e.g. CEDEN) which was used to determine the Yuba River (Englebright Lake Dam to Feather River, Lower) water body segment within the tentatively selected project (TSP) scope (and all other water body segments including and downstream of New Bullards Bar Reservoir) as impaired for mercury. Under Section 4.3.7.3 Avoidance, Minimization, and Mitigation Measures, the FR/EA also does not define the soil concentrations "significantly above background mercury level" that would trigger	construction characterization, monitoring during construction, and adaptive controls. Section Appendix C, section C-10. Construction Procedures and Water Control Plan discusses some potential controls and Best Management Practices (BMPs) to mitigate risks from contaminant releases during construction. Contaminant concentrations that may be environmentally relevant will be addressed through characterization, monitoring and adaptive controls through the 401 Certification process. Appendix C, section C-21 Special Studies puts forth possible means of mitigating encountered hazardous and toxic materials. It is possible that based on Special Studies, site-specific water quality criteria for mercury will be used to address potential methylmercury effects. Please refer to the discussion of the major thematic concern "Potential Impacts Related to Mercury" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments. Although the waterbodies in the Yuba River watershed are all listed as impaired waterbodies due to mercury contamination, the specific concentration of mercury in any given location is unknown. Technical evaluations and site characterizations for all proposed measures were not possible within the scope of the study due to previously mentioned time and funding constraints, therefore, evaluation of Cost Risk/Uncertainty related to potential mercury contamination were made based on professional judgment.

Comment	Comment Text	Response
	ceasing construction. The 401 Water Quality Certification for this project may require that the USACE/YCWA submit a sediment mercury monitoring and a contaminated sediment management plan for Executive Officer approval prior to construction activities describing actions to identify areas with elevated mercury concentrations and a plan to isolate, remove, and/or prevent downstream transport of mercury-contaminated sediments in the restoration areas. The best management practices should consider erosion prevention methods to prevent mercury-contaminated sediments from re-entering the waterways. The mercury monitoring and contaminated sediment management plan should additionally consider locations where excavation materials will be placed and include detailed contingency measures if the median concentration of mercury on fine grained sediments (grain size less than 63 microns) is greater than 0.1 mg/kg [dry weight] are encountered. Within the Statewide Mercury Control Program for Reservoir's Staff Report for Scientific Peer Review1, modern background sediment concentrations for trace mercury areas have been proposed at 0.1 mg/kg [dry weight], which will be the proposed mercury load allocation designated to the Yuba River watershed.	
FFF-2	Basin Plan The Central Valley Water Board is required to formulate and adopt Basin Plans for all areas within the Central Valley region under Section 13240 of the Porter-Cologne Water Quality Control Act. Each Basin Plan must contain water quality objectives to ensure the reasonable protection of beneficial uses, as well as a program of implementation for achieving water quality objectives with the Basin Plans. Federal regulations require each state to adopt water quality standards to protect the public health or welfare, enhance the quality of water and serve the purposes of the Clean Water Act. In California, the beneficial uses, water quality objectives, and the Antidegradation Policy are the State's water quality standards. Water quality standards are also contained in the National Toxics Rule, 40 CFR Section 131.36, and the California Toxics Rule, 40 CFR Section 131 .38. The Basin Plan is subject to modification as necessary, considering applicable laws, policies, technologies, water quality conditions and	Comment noted.

Comment	Comment Text	Response
	priorities. The original Basin Plans were adopted in 1975, and have been updated and revised periodically as required, using Basin Plan amendments. Once the Central Valley Water Board has adopted a Basin Plan amendment in noticed public hearings, it must be approved by the State Water Resources Control Board (State Water Board), Office of Administrative Law (OAL) and in some cases, the United States Environmental Protection Agency (USEPA). Basin Plan amendments only become effective after they have been approved by the OAL and in some cases, the USEPA. Every three (3) years, a review of the Basin Plan is completed that assesses the appropriateness of existing standards and evaluates and prioritizes Basin Planning issues. For more information on the Water Quality Control Plan for the Sacramento and San Joaquin River Basins, please visit our website: http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/ .	
FFF-3	Antidegradation Considerations All wastewater discharges must comply with the Antidegradation Policy (State Water Board Resolution 68-16) and the Antidegradation Implementation Policy contained in the Basin Plan. The Antidegradation Policy is available on page IV-15.01 at: http://www.waterboards.ca.gov/centralvalleywater_issues/basin_plans/ sacsjr.pdf In part it states: Any discharge of waste to high quality waters must apply best practicable treatment or control not only to prevent a condition of pollution or nuisance from occurring, but also to maintain the highest water quality possible consistent with the maximum benefit to the people of the State. This information must be presented as an analysis of the impacts and potential impacts of the discharge on water quality, as measured by background concentrations and applicable water quality objectives. The antidegradation analysis is a mandatory element in the National Pollutant Discharge Elimination System and land discharge Waste Discharge Requirements (WDRs) permitting processes. The	All required permits will be acquired prior to project construction, as appropriate.

Comment	Comment Text	Response
	environmental review document should evaluate potential impacts to both surface and groundwater quality.	
FFF-4	Construction Storm Water General Permit Dischargers whose project disturb one or more acres of soil or where projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the General Permit for Storm Water Discharges Associated with Construction Activities (Construction General Permit), Construction General Permit Order No. 2009-009-DWQ. Construction activity subject to this permit includes clearing, grading, grubbing, disturbances to the ground, such as stockpiling, or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility. The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). For more information on the Construction General Permit, visit the State Water Resources Control Board website at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.shtml.	All required permits will be acquired prior to project construction, as appropriate.
FFF-5	Phase I and II Municipal Separate Storm Sewer System (MS4) Permits The Phase I and II MS4 permits require the Permittees reduce pollutants and runoff flows from new development and redevelopment using Best Management Practices (BMPs) to the maximum extent practicable (MEP). MS4 Permittees have their own development standards, also known as Low Impact Development (LID)/post-construction standards that include a hydromodification component. The MS4 permits also require specific design concepts for LID/post-construction BMPs in the early stages of a project during the entitlement and CEQA process and the development plan review process. For more information on which Phase I MS4 Permit this project applies to, visit the Central Valley Water Board website at: http://www.waterboards.ca.gov/centralvalley/water_issues/storm_water/municipal_permits/	All required permits will be acquired prior to project construction, as appropriate.

Comment	Comment Text	Response
	For more information on the Caltrans Phase I MS4 Permit, visit the State Water Resources Control Board at: http://www. waterboards. ca. gov/water _issues/programs/stormwater/caltrans. shtmI For more information on the Phase II MS4 permit and who it applies to, visit the State Water Resources Control Board at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/phase_ii_municipal.shtml	
FFF-6	Industrial Storm Water General Permit Storm water discharges associated with industrial sites must comply with the regulations contained in the Industrial Storm Water General Permit Order No. 2014-0057-DWQ. For more information on the Industrial Storm Water General Permit, visit the Central Valley Water Board website at: http://www.waterboards.ca.gov/centralvalley/water_issues/storm_water/industrial_general_ perm its/index. shtmI.	All required permits will be acquired prior to project construction, as appropriate.
FFF-7	Clean Water Act Section 404 Permit If the project will involve the discharge of dredged or fill material in navigable waters or wetlands, a permit pursuant to Section 404 of the Clean Water Act may be needed from the United States Army Corps of Engineers (USACOE). If a Section 404 permit is required by the USACOE, the Central Valley Water Board will review the permit application to ensure that discharge will not violate water quality standards. If the project requires surface water drainage realignment, the applicant is advised to contact the Department of Fish and Game for information on Streambed Alteration Permit requirements. If you have any questions regarding the Clean Water Act Section 404 permits, please contact the Regulatory Division of the Sacramento District of USACOE at (916) 557-5250.	Although USACE does not self-issue Section 404 permits. A Section 404(b)(1) analysis has been completed and is included in the Environmental Appendix D - Attachment 3.
FFF-8	Clean Water Act Section 401 Permit - Water Quality Certification	Through informal consultation, CVWQCB indicated preliminary support of the project and acknowledges USACE’s intent to apply for

Comment	Comment Text	Response
	If an USACOE permit (e.g., Non-Reporting Nationwide Permit, Nationwide Permit, Letter of Permission, Individual Permit, Regional General Permit, Programmatic General Permit), or any other federal permit (e.g., Section 10 of the Rivers and Harbors Act or Section 9 from the United States Coast Guard), is required for this project due to the disturbance (i.e., discharge of dredge or fill material) of waters of the United States (such as streams and wetlands), then a Water Quality Certification must be obtained from the Central Valley Water Board prior to initiation of project activities. There are no waivers for 401 Water Quality Certifications.	a CQA Section 401 WQC permit during the PED phase. All required permits will be acquired prior to project construction, as appropriate.
FFF-9	Waste Discharge Requirements (WDRs)- Discharges to Waters of the State If USACOE determines that only non-jurisdictional waters of the State (i.e., "non-federal" waters of the State) are present in the proposed project area, the proposed project may require a Waste Discharge Requirement (WDR) permit to be issued by Central Valley Water Board. Under the California Porter-Cologne Water Quality Control Act, discharges to all waters of the State, including all wetlands and other waters of the State including, but not limited to, isolated wetlands, are subject to State regulation.	All required permits will be acquired prior to project construction, as appropriate.
FFF-10	Land Disposal of Dredge Material If the project will involve dredging, Water Quality Certification for the dredging activity and Waste Discharge Requirements for the land disposal may be needed. For more information on the Water Quality Certification and WDR processes, visit the Central Valley Water Board website at: http://www.waterboards.ca.gov/centralvalley/help/business_help/permit2.shtml	All required permits will be acquired prior to project construction, as appropriate.
FFF-11	Dewatering Permit If the proposed project includes construction or groundwater dewatering to be discharged to land, the proponent may apply for coverage under State Water Board General Water Quality Order (Low Risk General Order) 2003-0003 or the Central Valley Water Board's Waiver of Report of Waste Discharge and Waste Discharge	All required permits will be acquired prior to project construction, as appropriate.

Comment	Comment Text	Response
	Requirements (Low Risk Waiver) R5-2013-0145. Small temporary construction dewatering projects are projects that discharge groundwater to land from excavation activities or dewatering of underground utility vaults. Dischargers seeking coverage under the General Order or Waiver must file a Notice of Intent with the Central Valley Water Board prior to beginning discharge. For more information regarding the Low Risk General Order and the application process, visit the Central Valley Water Board website at: http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2003/wqo/wqo2003-0003. Pdf For more information regarding the Low Risk Waiver and the application process, visit the Central Valley Water Board website at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/waivers/r5-2013-0145_res.pdf	
FFF-12	Low or Limited Threat General NPDES Permit If the proposed project includes construction dewatering and it is necessary to discharge the groundwater to waters of the United States, the proposed project will require coverage under a National Pollutant Discharge Elimination System (NPDES) permit. Dewatering discharges are typically considered a low or limited threat to water quality and may be covered under the General Order for Dewatering and Other Low Threat Discharges to Surface Waters (Low Threat General Order) or the General Order for Limited Threat Discharges of Treated/Untreated Groundwater from Cleanup Sites, Wastewater from Super chlorination Projects, and Other Limited Threat Wastewaters to Surface Water (Limited Threat General Order). A complete application must be submitted to the Central Valley Water Board to obtain coverage under these General NPDES permits. For more information regarding the Low Threat General Order and the application process, visit the Central Valley Water Board website at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/rS-2013-007 4. Pdf	All required permits will be acquired prior to project construction, as appropriate.

Comment	Comment Text	Response
	For more information regarding the Limited Threat General Order and the application process, visit the Central Valley Water Board website at: http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/rS-2013-0073.pdf	
FFF-13	NPDES Permit If the proposed project discharges waste that could affect the quality of the waters of the State, other than into a community sewer system, the proposed project will require coverage under a National Pollutant Discharge Elimination System (NPDES) permit. A complete Report of Waste Discharge must be submitted with the Central Valley Water Board to obtain a NPDES Permit. For more information regarding the NPDES Permit and the application process, visit the Central Valley Water Board website at: http://www.waterboards.ca.gov/centralvalley/help/business_help/permit3.shtml	All required permits will be acquired prior to project construction, as appropriate.
GGG-1	I am writing to provide NOAA's National Marine Fisheries Services (NMFS) comments on the Yuba River Ecosystem Restoration Feasibility Study, Draft Interim Feasibility Report and Environmental Assessment (FS/EA), dated January 2018. NMFS appreciates the opportunity to be involved in the study and the opportunity to provide comments. NMFS is responsible for the United States' ocean resources and their habitat. This includes anadromous fish found in the Yuba River, such as Central Valley spring-run Chinook salmon (Oncorhynchus tshawytscha), fall-run Chinook salmon (0. tshawytscha), California Central Valley steelhead (0. mykiss), and the southern distinct population segment of North American green sturgeon (Acipenser medirostris). Central Valley spring-run Chinook salmon, California Central Valley steelhead, and the southern distinct population segment of North American green sturgeon are all listed as threatened under the Federal Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.). All three of these species are present in the Yuba River and have designated critical habitat in the Yuba River. In addition to the ESA,	Comment noted.

Comment	Comment Text	Response
	NMFS has authority under the Fish and Wildlife Coordination Act (16 U.S.C. 662(a)), and the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1855(b)). Under the MSA all of the historic habitat for Chinook salmon in the Yuba River watershed has been designated as essential fish habitat. As identified in the EA, the Yuba River watershed has been impacted by human activities for over one hundred years. These activities have included hydraulic gold mining, mining with dredges, altering the river channel, exporting water, altered stream flows, and damming of the river for flood control, water supply and power. Activities such as hydraulic mining have resulted in large amounts of rock and dirt being deposited in the Yuba river channel and floodplains. Mining with dredges has resulted in trenches reaching down 90 feet, and tailings that have altered the course of the Yuba River. Additionally, the lower Yuba River was moved to the north to address flooding due to mining debris, and to allow dredging in the old river channel. Dams on the river enable an average of 610,000 acre feet of water to be diverted out of the Yuba River watershed annually. Storing water, and diverting water out of the Yuba River watershed has altered the flow regime in the Yuba River watershed, by reducing flows in the spring and increasing summer and fall flows. Upstream fish passage has been blocked by dams such as the Corps' Englebright Dam. Englebright Dain is the dam the furthest downstream on the Yuba River that has no fish passage. Englebright Dam is the dam that precludes upstream migrating salmonids from accessing historic habitat that NMFS has identified as being necessary for recovery of ESA listed salmonid species. Evidence suggests that upstream fish passage is impaired at the Corps' Daguerre Point Dam and that downstream fish passage may be resulting in significant mortalities of ESA listed salmonids. All of these activities have negatively impacted the Yuba River ecosystem and the fish resources for which NMFS has responsibilities.	
GGG-2	The reconnaissance study for the Yuba River Ecosystem Restoration was initiated at the request of the Yuba County Water Agency (YCWA). YCWA has been working with NMFS and other organizations to identify actions in the Yuba River watershed to implement to work toward recovery of ESA listed species. It is NMFS' understanding that YCWA's request for the FS/EA was made as an	The upstream and downstream fish passage measures that were identified in the Reconnaissance Study were also considered in the Feasibility Study.

Comment	Comment Text	Response
	effort to identify actions the Corps might undertake to address ecosystem issues in the Yuba River watershed, including fish passage at dams owned by the Corps. The reconnaissance study identified a number of potential fish passage improvement actions. These included improving upstream and downstream fish passage at Daguerre Point Dam, and identifying alternatives for upstream and downstream fish passage at Englebright Dam.	
GGG-3	NMFS recognizes that the U.S. Army Corps of Engineers (Corps) has conducted an extensive review for this draft FS/EA. The draft FS/EA outlines a proposed plan to reconnect the Yuba River to its floodplain, create rearing habitat for juvenile fish, create riparian habitat, and facilitate improved conditions for the natural recruitment of riparian habitat. Improvements to approximately 178 acres of existing aquatic and riparian habitat along the lower Yuba River, between Englebright Dam and the confluence of the Yuba and Feather rivers in Yuba County, are being proposed in the FS/EA. Measures such as side channels, backwaters, floodplain lowering, riparian planting, and installation of hydraulic roughness and structural complexity features that replicate nature could be implemented throughout the project area. These measures are all helpful in restoring ecosystem functions in the Yuba River.	Thank you for acknowledging the benefit of habitat restoration on the lower Yuba River.
GGG-4	The tentatively selected plan (TSP) does not include any actions to address fish passage. The FS/EA identifies that the lack of fish passage to habitat historically used by ESA listed fish is a "significant ecosystem problem that was considered in this study" and "the TSP would not resolve the problem of blocked and impaired fish passage and altered hydrologic and sediment transport regimes caused by existing dams" (page 8 of the executive summary of the FS/EA). Inclusion of fish passage upstream of the Corps' Englebright Dam and improvement of fish passage at the Corps' Daguerre Point Dam in this proposed action would restore more of the ecosystem functions in the Yuba River watershed than all of the other actions in the proposal. Historically, salmon and steelhead were present in great abundance upstream of Englebright Dam and the nutrients from salmon carcasses were a very important part of the ecosystem. Since Englebright Dam was constructed, the upper Yuba River ecosystem has had a major	The measure screening process described in Section 3.4.3 of the feasibility report recognizes that Englebright Dam Removal would restore the highest quality and quantity of habitat of all the measures evaluated. The quality and quantity of habitat restored by Daguerre Point Dam Removal were given the second highest ranking, along with Lower Yuba Habitat Restoration. The fish ladder, fish tram, fish bypass, and collect and transport measures at Englebright Dam, and step pools and bypass at Daguerre Point Dam, did not score as high because structural or mechanical fish passage would restore only one component of the aquatic ecosystem and would not restore geomorphic or hydrologic processes or be self-sustaining. Additionally, the USACE National Ecosystem Restoration objective is to reasonably maximize benefits compared to cost. When the costs and cost risks of dam removal and fish passage measures were

Comment	Comment Text	Response
	source of nutrients eliminated from the ecosystem. One study in the northwest identified 13 7 species of animals that utilize the nutrients from salmon carcasses. Numerous other studies have identified that salmon nutrients are taken up by the vegetation along streams, consumed by animals and birds, and contribute to more productive aquatic ecosystems.	weighed against the restoration benefits, those measures did not compare well with Lower Yuba River Habitat Restoration.
GGG-5	In addition to salmon, green sturgeon are impacted by Daguerre Point Dam. Adult green sturgeon have been observed in the Yuba River immediately downstream of Daguerre Point Dam. The fish ladders at Daguerre Point Dam were designed for salmonids and are of a design that green sturgeon are not able to utilize. Daguerre Point Dam is a complete upstream fish passage barrier to ESA listed green sturgeon. NMFS has identified Daguerre Point Dam as having a high threat ranking to green sturgeon and that volitional upstream passage should be provided for green sturgeon at Daguerre Point Dam.	USACE acknowledges that green sturgeon cannot pass Daguerre Point Dam. However, the purpose of the study is not the recovery of individual species.
GGG-6	One of the four planning objectives identified by the FS/EA was to "Improve longitudinal river connectivity", including the blocked and impaired passage of migrating fish. The FS/EA identifies that longitudinal river connectivity including blocked and impaired passage of migrating fish is not being addressed through the actions included in the TSP. Since the Corps has identified through the FS/EA that fish passage at the Corps' dams is "a significant ecosystem problem", NMFS believes that the Corps should include measures in the TSP to address the most significant ecosystem restoration issue in the Yuba River watershed. Fish passage in the Yuba River watershed has been studied and evaluated for over 15 years by multiple government agencies. Further delay in addressing fish passage in the Yuba River delays recovery of ESA listed Central Valley spring-run Chinook salmon and California Central Valley steelhead. As with many other Corps dams which could potentially block salmon and steelhead access to historic habitat, fish passage at the Corps' dams in the Yuba River should be included in the TSP. For these reasons, NMFS believes that instead of further studies as identified in the FS/EA, fish passage measures at the Corps' dams should be included in the actions in TSP at this time.	There is no requirement that the recommended plan must satisfy every objective of the study. Nonetheless, expansion and improvement of aquatic habitats along the Lower Yuba River will improve longitudinal river connectivity by reducing existing gaps between patches of higher quality habitats for migrating fish. The Executive Summary (Section ES.10) of the report specifically recognizes that the blockage of fish passage by existing dams is a significant ecosystem problem that would not be resolved by the recommended plan and could be addressed in a future study. USACE found that currently available information regarding existing fish passage at Daguerre Point Dam (DPD) is not sufficient to demonstrate that any of the fish passage measures at DPD would result in a justified plan for ecosystem restoration. Although existing information indicates that modification of the dam could result in some improvement in fish passage, that information is not sufficient to support the recommendation of a USACE ecosystem restoration project. In particular, there is a lack of information needed to quantify the magnitude of impairment of salmonid passage at DPD. Quantitative information regarding the existing impairment of

Comment	Comment Text	Response
		upstream passage is needed to estimate the potential improvement that could be achieved by measures at the dam.
HHH-1	The California Department of Fish and Wildlife (CDFW) received and reviewed the Draft Interim Feasibility Report/ Environmental Assessment (FR/EA) from U.S. Army Corps of Engineers (USAGE) for the Yuba River Ecosystem Restoration Feasibility Study (Project) in Yuba County pursuant to the requirements of the National Environmental Policy Act (NEPA). Yuba County Water Agency (YCWA) is the non-Federal sponsor for the Project. USACE is the lead agency for the Project and is the lead under NEPA. YCWA, the lead agency under the California Environmental Quality Act (CEQA), is expected to complete a CEQA compliant environmental analysis after Congressional authorization. CDFW appreciates the opportunity to provide comments and recommendations regarding those activities involved in the Project that may affect California fish and wildlife resources. Likewise, we appreciate the opportunity to provide comments regarding those aspects of the Project that CDFW, by law, may need to exercise its own regulatory authority under the Fish and Game Code. CDFW ROLE CDFW is California's Trustee Agency for fish and wildlife resources, and holds those resources in trust by statute for all the people of the State (Fish & G. Code,§§ 711.7, subd. (a) & 1802; Pub. Resources Code,§ 21070; CEQA Guidelines§ 15386, subd. (a)). CDFW, in its trustee capacity, has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species (Id.,§ 1802.). Similarly, for purposes of CEQA, CDFW provides, as available, biological expertise during public agency environmental review efforts, focusing specifically on projects and related activities that have the potential to adversely affect fish and wildlife resources. CDFW may also act as a Responsible Agency under CEQA (Pub. Resources Code, § 21069; CEQA Guidelines, § 15381.). The Project may be subject to CDFW's lake and streambed alteration regulatory authority (Fish & G. Code, § 1600 et seq.). Likewise, to the extent implementation of the Project as proposed may result in "take", as	Comment noted.

Comment	Comment Text	Response
	defined in Fish and Game Code section 86, of any species protected under the California Endangered Species Act (CESA) (Fish & G. Code, § 2050 et seq.), related authorization as provided by the Fish and Game Code will be required. CDFW also administers the Native Plant Protection Act, Natural Community Conservation Program, and other provisions of the Fish and Game Code that afford protection to California's fish and wildlife resources. PROJECT DESCRIPTION SUMMARY The Project site is located on the lower Yuba River, below Englebright Dam to the confluence with the Feather River in the County of Yuba. The purpose of the Project is to improve degraded ecosystem form, functions, and processes in the Yuba River watershed including the quality, quantity, and connectivity of aquatic and riparian habitats. The feasibility study seeks to identify Project alternatives that address the following considerations to the extent practicable: 1) do not increase flood risk or reduce flood management capabilities, 2) do not have a significant negative effect on Endangered Species Act (ESA)-listed species or impair existing habitat for listed species in the future, 3) avoid or minimize, where practicable, providing upstream passage for nonnative fish, 4) avoid or minimize adverse effects on the downstream water users' diversions at Daguerre Point Dam, 5) avoid or minimize, where practicable, adverse effects to groundwater recharge, 6) avoid or minimize, where practicable, impeding green sturgeon recovery efforts, and 7) avoid or minimize, where practicable, impeding public access or recreational opportunities as currently allowed. USACE used four planning criteria: completeness, effectiveness, efficiency, and acceptability, to formulate, screen, evaluate, and compare measures and alternative plans. The four general types of initial measures that were developed were: 1) riverine habitat restoration, 2) connectivity at Daguerre Point Dam (DPD), 3) connectivity at Englebright Dam, and 4) connectivity at New Bullards Bar Dam. Measures and plans that passed the screening criteria were evaluated and compared against more specific evaluation criteria. Evaluation criteria included costs, outputs, or effects and reflect the planning objectives or constraints. Based on screening results, only habitat restoration was carried forward for a more detailed evaluation. USACE formulated a final array of alternatives for habitat restoration and the National Environmental	

Comment	Comment Text	Response
	Restoration (NER) plan (Alternative 5) was identified as the plan that reasonably maximizes ecosystem restoration benefits in the Yuba River watershed relative to costs, restoring about 178.6 acres at an estimated cost of $96. 76 million. The NER plan has been designated as the Tentatively Selected Plan (TSP) in accordance with the USACE objective for ecosystem restoration. The principal features of the TSP include restoration of approximately 43 acres of aquatic habitat including side channels, backwater areas, bank scallops, and channel stabilization. The TSP also includes about 136 acres of riparian habitat restoration consisting of floodplain lowering and grading and riparian vegetation plantings, which will increase the quantity and quality of riparian habitat in the river corridor.	
HHH-2	CDFW appreciates the extensive review conducted as part of this draft FR/EA but is concerned with the screening criteria and subjective quantification of ecosystem restoration benefits utilized to evaluate potential ecosystem restoration measures and ultimately select the TSP as the preferred Project alternative. Given the long history of anthropogenic impacts to the Yuba River watershed, habitat restoration in the lower Yuba River is essential to improve ecosystem function. CDFW believes other restoration measures exist that may provide a larger-scale and longer-term benefit to the ecosystem than the preferred Project alternative. The TSP would not resolve some significant issues impairing the ecosystem such as blocked and impaired fish passage and altered hydrologic and sediment transport regimes caused by existing dams. These issues could be largely resolved by improving longitudinal river connectivity at these facilities, specifically DPD. As DPD primarily serves as a debris dam, it disrupts natural hydrology and fluvial geomorphic processes in the Yuba River upstream and downstream of the dam. The FR/EA suggests that dam modification and fish passage measures at DPD did not pass the screening criteria and were not selected for more detailed evaluation. CDFW believes if dam modifications were better developed, they would likely rank the same as, or better than the habitat restoration measure in benefits to the ecosystem.	USACE appreciates CDFW's confirmation that habitat restoration in the lower Yuba River, which is USACE's recommended plan, is essential to improve ecosystem function. The Executive Summary (Section ES.10) of the report specifically recognizes that the blockage of fish passage by existing dams is a significant ecosystem problem that would not be resolved by the recommended plan and could be addressed in a future study. USACE's National Ecosystem Restoration objective is to maximize restoration benefits relative to costs. Consequently, USACE must consider costs and cost risks, as well as ecosystem benefits, when selecting a plan for recommendation to Congress. As a result, some measures that would provide similar or even greater benefits than Lower Yuba Habitat Restoration were screened out from detailed evaluation. The measures screening process shown in Table 3-4 of the feasibility report gave high scores to DPD Removal for restoration of hydrologic character and geomorphic character, but the other DPD measures evaluated would not provide the same benefits. USACE planning policy requires the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. Extensive study of every measure is not possible under the time and funding limits on planning studies mandated by Congress in Section 1001 of the Water Resources Reform and Development Act of 2014. Those restrictions necessitate

Comment	Comment Text	Response
		an increased reliance on existing information and professional judgment.
HHH-3	DPD was constructed in 1906 and diversion of the river over the dam began in 1910. Crude fish ladders were constructed in 1911, destroyed in 1927-28 and rebuilt in 1938, destroyed again in 1950 and rebuilt in 1965 (CDWR and USACE 2003). The fish ladders were constructed to allow salmon (Oncorhynchus tshawytscha) and steelhead (Oncorhynchus mykiss) to pass over the dam, however these ladders are still a significant impediment for salmon and steelhead and do not allow for upstream passage of all species or lifestages of fish, including green sturgeon (Acipenser medirostris), an ESA listed threatened species and State species of special concern, and white sturgeon (Acipenser transmontanus), a State species of special concern. According to National Marine Fisheries Service (NMFS) (2012 and 2014), the DPD fish ladders do not meet modern fish passage design standards, and are not effective in passing all species over a full range of flows. Additionally, water volumes and velocities in the ladders must be actively adjusted as flows in the Yuba River change in order to insure optimal passage conditions and attraction flows. Downstream passage at the DPD subjects fish to abrasion, scale loss, and disorientation, which likely causes juvenile fish to be subject to higher rates of mortality and predation (CDFW and USACE 2003). Additionally, the design of DPD creates a deep plunge pool below the dam that harbors predatory fish species, including striped bass (Marone saxatilis) and Sacramento pikeminnow (Ptychocheilus grandis), which likely reduces juvenile salmonid survival during outmigration. Per section 5901 of the Fish and Game Code, it is unlawful to construct or maintain in any stream, any device or contrivance that prevents, impedes, or tends to prevent or impede, the passing of fish up and downstream. Fish and Game Code section 5937 requires the owner of any dam to allow sufficient water at all times to pass through a fishway, to keep in good condition any fish that may be planted or exist	Comments noted. USACE found that currently available information regarding existing fish passage at Daguerre Point Dam (DPD) is not sufficient to demonstrate that any fish passage measure at DPD would result in a justified plan for ecosystem restoration. Although existing information indicates that modification of the dam could result in some improvement in fish passage, that information is not sufficient to support the recommendation of a USACE ecosystem restoration project. In particular, there is a lack of information needed to quantify the magnitude of impairment of salmonid passage at DPD. Quantitative information regarding the existing impairment of upstream passage is needed to estimate the potential improvement that could be achieved by measures at the dam. Dam modification and fish passage improvement measures were considered as initial measures in the feasibility study, but were screened out from detailed evaluation based upon the information currently available.

Comment	Comment Text	Response
	below the dam. CDFW believes fish passage should be made available to all species and life stages of fish above and below DPD over a full range of flows in the lower Yuba River and further recommends that USACE give higher priority to longitudinal river connectivity at DPD in the development and evaluation of measures. Specifically, USACE should evaluate dam modification and fish passage improvement measures at DPD. DPD is owned and operated by USACE and is therefore uniquely situated to address the ongoing impacts to the Yuba River ecosystem caused by their own facility. While the recommendations in the FR/EA do not preclude another party from altering DPD, other parties within the watershed would need to gain permission from the USACE to alter DPD. Several other parties are currently implementing or plan to implement habitat restoration work in the river above and below DPD, including the United States Fish and Wildlife Service (USFWS) Anadromous Fish Restoration Program, Yuba County Water Agency (YCWA), and non-governmental organizations (NGOs). In addition, USACE has an existing program to augment spawning gravel in the Yuba River below Englebright Dam. Modification of DPD would improve access for fish to this upstream habitat and as a consequence, juvenile production from this area and thereby expanding the ecosystem benefit already being provided. The FR/EA states that the purpose of this feasibility study is to develop an implementable and acceptable plan to change the future condition and address specific water and related land resources problems and opportunities in the Yuba River watershed. CDFW believes modifications to DPD would achieve the purpose of the Project while complementing current and future habitat restoration activities.	
HHH-4	In the FR/EA, the screening criteria for ecosystem restoration Project measures utilized by the USA CE were based on "efficiency (cost, habitat quantity, and habitat quality) and risk to efficiency." However, in order to adequately characterize the true benefits for long-term restoration in the Yuba River, screening criteria should include further	The USACE National Ecosystem Restoration objective is to reasonably maximize benefits relative to costs. The cost of the recommended plan must be reasonable and justified. The criteria used to screen measures were developed to allow a consistent set of criteria to be applied to all measures and also inform the NER

Comment	Comment Text	Response
	criteria such as likelihood of being funded by others, the longevity and success of the Project achieving ecosystem restoration processes and the need to address ongoing problems in the watershed. CDFW offers the following comments on the screening criteria. Ultimately, CDFW believes the screening criteria and selection of Project measures should be weighted more heavily on the ecosystem benefits to the Yuba River and to a lesser extent the cost of implementing those measures.	objective. Implementation risks and sustainability were considered in the screening of measures. The study objectives, which were used to formulate and screen measures, were based on the ecosystem problems identified in the watershed.
HHH-5	Habitat restoration projects as described in the TSP are considered by CDFW to be of high importance to restoring functioning habitat in the Yuba River. However, as mentioned above, these restoration projects all have a high likelihood of being funded and implemented by other parties, such as USFWS, YCWA, and NGOs. The potential for this same work to be completed by another party is not considered or weighted in the current screening criteria. CDFW recommends this be considered and included when analyzing the habitat restoration measure in the efficiency criteria under the "quality of significance of habitat restored" and then "habitat scarcity" ranking criteria.	Under USACE planning policy, the likelihood of a measure being funded by other entities would not be an appropriate criterion for screening measures because it would result in the exclusion of the most beneficial and cost-effective solutions. However, measures that have already been funded were included in the future without-project conditions and were thereby excluded from further consideration in this study. Degradation of ecosystem structure, function, and process on the Lower Yuba River is severe and warrants the restoration efforts of multiple agencies. USACE gives priority to restoration in areas that have multi-agency participation.
HHH-6	Given that environmental changes, such as scouring and changes in river course caused by high flows, that occur in the Yuba River may impact the permanence of restoration projects, it would be more prudent for USACE to address modifications to existing dam facilities for this Project that are not compliant for fish passage (e.g. DPD) in the lower Yuba River. The longevity of conventional habitat restoration would have a much shorter life span than modifications to DPD. For example, a single high spring flow event could eliminate implemented habitat restoration activities in a matter of minutes, but would not affect river connectivity provided by the removal of DPD. Appropriate modifications to DPD could provide perpetual benefits to multiple species and life stages of fish, restore connectivity, and return natural riverine processes to this section of the river.	The sustainability of recommended plan's intended benefits has been an important consideration during feasibility level design of the plan. Additional analysis of the risks to project sustainability from high flow events has been included in the Engineering Appendix. The excavation of aggraded portions of the river channel and floodplain are expected to be durable and sustainable. Should flood events damage a stand of vegetation, it is expected that reduced depth to groundwater, source seed availability, and improved substrate conditions will encourage appropriate seed dispersal, germination, and establishment of new growth. Additionally, disruptions from flood events will create new age classes within the vegetation stands, creating natural variability in composition, structure, and function. Natural disruptions and regeneration of vegetation are a component of dynamic ecosystem processes and evidence of a self-sustaining project. A Monitoring and Adaptive Management Plan (MAMP) is included in this report. The non-Federal sponsor will also be required to operate, maintain, repair, rehabilitate, and replace project features as needed to provide the intended restoration benefits for a period of ten years after the ecological success criteria in the MAMP have been met.

Comment	Comment Text	Response
		Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
HHH-7	It is unclear how or if staffing and equipment costs associated with actively managing flows through the ladder as well as maintenance of the ladders and debris removal were factor into ranking process. CDFW recommends the longevity and success of achieving habitat restoration processes versus permanent modifications to existing dam structures be considered and included when analyzing the connectivity at DPD measure in the efficiency criteria under the "quality of significance of habitat restored" and then "geomorphic condition" and "self-sustaining" ranking criteria. CDFW believes habitat restoration measures should score lower than permanent in-river structure modifications that facilitate more sustainable long-term ecosystem restoration processes.	Staffing and equipment costs associated with existing fish passage at Daguerre Point Dam would continue under all management measure scenarios except for dam removal. The savings in existing operation and maintenance costs at the dam would not be significant in comparison to the much higher dam removal costs. See previous response regarding sustainability.
HHH-8	As described above, risks associated with the longevity of conventional habitat restoration projects are high. Additional funding would need to be allocated for longterm maintenance of any habitat restoration projects that may be impacted by high flows in the lower Yuba River. Some funding is included in the FR/EA, but the report does not indicate how much money would truly be allocated for repairs or reimplementation of habitat restoration measures. CDFW recommends that consideration of a long-term habitat restoration maintenance agreement be included and analyzed in the "cost risks" ranking criteria.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments. A Monitoring and Adaptive Management Plan (MAMP) is included in this report. The non-Federal sponsor will be required by the Project Partnership Agreement to operate, maintain, repair, rehabilitate, and replace (OMRR&R) project features as needed to provide the intended restoration benefits for a period of ten years after the ecological success criteria in the MAMP have been met. Estimated costs for the MAMP and OMRR&R are included in this report.
HHH-9	The FR/EA states that the fish ladders at DPD do not meet modern fish passage design standards, and are not effective in passing all species over a full range of flows. Table 3-1 of the report omits any restoration measures as to how to address the outdated and ineffective fish ladders on DPD. As described above, better developing measures to improve the fish passage at DPD should have been prioritized and evaluated as an alternative to address the Yuba River's degraded ecosystem since the USACE is responsible for operation and maintenance of the dam. The	As described in Section 3.4.2.1 in the FR/EA, improvements to the existing fish ladders at Daguerre Point Dam were not considered in detail because this measure does not provide improved downstream passage for juveniles. The greatest advantage this measure offers to upstream fish passage is the substantial increase in attraction flow at the proposed fish ladder entry across a broad range of flows. Additionally, please refer to the response to comment III-3.

Comment	Comment Text	Response
	NMFS has determined that the ladders do not meet criteria for fish passage and that, though fish may pass DPD, there is substantial delays in migration with ESA-listed fish often holding in unsuitable water temperatures. CDFW agrees with this determination. The FR/EA characterizes all habitat upstream of DPD as useable, but does not take into account when it is not available to various species and life stages of fish due to significant delays in migration timing or blockage caused by the dam. For these reasons, CDFW recommends that measures related to modification of the facilities at DPD be weighted higher (or the highest) in the "connectivity" ranking.	
HHH-10	USACE utilized the potential for mercury contamination as a driver when ranking the overall efficiency of ecosystem restoration measures. The DPD removal measure received an efficiency ranking of low-medium (versus very high for the habitat restoration measure) in part due to this driver. CDFW is concerned this driver may have skewed the overall efficiency ranking of DPD removal as an ecosystem restoration measure and plays a major role in why habitat restoration prevailed as the top ecosystem restoration measure. Much uncertainty exists as to the actual concentrations of mercury and overall toxicity of sediments trapped behind DPD. Additionally, the FR/EA does not include recent samples or literature verifying the presence of mercury and other toxins in sediments behind DPD. Thus, CDFW believes it is inappropriate for USACE to determine the efficiency ranking of the DPD removal measure based on an assumption of high potential for mercury contamination and recommends USACE instead calculate the efficiency ranking based on a range of potential mercury contamination (i.e., none, low, medium, and high).	The cost estimate for DPD removal used in the Efficiency ranking did not assume any added cost for sediment disposal due to mercury contamination. Potential added costs due to mercury contamination were explicitly considered in the screening process as a cost risk factor separate from the Efficiency ranking. Changing or removing that cost risk factor would not change the results of the screening process.
HHH-11	CDFW requests written notification of proposed actions and pending decisions regarding the proposed Project. Written notifications should be directed to: California Department of Fish and Wildlife, North Central Region, 1701 Nimbus Road, Rancho Cordova, CA 95670. CDFW appreciates the opportunity to comment on the Draft Interim FR/EA. CDFW personnel are available for consultation regarding biological resources and strategies to minimize impacts. CDFW staff recommend USACE form a multi-agency, interdisciplinary technical working group to help identify and screen measures to determine which alternatives may provide the best ecosystem benefits. Because of the	USACE will notify CDFW when the final report is available for State and Agency Review. The time and funding constraints for the planning phase of the study did not allow the formation of a multi-agency technical working group or interagency steering committee.

Comment	Comment Text	Response
	poor fish passage conditions at DPD, CDFW also recommends the USACE help establish an interagency steering committee to evaluate near-term fish passage improvement options and to also become better coordinated with long-term fish passage and salmon reintroduction efforts in the Yuba watershed, a more fulfilling ecosystem restoration objective.	
III-1	Cover Letter- Yuba County Water Agency ("YCWA") has reviewed the above-referenced draft report, which the U.S. Army Corps of Engineers ("Corps") made available for public review on January 4, 2018. YCWA's comments are enclosed. YCWA continues to support the Yuba River Ecosystem Restoration Feasibility Study, as evidenced by YCWA agreeing to serve as the non-Federal study sponsor (Feasibility Cost Share Agreement dated July 2, 2015; as amended July 31, 2017), and YCWA's continued cost-share payments and constructive work to support the Corps in the study's development.	Comment noted.
III-2	YCWA has spent decades studying and implementing habitat enhancement measures on the lower Yuba River, most-recently through the Yuba Accord's River Management Team science program, and the FERC process for the relicensing of the Yuba River Development Project. The Corps' draft report presents information that is different in material respects from information developed by YCWA during the FERC process for the relicensing of the Yuba River Development Project, as well as for other sensitive ongoing proceedings. YCWA recognizes that the Corps is constrained by regulations and planning policies requiring that certain approaches and tools be used that may result in a different interpretation of resource issues and potential solutions. YCWA's comments on the Corps' draft report are provided to attempt to reconcile some of these differences and to clarify YCWA's position on the administrative record in this and various other processes.	Comment noted. The information presented in USACE's report is intended to support USACE's planning and decision-making processes for this feasibility study. It is not intended to supersede information developed by YCWA or other entities for other purposes.
III-3	YCWA previously provided the Corps with technical input and comments for the interim feasibility study, including: (1) problems and opportunities; (2) project objectives; (3) identification and · screening	Comment noted.

Comment	Comment Text	Response
	of proposed aquatic habitat enhancement measures; (4) development of alternatives; and (5) methodological considerations associated with the evaluation of proposed aquatic habitat enhancement measures and formulation of alternatives.	
III-4	During the past two years, YCWA also brought to the Corps' attention several concerns that YCWA had (and still has) about the recommended alternatives arising from this study. One of our primary concerns has been the lack of any fisheries-passage alternatives. The interim feasibility study is one of only four Corps ecosystem restoration project studies authorized in 2014, and the Congressional authorization to initiate the study specifically referred to fish passage. (See "Yuba River Fish Passage, CA (Englebright & Daguerre Point Dams), CA" in the Energy and Water Development Appropriations Act of 2014, Division D, P.L. 113-76.) Moreover, many of more than 200 public comments submitted during the public scoping process expressed concerns that fish passage is one of the primary ecological problems facing the Yuba River. Despite these concerns and comments, however, the draft interim feasibility study report does not adequately address this issue.	The study considered a wide range of fish passage measures at Englebright and Daguerre Point dams. USACE found that fish passage measures for Englebright Dam had low efficiency and high risks. USACE also found that currently available information regarding existing fish passage at Daguerre Point Dam (DPD) is not sufficient to demonstrate that any of the fish passage measures would result in a justified plan for ecosystem restoration. Although existing information indicates that modification of the dam could result in some improvement in fish passage, that information is not sufficient to support the recommendation of a USACE ecosystem restoration project. In particular, there is a lack of information needed to quantify the magnitude of impairment of salmonid passage at DPD. Quantitative information regarding the existing impairment of upstream passage is needed to estimate the potential improvement that could be achieved by measures at the dam. The level of analysis in the feasibility report is consistent with USACE policy for this type of study and with the study's time and funding constraints.
III-5	YCWA's attached comments on the draft interim feasibility study report are technical in nature and reflect decades of experience studying and implementing lower Yuba River habitat enhancement measures. We know that the Corps, YCWA and numerous other stakeholders share an interest that the habitat enhancement measures that go forward as part of the Yuba River Ecosystem Restoration Project are developed based on the best-available science, reflect cost-effective expenditures of public dollars, and are sustainable in the dynamic Yuba River watershed. Our comments are primarily directed at this common interest. YCWA looks forward to continuing to work with the Corps on this important project. YCWA's support for the interim feasibility study, commitment to working collaboratively with the Corps, and desire to see that this study goes forward, are unwavering. Please do not infer the contrary from YCWA's comments.	Comment noted. USACE acknowledges YCWA's unwavering support for the study.

Comment	Comment Text	Response
III-6	General Comments- The Yuba County Water Agency (YCWA) continues to support environmental stewardship in the lower Yuba River and the Yuba River Basin. YCWA also continues to support the Yuba River Ecosystem Restoration Feasibility Study (YRERFS), as evidenced by YCWA agreeing to serve as the non-Federal study sponsor (Feasibility Cost Share Agreement dated July 2, 2015; as amended July 31, 2017), and YCWA's continued cost-share payments and constructive work to suppr1t the U. S. Army Corps of Engineers (Corps) in the study's development.	Comment noted.
III-7	To assist the Corps in developing a comprehensive and defensible Draft Interim Feasibility Report and Environmental Assessment (EA) over the past two-year period during which the Corps' Draft Interim Feasibility Report and EA was developed, YCWA provided the Corps with technical input and comments regarding several aspects of the project, including: (1) problems and oppo1tunities; (2) project objectives; (3) identification and screening of proposed aquatic habitat enhancement measures; (4) development of alternatives; and (5) methodological considerations associated with the evaluation of proposed aquatic habitat enhancement measures and formulation of alternatives. Attachment 1 to these comments contains copies of: (a) YCWA's August 2, 2017 comments on the Corps' "Screening of Measures" document; (b) YCWA's August 11, 2017 comments on the Corps' Habitat Evaluation Assessment Approach Technical Memorandum; (c) YCWA's October 2016 Modeled Flow Considerations Technical Memorandum; and (d) YCWA's February 3, 2017 updated "effective habitat approach" document.	Comment noted. USACE has carefully considered YCWA's input throughout the study and has incorporated YCWA's information and recommendations whenever appropriate under USACE policies and study constraints.
III-8	During the past two years, YCWA also brought to the Corps' attention several concerns that YCWA had (and still has) about the recommended alternatives arising from this study. One of our primary concerns has been the lack of any fisheries-passage alternatives. The interim feasibility study is one of only four Corps ecosystem restoration project studies authorized in 2014, and the Congressional authorization to initiate the study specifically referred to fish passage. (See "Yuba River Fish Passage, CA (Englebright & Daguerre Point Dams), CA" in the Energy and Water Development Appropriations Act	See response to Comment III-4

Comment	Comment Text	Response
	of 2014, Division D, P.L. 113-76.) Moreover, many of more than 200 public comments submitted during the public scoping process expressed concerns that fish passage is one of the primary ecological problems facing the Yuba River. However, despite these concerns, this issue is not adequately addressed in the Corps' draft Tentatively Selected Plan (TSP). General comments pertaining to the Corps' Draft Interim Feasibility Report and EA are provided below, by subject matter.	
III-9	SUSTAINABILITY OF PROPOSED HABITAT ENHANCEMENT MEASURES YCWA previously expressed its concerns regarding the sustainability of proposed habitat enhancement measures to the Corps on numerous occasions, including in YCWA's October 3, 2017 e-mail to Colonel Ray and draft letter, and YCWA's October 3, 2017 follow-up e-mail (copies in Attachment 2). YCWA's draft letter asked how the Corps will provide assurances regarding the sustainability of the actions proposed to be implemented by the draft TSP through future high water events and YCWA's follow-up e-mail emphasized these concerns. The Corps has not responded to YCWA regarding these concerns. YCWA is re-iterating its concerns about sustainability of the Corps' proposed habitat enhancement measures in these comments, because YCWA continues to believe that these are important issues that require more thorough consideration by the Corps. The screening criteria on page 39 of the Corps' 2018 Draft Interim Feasibility Report and EA includes rankings for "self-sustaining", which are intended to represent the extent to which the measures would restore a self-sustaining ecosystem. On page 161, the draft report states "The proposed habitat restoration is a sustainable solution", but no evidence is provided to suppo1t this statement. The high flows that occurred during the winter of 2017 changed the channel alignment and configuration throughout much of the lower Yuba River. In consideration of these high flows that occurred during the winter of 2017, a visual comparison of the Corps' proposed habitat enhancement site locations is provided below. The Corps' "Habitat Increment I" taken from page 49 of the Draft Interim Feasibility Repo1t and EA is shown in the figure immediately below. The Highway 20 Bridge is in the far left part of this figure.	Under USACE's risk-informed decision-making process, a plan is tentatively selected for the draft report based on the level of analysis necessary to support that decision. Subsequent to the draft report, feasibility-level design for the recommended plan has included additional analysis of sustainability and resiliency for the final feasibility report. The additional analysis has included consideration of the effects of the 2017 high flows and further evaluation of estimated OMRR&R costs. USACE and YCWA have also discussed YCWA's concerns during several meetings. Further design analysis of sustainability and resiliency will occur during the preconstruction engineering and design phase. Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	[figure 3-3] The figure below on the left shows the location of the westernmost component (just upstream of the Highway 20 Bridge) of "Habitat Increment 1" in April 2015 and the figure below on the right shows the location identified for "Habitat Increment 1" in May 201 7. [comparison of Lower Yuba River near Hwy 20 Bridge during April 2017 and May 2017] As shown in the right figure above, the high flows that occurred during the winter of 2017 significantly altered the planform geometry (i.e., the "shape" of the lower Yuba River in this area). Consequently, if Habitat Increment 1 had been implemented before the winter of 2017, it would not have been sustained after the high flow conditions that occurred that winter. Text on page 167 of the draft report states "As the study progresses into feasibility level design, sustainability and resiliency will continue to drive design criteria, with a goal of maximizing performance and durability in a highly variable system." Because the public review draft document did not consider the effects of the changes in the Yuba River channel that occurred during the 2017 high river flows, it is questionable whether concerns about sustainability and resiliency actually have driven project design to date. In fact, it does not appear that such concerns have been considered at all. At a minimum, the proposed habitat measures described in the Corps' Draft Interim Feasibility Repo1t and EA should be reevaluated considering the lower Yuba River channel re-alignments and re-configurations that occurred during 2017. It seems clear that the sustainability of habitat measures would significantly affect the cost of operation, maintenance, repair, replacement and rehabilitation pf enhancement measures (discussed below).	
III-10	OPERATION, MAINTENANCE, REPAIR, REPLACEMENT, AND REHABILITATION (OMRR&R) • As acknowledged on pg. C-33 and C-34 of Appendix C (Engineering), "ecosystem restoration ... incurs risk due to infrequent ... high flow events that could cause significant geomorphologic change	See previous response. USACE has given YCWA the opportunity to participate in the development of the feasibility-level design for the final feasibility report. YCWA has also participated in the development of the Monitoring and Adaptive Management Plan. The OMRR&R manual will be prepared in consultation with YCWA, as

Comment	Comment Text	Response
	and damage the restoration features. These risks are mitigated through monitoring and adaptive management and Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R)." • Pages 163-164 of the Corps' Draft Interim Feasibility Report and EA state "The non-Federal sponsor will need to periodically inspect the project to prevent encroachments or other damage caused by human activities and to determine whether any repair, replacement, or rehabilitation of project features is needed ... Repair, Replacement and Rehabilitation actions are to conform to the project as-built plans and specifications unless other arrangements are made ~with the district commander." • Page 164 of the Corps' Draft Interim Feasibility Report and EA states "A final OMRR&R manual would be prepared after the completion of construction and provided to the non-Federal sponsor." • Page 168-"Section 1161 of the WRDA 2016 states that the responsibility of a non-Federal interest for operation and maintenance of the nonstructural and non-mechanical elements of a project, or a component of a project, for ecosystem restoration shall cease 10 years after the date on which the Secretary of the Army determines the criteria for ecosystem restoration success have been met." • Page 14 of Environmental Appendix D, Attachment 6 - Feasibility-Level Monitoring and Adaptive Management Plan states that "If success criteria are not met after initial monitoring, the monitoring activities would continue until success criteria are met and would be cost shared for up to ten years following construction. If monitoring is required beyond 10 years, costs would be the sole responsibility of the non-Federal sponsor. Costs associated with the maximum cost-shared amount of monitoring (i.e., up to 10 years) would be $1,238,400." Comments YCWA has repeatedly expressed its concerns about OMRR&R issues and the associated potential YCWA responsibilities to the Corps, and YCWA has requested that the Corps and YCWA have additional discussions regarding sustainability and persistence of proposed habitat enhancement measures. However, the Corps has indicated that such matters will be deferred until the design phase of the project. Given the	the non-Federal sponsor, as required by USACE regulation. Section 103 of the Water Resources Development Act of 1986, as amended, requires the non-Federal sponsor for an ecosystem restoration project to accept responsibility for 100 percent of the OMRR&R costs of the project. USACE does not have the authority to modify that requirement.

Comment	Comment Text	Response
	potential operational and financial liabilities associated with such issues and responsibilities, YCWA reiterates its request that the Corps initiate discussions with YCWA regarding these issues as soon as possible. To be clear, it is not acceptable to YCWA to be assigned an open-ended financial responsibility for OMRR&R of the proposed habitat enhancement measures. Such a proposal would be well-beyond the appropriate scope of the duties of a non-Federal sponsor for a program of this type. Even if YCWA agreed to assume some level of responsibility for maintenance, repair, replacement and rehabilitation activities associated with the proposed habitat enhancement measures, it would not be appropriate for the Corps to propose to simply "provide a final OMRR&R manual to the non-Federal sponsor". Instead, the Corps should work directly with YCWA to collaboratively develop a mutually-agreeable plan.	
III-11	DAGUERRE POINT DAM FISH PASSAGE ISSUES YCWA is seeking to support the Corps' efforts to complete the feasibility study in 2019, which would be followed by the issuance of a Report of the Chief of Engineers recommending Congressional authorization of a project or a series of actions to restore the Yuba River ecosystem. However, the Draft Interim Feasibility Report and EA indicates that the National Ecosystem Restoration (NER) Plan (i.e., Alternative 5 comprised of habitat increments 2, 3a, Sa and Sb) would consist only of habitat enhancement measures within the lower Yuba River, downstream of the Highway 20 Bridge. Although these habitat enhancement measures would contribute to the enhancement of the Yuba River ecosystem, they would not address the historical loss of longitudinal habitat connectivity for anadromous fish species (Chinook salmon and steelhead). On the other hand, passage improvements at Daguerre Point Dam, in the form of a step pool alternative, would immediately benefit fish species by providing them opportunities to volitionally swim up and over the dam to upstream spawning habitats. Such improvements also would provide safe passage for listed juvenile salmon ids downstream over the dam, which is currently considered to be a predation and mortality "hotspot." Moreover, besides providing direct benefits to fish	See response to Comment JJJ-4. Although the recommended plan would not improve fish passage past existing dams, the recommended plan would improve aquatic and riparian habitats in the lower river corridor, which will improve longitudinal connectivity between aquatic and riparian habitat patches along the corridor. Public safety is always USACE's highest priority when planning a new project. To be recommended to Congress for authorization, a proposed project must satisfy specific requirements associated with an authorized USACE mission, in addition to meeting general requirements including the protection of public safety. This study seeks to recommend authorization of a new project for ecosystem restoration. Under USACE policy, the improvement of public safety cannot be the main justification supporting the recommendation of a new ecosystem restoration project. A safety issue at an existing project would be appropriately addressed through the use of funds provided for the operation of that project, rather than by authorization of a new project serving a different purpose. USACE currently uses operations and maintenance funding to maintain warning signs upstream of Daguerre Point Dam, increase public contact during periods of unusually high flows, and issue news releases to increase public awareness of safety at dams.

Comment	Comment Text	Response
	passing Daguerre Point Dam, these improvements also would improve the efficiency of all habitat enhancements implemented upstream of Daguerre Point Dam by providing higher survival rates for the fish that benefit from these improvements. The Daguerre Point Dam Step Pool Alternative also would save human lives by replacing the current 20-foot drop and hydraulic reversal at the bottom of the dam (which has trapped and drowned people who have passed over the dam) with a series of step pools with relatively small drops. Even if the Daguerre Point Dam Step Pool Alternative is not included in the NER, it still should be included in the Corps' final array of alternatives for evaluation in the Report of the Chief of Engineers, given its ecosystem and public safety benefits. This alternative is impo1tant because spring-run Chinook salmon and steelhead are listed as threatened species under the federal Endangered Species Act (ESA), and spring-run Chinook salmon also is listed as a threatened species under the California Endangered Species Act. This alternative also is important because fish passage improvements are strongly supported by local, state and federal agencies, conservation groups and other stakeholders.	Because study resources and time were limited, it was not possible to further analyze in the final array of alternatives the Daguerre Point step pool measure, which was not a candidate for selection based on cost-efficiency and risks relative to the other measures evaluated.
III-12	PROJECT ESTIMATED COSTS The Corps and YCWA are the lead agencies for the YRERFS and share its costs equally. During the construction phase, the cost share would be 65% federal and 35% non-Federal. The non-Federal sponsor (i.e., YCWA) would be solely responsible for many as of yet unspecified costs (e.g., real estate, mineral rights, remediation of toxic materials). The NER plan (Alternative 5) has been identified by the Corps as the plan that would reasonably study apparently range from a low "bin" of 0 to $200 million to an upper amount of over $1,800 million. YCWA has frequently expressed its concerns regarding cost-related issues to the Corps, and has requested that the Corps provide: (1) information regarding the assumptions that the Corps used for cost-estimating purposes; and (2) a clear explanation of how the cost estimates were derived. YCWA requests that the Corps' Draft Interim Feasibility Report and EA be revised to include this supporting information. maximize ecosystem restoration benefits in the lower Yuba River	Comment noted. The Final FR/EA will provide cost estimates at a Class III level per ER 1110-2-1302, which states: Class 3 – Technical information (including designs) are approaching a 10-60% quality of project definition. There is greater confidence in project planning and scope, construction elements and quantity development. The estimates rely less on generic cost book items, greater reliance on quotes, recent historical and site-specific crew based details. Class 3 estimates are a reflection of improved technical documents. The estimates must be supported by a technical information (scope, design, acquisition and construction methods, etc.) discussion within the estimate and the uncertainties associated with each major cost item in the estimate. Special attention must be given to large construction elements and items that are sensitive to technical information change. Typical Contingency Range could be 20% to 50%.

Comment	Comment Text	Response
	relative to costs, restoring about 178.6 acres at an estimated cost of $96. 76 million. Estimated costs for other alternatives in the	
III-13	RANKING FACTORS, RANKINGS AND SCREENING RESULTS Tables 3-2 through 3-6 of the Corps' Draft Interim Feasibility Repo1t and EA list the various ranking factors and rankings that the Corps made during its screening process, and Table 3-7 summarizes the results of this screening process. Unfortunately, the draft report contains almost no information regarding how the Corps determined these ranking factors and rankings. For example, Table 3-2 just lists the cost rankings and ranking factors for the various potential measures, and the draft rep01t does not contain any information regarding the estimated costs of the various potential measures or how these cost rankings and ranking factors were developed. Similarly, Table 3-3 just provides the rankings and ranking factors for the quantity of habitat that would be restored by each potential measure, but the draft report does not list the estimated acres of habitat or any other details regarding these rankings. Moreover, as discussed in the following specific comments, YCWA disagrees with the habitat quantity ranking for the Daguerre Point Dam step pool measure. Table 3-4 provides the rankings of six different quality factors, but the draft report does not explain how any of these rankings were made, and some of them, like the "High" ranking for the Lower Yuba Habitat Restoration measure for "Self-Sustaining" factor, appear to be incorrect (for the reasons discussed above). Table 3-5 contains calculations of the efficiencies of the various measures, using the cost rankings from Table 3-2, the quantity rankings from Table 3-3 and the quality rankings from Table 3-4. Any deficiencies in these rankings therefore are carried forward into the calculated efficiency rankings in Table 3-5. Table 3-6 contains risk rankings for five different risk factors for each of the potential measures, but the draft report does not explain the bases for any of these factors and instead simply states that they are based on "professional judgment." Table 3-7 presents a single factor representing a summary of the subjective efficiencies from Table 3-5, but lists all five of the individual risk factors from Table 3-6. Consequently, risk appears to be weighted five times more heavily than "efficiency". Also, Table 3-7 contains a "Screening Break" and only the	[Additional explanation of the assignment of ranking factors has been added to Chapter 3.] Risk was not weighted five times more heavily than efficiency in Table 3-7. The five risk factors are shown separately to clearly show that Lower Yuba Habitat Restoration had the lowest risk in all five categories. Lower Yuba Habitat Restoration also had the highest efficiency ranking, so there was no trade-off between risk and efficiency in assigning the top ranking to that measure. Risk and efficiency were considered separately and were not weighted relative to each other.

Comment	Comment Text	Response
	Lower Yuba Habitat Restoration measure is above this break. It therefore is the only potential measure that is carried forward for additional analyses in the draft report. Because these rankings, ranking factors, risk factors, and the manner in which they are presented in Table 3-7 are critical to the draft repo1t's conclusion that only the Lower Yuba Habitat Restoration measure should be carried forward for additional analyses, and because YCWA has serious questions regarding how these rankings, ranking factors and risk factors were determined, the draft report needs to be substantially edited to explain the bases for these rankings and ranking and risk factors. As part of this process, the Corps should consider YCWA's comments while reevaluating the rankings, ranking factors and risk factors. YCWA believes that the result of this process will be that the revised report will conclude that the Daguerre Point Dam step pool measure should be carried forward for additional analyses.	
III-14	Specific comments- Page ES-5 - "Longitudinal river connectivity would be increased by improving approximately five river miles of aquatic habitat, improving refuge, rearing, and food production options for migrating fish along the lower Yuba River." Comment YCWA does not agree with this statement. The Draft Interim Feasibility Report and EA (p. 22) states: "Critical components of connectivity include the longitudinal, or downstream, movement of water and sediment, and the upstream movement of anadromous fish and the oceanic nutrients they provide." Longitudinal river connectivity therefore would be increased through fish passage improvements, not through habitat enhancement measures.	Comment Noted. Expansion and improvement of aquatic habitats along the Lower Yuba River will improve longitudinal river connectivity by reducing existing gaps between patches of higher quality habitats for migrating fish. USACE recognizes that Lower Yuba River Habitat Restoration will provide less of an improvement in longitudinal river connectivity than some of the other measures considered.
III-15	Page ES-8 - Under the heading "Unresolved Issue", the text states "A significant ecosystem problem that was considered in this study would not be resolved by the TSP. Specifically, the TSP would not resolve the problem of blocked and impaired fish passage ... " Comment	Comment noted. USACE has considered YCWA's concerns regarding fish passage at Daguerre Point Dam throughout the feasibility study and expended substantial effort in evaluating fish passage measures at the dam as part of the study. See response to Comment III-4.

Comment	Comment Text	Response
	On several occasions throughout the course of the feasibility study, YCWA expressed its concerns to the Corps regarding fish-passage issues, particularly those associated with upstream and downstream passage at Daguerre Point Dam. Because YCWA believed so strongly that the Corps should consider these impo1tant issues, YCWA submitted a letter to the Corps on August 8, 2017, which encouraged the Corps to include the "Daguerre Point Dam Step Pool Alternative" in the Yuba River Ecosystem Restoration Feasibility study, Report of the Chief of Engineers to Congress. The Corps never responded to YCWA's August 8, 2017 letter, despite several subsequent inquires by YCWA including a follow-up e-mail and draft letter dated October 3, 2017. YCWA is re-submitting its August 8, 2017 letter and its October 3, 2017 e-mail and draft letter to the Corps with these comments (see Attachment 2) because YCWA continues to believe that the fish-passage issues at Daguerre Point Dam are very important, and YCWA continues to strongly encourage the Corps to include the Daguerre Point Dam Step Pool Alternative in the Final Report of the Chief of Engineers to Congress.	
III-16	SPECIFIC COMMENTS Specific comments pertaining to the Corps' Draft Interim Feasibility Report and EA are provided below, and are organized by topic and in chronological order as they appear in the document. EXECUTIVE SUMMARY • Page ES-5 - "Longitudinal river connectivity would be increased by improving approximately five river miles of aquatic habitat, improving refuge, rearing, and food production options for migrating fish along the lower Yuba River." Comment YCWA does not agree with this statement. The Draft Interim Feasibility Report and EA (p. 22) states: "Critical components of connectivity include the longitudinal, or downstream, movement of water and sediment, and the upstream movement of anadromous fish and the oceanic nutrients they provide." Longitudinal river connectivity therefore would be increased through fish passage improvements, not through habitat enhancement measures.	The study's longitudinal river connectivity objective includes the movement of fish, water, sediment, and ocean nutrients. Expansion and improvement of aquatic habitats along the Lower Yuba River will contribute to improved longitudinal river connectivity by reducing existing gaps between patches of higher quality habitats for migrating fish. USACE recognizes that Lower Yuba River Habitat Restoration will provide less of an improvement in longitudinal river connectivity than some of the other measures considered.

Comment	Comment Text	Response
III-17	Page ES-8 - Under the heading "Unresolved Issue", the text states "A significant ecosystem problem that was considered in this study would not be resolved by the TSP. Specifically, the TSP would not resolve the problem of blocked and impaired fish passage ... " Comment o On several occasions throughout the course of the feasibility study, YCWA expressed its concerns to the Corps regarding fish-passage issues, particularly those associated with upstream and downstream passage at Daguerre Point Dam. Because YCWA believed so strongly that the Corps should consider these important issues, YCWA submitted a letter to the Corps on August 8, 2017, which encouraged the Corps to include the "Daguerre Point Dam Step Pool Alternative" in the Yuba River Ecosystem Restoration Feasibility Study, Report of the Chief of Engineers to Congress. The Corps never responded to YCWA's August 8, 2017 letter, despite several subsequent inquires by YCWA including a follow-up e-mail and draft letter dated October 3, 2017. YCWA is re-submitting its August 8, 2017 letter and its October 3, 2017 e-mail and draft letter to the Corps with these comments (see Attachment 2) because YCWA continues to believe that the fish-passage issues at Daguerre Point Dam are very important, and YCWA continues to strongly encourage the Corps to include the Daguerre Point Dam Step Pool Alternative in the Final Report of the Chief of Engineers to Congress.	Comment noted.
III-18	Page ES-8 - Under the heading "Unresolved Issue", the text states "A significant ecosystem problem that was considered in this study would not be resolved by the TSP. Specifically, the TSP would not resolve the problem of blocked and impaired fish passage and altered hydrologic and sediment transport regimes caused by existing dams. Additional investigation of this unresolved problem could be addressed in a future study under the same authority." Comments As YCWA has previously emphasized to the Corps (particularly in YCWA's August 8, 2017 letter) that although habitat enhancements within the lower Yuba River would restore some of the degraded conditions in the Yuba River ecosystem, YCWA remains concerned	Comments noted. The study's longitudinal river connectivity objective includes the movement of fish, water, sediment, and ocean nutrients. While there is no requirement that the recommended plan must satisfy every objective of the study, expansion and improvement of aquatic habitats along the Lower Yuba River will contribute to improved longitudinal river connectivity by reducing existing gaps between patches of higher quality habitats for migrating fish. USACE recognizes that Lower Yuba River Habitat Restoration will provide less of an improvement in longitudinal river connectivity than some of the other measures considered. As described in Chapter 3 of the Final FR/EA, step pools were not carried forward to the final array of alternatives due to a combined

Comment	Comment Text	Response
	that the TSP does not include measures to address the historical loss of habitat connectivity for anadromous fish species in the lower Yuba River. This is an important consideration because spring-run Chinook salmon and steelhead are listed as threatened species under the federal Endangered Species Act, and spring-run Chinook salmon also are listed as a threatened species under the California Endangered Species Act. The 2018 Draft Feasibility Report/EA states several times that there is too much uncertainty to address fish passage issues, and that additional investigations are required, particularly with respect to fish passage at Daguerre Point Dam. However, the Corps has previously conducted the following studies on fish passage at Daguerre Point Dam: • In 2001, the Corps conducted a fish passage improvement study at Daguerre Point Dam (Corps 2001). • In 2003, the Corps and DWR completed a document titled "Analysis of Potential Benefits to Salmon and Steelhead from Improved Fish Passage at Daguerre Point Dam." • In 2003, the Corps also completed a document titled "Daguerre Point Dam Fish Passage Improvement Project Alternative Concepts Evaluation". As described on page 31, Alternative 2B2 (Construct Series of Low-Head Weirs Downstream of Existing Dam) would “produce a step-pool arrangement conducive to fish passage." Alternative 2B2 was found (p. v) to provide "Significant Improvement to Upstream and Downstream Fish Passage". 9 Febr11a1y 23, 2018 • In 2005, the Corps prepared the Daguerre Point Dam Initial Appraisal Report, which recommended that the Corps proceed into feasibility as a cost-shared feasibility study to determine the Federal interest in providing fish passage improvement, restore fisheries, restoration of aquatic habitat, and flood damage reduction associated with Daguerre Point Dam. The position in the 2018 Draft Feasibility Report/EA on this issue is contradictory to the conclusions presented in the Corps' 2005 report. Given that several previous focused efforts investigated fish passage issues at Daguerre Point Dam, there sufficient information available to evaluate these issues, and the purported "uncertainty" is questionable. In fact, the Corps' own 2005 Alternative Concepts Evaluation	evaluation of potential benefits, costs, and remaining risks and uncertainties. Please refer to the discussion of the major thematic concern "Daguerre Point Dam Fish Passage – Plan Formulation" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	contained sufficient information for the Corps to conclude that a step pool alternative would provide significant improvements to both upstream and downstream fish passage. o NMFS's 2014 Final Recovery Plan for Central Valley Chinook salmon and steelhead includes Recovery Action YURI .4 titled "Modify Daguerre Point Dam to provide unobstructed volitional upstream passage of adult steelhead and Chinook salmon (and sturgeon) and to minimize predation of juveniles moving downstream." o NMFS's 2018 Draft Recovery Plan for the Southern Distinct Population Segment of North American Green Sturgeon states that "Daguerre Point Dam on the Yuba River is also a target for modification or removal." NMFS Recovery Action le (Priority: 2) is to provide upstream passage at Daguerre Point Dam in the Yuba River. o Fish passage improvements continue to be strongly supported by local, state and federal agencies, conservation groups and other stakeholders. Given the ecosystem and public safety benefits of the Daguerre Point Dam Step Pool Alternative, YCWA continues to encourage the Corps to include this alternative in the Corps' final array of alternatives that are evaluated in the Chief's Report to Congress.	
III-19	DAGUERRE POINT DAM • Page 8 - "USA CE is responsible for operation and maintenance of the dam." Comment Because the Corps does not "operate" the dam, YCWA recommends that this sentence be edited as follows. "USACE is responsible for operation and maintenance of the two fish ladders at the dam and for maintenance of the dam."	Although the dam does not require continuous active operation, USACE is responsible for operation and maintenance of the dam, including ancillary features such as the fish ladders. The sentence indicates USACE’s general responsibility, rather than specific activities that are regularly performed by USACE.
III-20	Page 8- "Not operated for flood control or recreation." Comment YCWA recommends that this sentence be edited as follows. "Not operated for flood control or recreation. Although the Corps maintains large warning signs and a portage trail around dam. Several	The purpose of the referenced section is to describe existing water projects in relation to feasibility study’s purpose, which is ecosystem restoration. No change was made to the quoted statement; however, the recreational boating hazard at Daguerre Point Dam has been noted in Section 4.3.9.1 in the FR/EA.

Comment	Comment Text	Response
	boating deaths have occurred when people passed over the dam into the plunge pool below the dam and drowned there."	
III-21	ENGLEBRIGHT DAM- Page 9 - "Englebright Reservoir is used as an afterbay for releases from New Bullards Bar Reservoir through the New Colgate Powerhouse and is used as a regulating reservoir to meet recreation and power generation needs and to capture uncontrolled flows from the Middle and South Yuba rivers to manage downstream releases to the lower Yuba River." Comments o This statement is not factually correct and needs to be edited to address the following points. o Englebright Reservoir is not a "regulating reservoir," it does not "capture uncontrolled flows" to any significant extent, and it is not "used to manage downstream releases to the lower Yuba River." o Flows in the lower Yuba River are managed by YCWA through the Yuba River Development Project. Water releases from Englebright Reservoir are managed by PG&E (through the Narrows 1 Powerhouse) and by YCWA (through the Narrows 2 Powerhouse) to maintain Yuba Accord instream flows for fisheries, while also generating hydroelectric power, providing surface water for irrigation, maintaining Englebright Reservoir water surface elevations within a range suitable for recreation, and other beneficial uses. During high flows, unregulated flows pass over the top of Englebright Dam directly into the lower Yuba River (as shown in Figure 1-7).	The quoted statement has been revised as suggested, except for the information already included in the subsection.
III-22	Page 10 - "Englebright Dam and its associated hydropower facilities are impassable in the upstream direction, and therefore is the upstream limit of anadromous fish migration in the Yuba River." Comment o Because Englebright Dam has been a complete barrier to upstream passage since it was completed, and was such a barrier before either powerhouse was constructed, YCWA recommends that this sentence be edited as follows:	The quoted statement has been revised to remove the reference to hydropower facilities.

Comment	Comment Text	Response
	• "Engle bright Dam is impassable to fish migrating in the upstream direction, and therefore is the upstream limit of anadromous fish migration in the Yuba River."	
III-23	YUBA RIVER DEVELOPMENT PROJECT – Page 10 - "The Yuba River Development Project serves multiple uses, including hydropower, flood control, water supply, and environmental resources. The project as described in YCWA's December 2, 2013, Draft License Application consists of 1) New Bullards Bar Dam and Reservoir; 2) Our House Diversion Dam,· 3) Log Cabin Diversion Dam,· 4) Lohman Ridge Diversion Tunnel; 5) Camptonville Diversion Tunnel; 6) New Cole gate Powerhouse; 7) Narrows 2 Powerhouse; and 8) several recreational facilities. The project currently operates under a FERC license issued May 16, 1963 and amended May 6, 1966. The project has an energy generation capacity of 361 megawatts." Comment o YCWA recommends that this sentence be edited as follows: "The Yuba River Development Project serves multiple uses, including hydropower, flood control, water supply, and environmental resources. The project, as described in YCWA 's June 2, 2017 Amended Final License Application to FERC consists of 1) New Bullards Bar Dam and Reservoir,· 2) Our House Diversion Dam; 3) Log Cabin Diversion Dam; 4) Lohman Ridge Diversion Tunnel,· 5) Camptonville Diversion Tunnel,· 6) New Colgate Powerhouse,· 7) Narrows 2 Powerhouse; and 8) several recreational facilities centered around New Bullards Bar Reservoir. The project's original FERC license was issued May 16, 1963 and amended May 6, 1966. Since May 2016. the Project has operated under annual FERC licenses, which have under the same terms as the FERC license that expired on April 30, 2016. The project has an energy generation capacity of 361 megawatts."	The quoted statement has been revised as suggested.
III-24	Page 12- "BA for the Application for New FERC License Draft. YCWA, April 2014." Comment o YCWA recommends that this citation be replaced with the following and moved to the appropriate spot so that it is in chronological order:	The citation has been revised.

Comment	Comment Text	Response
	"Applicant-Prepared Draft Biological Assessment for Central Valley Spring-Run Chinook Salmon, Central Valley Steelhead and North American Green Sturgeon, in Volume IV of YCWA's June 2, 2017 Amended Final License Application to FERC."	
III-25	LOWER YUBA RIVER ACCORD – Page 16 - "The Yuba Accord is a consensus-based, comprehensive program designed to protect and enhance 24 miles of the lower Yuba River extending from Engle bright Dam downstream to Yuba River's confluence with the Feather River. The Yuba Accord was put into place to address water management in the lower Yuba River until a new FERC license is issued for the Yuba River Development Project. The Yuba Accord is composed of three interrelated agreements: 1) the Lower Yuba River Fisheries Agreement, which specifies lower Yuba River minimum stream flows and creates a detailed fisheries monitoring and evaluation program; 2) the Water Purchase Agreement, under which YCWA provides annual water supplies for fish and wildlife purposes in the Bay-Delta, CALFED's Environmental Water Account, the State Water Project, and the Central Valley Project; and 3) the Conjunctive Use Agreements which specify the terms of the Yuba Accord's conjunctive use program." Comment o YCWA recommends that this paragraph be expanded by adding the following sentence about the State Water Resources Control Board's 2008 order concerning the Yuba Accord and edited as follows: "The <u>Lower River</u> Yuba Accord is a consensus-based, comprehensive program designed to protect and enhance 24 miles of the lower Yuba River extending from Engle bright Dam downstream to Yuba River 's confluence with the Feather River. The Yuba Accord <u>addresses</u> water management in the lower Yuba River until a new FERC license is issued for the Yuba River Development Project. <u>The State Water Resources Control Board's Corrected Water Right Order 2008-0014, adopted in 2008, amended YCWA 's water-right permits to add the Yuba Accord instream flow schedules, which YCWA had been implementing under pilot programs since 2006.</u> The	The quoted statement has been revised as suggested.

Comment	Comment Text	Response
	Yuba Accord is composed of three interrelated agreements: 1) the Lower Yuba River Fisheries Agreement, which specifies lower Yuba River minimum stream flows and creates a detailed fisheries monitoring and evaluation program; 2) the Water Purchase Agreement, under which YCWA provides annual water supplies for fish and wildlife purposes in the Bay-Delta, CALFED's Environmental Water Account, the State Water Project, and the Central Valley Project; and 3) the Conjunctive Use Agreements which specify the terms of the Yuba Accord's conjunctive use program."	
III-26	PROBLEM STATEMENTS – Page 20 - "Section 2.2.1 - Problems" Comment As a general comment on Section 2.2.1, the Corps' Draft Interim Feasibility Report and EA identifies four specific problems in the Yuba River Watershed. However, there is no discussion in Section 2.2.1 explaining why the four identified bullet points are problems. Because these "problems" are important foundational components to justify the need for ecosystem restoration and the Corps' federal interest in conducting the feasibility study, YCWA recommends that the text in Section 2.2. l be expanded to explain why these problems exist within the watershed.	The causes of the four identified problems are described in Section 2.1 Purpose and Need for Action, and the first sentence in Section 2.2.1 Problems. In addition, each of the four problem statements includes the specific causes of the identified problem. [Information has been added or revised based on subsequent comments concerning the problem statements.]
III-27	Page 20 - "Modifications along the main stem and three forks of the Yuba River ... " Comment The statement above is not technically correct, and should be revised. There are not "three forks of the Yuba River". According to the river names on the relevant U. S. Geological Survey maps, the following three rivers flow into the Yuba River: (1) the North Yuba River; (2) the Middle Yuba River; and (3) the South Yuba River.	The quoted statement has been revised to remove the reference to forks.
III-28	Page 20-"The quality of aquatic habitat has been degraded by reduced ... oxygen levels ... " Comment	The reference to reduced oxygen levels has been deleted.

Comment	Comment Text	Response
	It is unclear why the Corps' document states that oxygen levels in the lower Yuba River have been reduced and degraded the quality of aquatic habitat. YCWA is not aware of any evidence that oxygen levels in the lower Yuba River are degraded and therefore recommends that this reference to oxygen levels be deleted. The Yuba River is one of the coldest, cleanest rivers in the entire Central Valley. Water quality objectives are established in Central Valley Regional Water Quality Control Board's (CVRWQCB) Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin Rivers, the fourth edition of which was initially adopted in 1998 and most recently revised in 2011 (CVRWQCB 1998). As described in YCWA's June 2, 2017 Amended Application for New License for the Yuba River Development Project FERC Relicensing (Project No. 2246) process, water quality data for the Yuba River is available from over 10 sources from the 1950s through 2009. The general dissolved oxygen (DO) Water Quality Basin Plan Objective of 7.0 mg/L applies to the Yuba River and its tributaries (CVRWQCB 1998). A review of these data (YCWA 2010) showed that surface water generally meets Basin Plan Objectives. To supplement the historical data regarding general water quality conditions for the FERC Relicensing, YCWA undertook the FERC-approved Study 2.3 (Water Quality), which is available at http://www.ycwa-relicensing.com. YCWA's study data were consistent with historical studies, and water quality is high. The water is generally clear (i.e., average turbidity of <36 NTU), and near saturation with dissolved oxygen (YCWA 2017). The USFWS 2017 Draft Environmental Assessment/Initial Study for the Hallwood Side Channel and Floodplain Restoration Project on the Lower Yuba River (Table 6, pg. 52) indicates that DO levels in the lower Yuba River exceed the Basin Plan Objective of 7.0 mg/L (see excerpt of Table 6, below). [*Table 6. Water quality parameters measured in the lower Yuba River near Marysville, CA (USACE 2012).*]	
III-29	Page 20 - "Longitudinal river connectivity has been reduced by altered hydroperiods and sediment transport as well as blocked and impaired passage of migrating fish."	Additional detail on fish passage issues has been added to section 2.2.1, under the bulleted problem statements.

Comment	Comment Text	Response
	Comments o The Corps' Draft Interim Feasibility Report and EA identifies "blocked and impaired passage of migrating fish" as a contributing factor to one of the four problems in the Yuba River Watershed. However, the document does not contain any description of the fish-passage issues that are associated with blocked and impaired fish passage. To provide additional understandings of the fish-passage issues for decision-makers and members of the public, YCWA recommends that the draft Feasibility Report be revised to describe Yuba River fish-passage issues. This description should discuss both the fish-passage issues associated with Englebright Dam and those associated with Daguerre Point Dam. A few suggested key issues are identified here: Adult Anadromous Salmonid Upstream Migration Issues • Englebright Dam is a complete barrier to upstream migrations of anadromous salmonids and all other fish. • Daguerre Point Dam has been reported to impair upstream fish passage for anadromous salmonids and other species because: - Fish can have difficulty finding the entrances to the ladders during times of high river flows due to relatively low attraction flows exiting the fish ladders - The fish ladders are narrow, have low flow capacities and can become clogged with debris. Daguerre Point Dam is a complete barrier to upstream migration of green sturgeon. Because the Corps administers Daguerre Point Dam, which is owned by the United States, any improvements to the dam would require the Corps to be involved. Juvenile Anadromous Salmonid Downstream Migration Issues •Juvenile downstream emigration may be impeded during low flows . •Juvenile fish may be injured or killed when they pass over the dam . •The plunge pool at the base of the dam may directly cause juvenile mortality.	

Comment	Comment Text	Response
	•Pools immediately upstream and downstream of the dam harbor piscivorous fish that prey on juvenile salmonids. •The beneficial effects of any habitat enhancement actions that are implemented upstream of Daguerre Point Dam would be reduced due to mortality of juvenile fish when they move downstream and encounter the dam.	
III-30	Page 20 - "Lateral river connectivity has been reduced by aggradation of the floodplain and channelization of the river." Comment o As YCWA previously has informed the Corps, this statement is not technically correct and should be deleted from the Corps' Draft Interim Feasibility Report and EA. The lower Yuba River experiences a higher frequency of floodplain inundation than that typically cited for alluvial stream channels in other river systems (RMT 2013). The Corps' Draft Interim Feasibility Report and EA could state that the fractions of cobble and large gravel in the streambed and the channel profile have been greatly altered, but these alterations do not equate to a lack of lateral connectivity under the usual metrics for such connectivity.	The problem statements in Section 2.2.1 (referenced in the executive summary) were developed to break down the complex and interrelated problems associated with ecosystem degradation in the Yuba River watershed in a way that facilitates a clearer understanding of problems within the context of the USACE ecosystem restoration authority and how problems relate to study objectives. For this reason, the problem statements are simplified. Although YCWA's comment indicates that lateral connectivity in terms of frequency of inundation of the floodplain is not restricted under current conditions, ecosystem functions in the Yuba River watershed and processes associated with lateral river connectivity are impaired. For example, the quality of lateral riverine connectivity has been altered by the aggradation of the floodplain related to the change in the character and distribution of the sediment in the river corridor. An important function of lateral river connectivity is to provide access for a variety of species to temporary habitats as well as bring nutrients from those floodplain habitats into the riverine system. The quantity of lateral river connectivity (floodplain accessible to the river) has also been reduced through creation of training berms/ dredger tailings.
III-31	Page 21- "Climate change is likely to reduce availability and access to cold water through increasing average air temperatures and decreasing precipitation. Reduced snow packs will cause prolonged periods of low streamflows during summer and early fall. Climate change will aggravate existing impacts to anadromous fish species in the Yuba River. A May 2017 report from biologists at the University of California, Davis, Center for Watershed Sciences and California Trout states that nearly 75 percent of California's salmon, trout, and steelhead will be extinct in 100 years unless critical habitat is protected and	The quoted statement has been revised as recommended.

Comment	Comment Text	Response
	restored. If present trends continue, 45 percent of species are likely to be extinct in the next 50 years (Moyle et al., 2017). " Comment These sentences do [not] clearly distinguish between general conditions in California and specific conditions in the Yuba River. Such distinctions are critical here because total precipitation in the Yuba River watershed is predicted to increase with climate change, although the percentage of rainfall will increase and the percentage of snowfall will decrease. Also, New Bullards Bar Reservoir will continue to have a large coldwater pool that will provide cold water for summer and early fall flows in the lower Yuba River. YCWA therefore recommends that these sentences be edited as follows: Climate change in California is likely to reduce availability and access to cold water through increasing average air temperatures and decreasing precipitation. Reduced snow packs will cause prolonged periods of low streamflows during summer and early fall in many California rivers. ~~Climate change will aggravate existing impacts to anadromous fish species in the Yuba River.~~ A May 2017 report from biologists at the University of California, Davis, Center for Watershed Sciences and California Trout states that nearly 75 percent of California's salmon, trout, and steel head will be extinct in 100 years unless critical habitat is protected and restored. If present trends continue, 45 percent of species are likely to be extinct in the next 50 years (Moyle et al., 2017). While hydrology in the Yuba River also will be affected by climate change, particularly by an increase in the percentage of total precipitation that will come as rainfall. New Bullards Bar Reservoir will continue to have a large coldwater pool that will provide cold water for summer and early fall flows in the lower Yuba River.	
III-32	Page 22 - "Critical components of connectivity include the longitudinal, or downstream, movement of water and sediment, and the upstream movement of anadromous fish and the ocean nutrients they provide." Comment This sentence ignores the importance of longitudinal connectivity for	The quoted statement has been revised to include the downstream movement of fish.

Comment	Comment Text	Response
	<u>downstream</u> movement of fish. YCWA recommends that this sentence be edited as follows: Critical components of connectivity include the longitudinal, or downstream, movement<u>s</u> of <u>fish</u>, water and sediment, and the upstream movement of <u>adult</u> anadromous fish and the ocean nutrients they provide.	
III-33	Page 26 - "USACE does not conduct any water control operations or releases for the debris dam." Comment The reference to "debris dam" is not clear here. YCWA recommends changing "the debris dam" to either "the dam" or "Englebright Dam."	The word "debris" has been deleted from the quoted statement.
III-34	Page 26 - "The discretionary functions include, but are not limited to ... " Comment YCWA recommends deleting "but are not limited to" here. If USACE has other important discretionary functions regarding Daguerre Point Dam, then they should be listed here.	The quoted statement has not been changed because it is legally correct. There are no other discretionary functions that are important for the purposes of the feasibility study.
III-35	Page 30 - Table 3-1. - Measures to Achieve Study Objectives. Comments o For the rows in Table 3-1 for "Lower Yuba River Habitat Restoration, "Floodplain grading," "Floodplain lowering," and "Side channel creation," there are X's in the column for "Objective: Improve longitudinal river connectivity." YCWA does not agree with these X's. Page 22 of the Corps Draft Interim Feasibility Report and EA states that "Critical components of connectivity include the longitudinal, or downstream, movement of water and sediment, and the upstream movement of anadromous fish and the oceanic nutrients they provide." It does not appear that these types of habitat enhancements in the lower Yuba River would improve longitudinal river connectivity for the upstream movement of anadromous fish (or for the downstream movement of fish). YCWA therefore recommends that these three X's be removed from this table.	Expansion and improvement of aquatic habitats along the Lower Yuba River will improve longitudinal river connectivity by reducing existing gaps between patches of higher quality habitats for migrating fish. USACE recognizes that Lower Yuba River Habitat Restoration will provide less of an improvement in longitudinal river connectivity than some of the other measures considered. The information provided in the comment does not indicate that step pools at Daguerre Point Dam would improve the quantity, quality, and complexity of aquatic habitats. Instead, the comment indicates that step pools would improve longitudinal river connectivity, as indicated in Table 3-1, by providing improved fish access to existing aquatic habitat upstream of the dam. Therefore, no change has been made to Table 3-1. USACE policy requires the use of certified models to calculate the ecosystem restoration outputs used to evaluate and select plans for recommendation. YCWA's applied Daguerre Point Dam passage

Comment	Comment Text	Response
	In the row in Table 3-1 for the Daguerre Point Dam Step Pools, the only X is in the column for the objective of improving longitudinal river connectivity. YCWA believes that an X should be added to this row in the column for the objective of improving the quantity, quality, complexity of aquatic habitats. Juvenile salmonid downstream passage at Daguerre Point Dam is influenced by the abundance and distribution of rearing juveniles within the lower Yuba River. Most juvenile Chinook salmon and steelhead rearing has been reported to occur upstream of Daguerre Point Dam (Beak 1989; CDFW 1991; SWRI et al. 2000). Kozlowski (2004) observed an estimated 82% of juvenile 0. mykiss were upstream of Daguerre Point Dam. He suggested that the distribution of juvenile O. mykiss appeared to be related to the distribution of spawning adults. The Yuba Accord River Management Team (RMT 2013) repo1ted that, with the exception of the upstream-most survey reach (i.e., Englebright Dam Reach) the density of juvenile Chinook salmon generally was higher in the survey reaches located upstream of Daguerre Point Dam than in the reaches downstream of the dam. The higher abundance of juvenile salmonids upstream of Daguerre Point Dam may be due to larger numbers of spawners, greater amounts of more complex, high-quality cover, and lower densities of predators such as striped bass and American shad, which reportedly are generally restricted to areas below the dam (YCWA et al. 2007). YCWA continues to recommend that the Corps revise its screening methodology to utilize the applied Daguerre Point Dam passage improvement adjustment factor, which is an expression of how much upstream habitat would effectively increase in value with passage improvements at Daguerre Point Dam. • The applied Daguerre Point Dam passage improvement adjustment factor is comprised of the complement of the initial Daguerre Point Dam passage improvement adjustment factor, plus one (i.e., 1 - initial Daguerre Point Dam passage improvement adjustment factor, plus 1). Therefore, the applied DPD passage improvement adjustment factor is (I- 0. 76+1) = 1.24. YCWA's February 3, 2017 document titled "Integration of Daguerre Point Dam Passage Improvement Actions with Habitat Improvement Measures to Provide Habitat Benefit Outputs for the Lower Yuba River" a copy of which is the fourth document in Attachment 1,	improvement adjustment factor is not a USACE-certified model. The YCWA adjustment factor is based on comparison of limited screw trap survey results for juvenile outmigrants in different reaches of the river. The YCWA adjustment factor assumes that the observed differences in numbers of fish are entirely due to mortality caused by Daguerre Point Dam that would be completely avoided by the construction of step pools. However, there are other possible causes for the observed differences. Also, because the natural mortality of juvenile fish is high, it is unclear whether a marginal reduction in the mortality of juvenile outmigrants would be valid as the sole metric for quantifying an increase in ecosystem outputs. To compare the cost-effectiveness of alternative plans as required by USACE policy, a common metric for ecosystem outputs applicable to all the alternative plans is needed. However, the YCWA adjustment factor is only applicable to the DPD step pools. For these reasons, USACE determined prior to the draft report that it was unlikely the YCWA adjustment factor could be certified by USACE as an ecosystem output model to be used to select and justify a recommended plan without additional quantitative data regarding upstream and downstream fish passage at DPD.

Comment	Comment Text	Response
	provided the Corps with a full description of this approach for calculating effective habitat approach. The calculation of the Daguerre Point Dam passage improvement adjustment factor is described on page 7 of the February 3, 2017 document. There is a present amount of steelhead juvenile rearing habitat (WUA) in the lower Yuba River upstream of Daguerre Point Dam, which can be presented in ft2 or acres. With Daguerre Point Dam passage improvements, the effective habitat value of this present habitat would be that amount (WUA in ft2 or acres) multiplied by the applied Daguerre Point Dam passage improvement adjustment factor. For example, presently there is an estimated 5,453,800 ft2 (125.2 acres) of juvenile steelhead rearing habitat (WUA) upstream of Daguerre Point Dam at the representative base flow of 730 cfs. With Daguerre Point Dam passage improvements, the present amount of juvenile steelhead rearing habitat (WUA) upstream of Daguerre Point Dam at the representative base flow of 730 cfs would increase by a factor or 1.24 for the Daguerre Point Dam passage improvement factor to 6,762,712 ft2 (155.3 acres). Moreover, if Daguerre Point Dam passage improvements are implemented and habitat enhancement measures upstream of Daguerre Point Dam also are implemented, then the effective habitat values of such measures would be the total amount of WUA (in ft2 or acres) due to the habitat enhancement measure multiplied by the applied Daguerre Point Dam passage improvement adjustment factor. Thus, the Daguerre Point Dam passage improvements would create additional benefits for any upstream habitat enhancements.	
III-36	SCREENING OF INITIAL MEASURES Page 34 - "In order to ensure that only implementable measures with a reasonable chance of achieving a significant increase in habitat value at a reasonable cost (i.e., efficient measures) were included in the final array of alternatives, criteria were established to further screen measures." Comment As previously discussed in YCWA's August 2, 2017 comments to the Corps on the Crops' draft "Screening of Measures" document (see	The large set of preliminary measures considered in the feasibility study is documented in Sections 3.4.2 and 3.4.2.1 of the feasibility report. The study duration and cost constraints mandated by Congress in Section 1001 of the Water Resources Development Act of 2014 compel the elimination of nonviable measures and alternatives from further technical evaluation as early as possible in the study process. Including some of the eliminated measures in the CE/ICA would require development, peer review, and USACE approval of a new ecosystem output model to quantify ecosystem outputs based on incremental improvements in fish passage. A

Comment	Comment Text	Response
	Attachment 1), this quoted sentence does not adequately explain the downsides of including more measures in the Cost Effectiveness/Incremental Cost Analysis (CE/ICA) and, if appropriate, then letting them be screened out of further analysis at that point. That approach would avoid the appearance that the Corps has pre-selected a limited set of measures, which contrasts YCWA's and the Corps' messages during public scoping meetings that the feasibility study would include analysis of a large set of options.	substantial effort was made to develop an approvable model within the constraints of the current study without a successful result. The criteria used to screen measures were developed to allow a consistent set of criteria to be applied to all measures and to provide a final array of measures that could be further evaluated within the study constraints.
III-37	Page 34 - "The criteria used to screen measures are efficiency (cost, habitat quantity, and habitat quality) and risk to efficiency." Comment As stated in this sentence, the Corps' used only two criteria for screening measures, efficiency and risk to efficiency. Federal planning criteria used for screening purposes are described in the USA CE Planning Guidance Notebook (Engineering Regulation 1105-2- 100, April 22, 2000), and include: (1) acceptability; (2) effectiveness; (3) efficiency; and (4) completeness. It is unclear why only efficiency was selected and applied in the Corps' screening document. The Draft Interim Feasibility Report and EA should be edited to either include these other screening measures or explain the decision not to include them.	In accordance with the 1983 Principles and Guidelines (P&G) and ER 1105-2-100, paragraph 2-3, the four P&G criteria are primarily used during the formulation of alternatives from measures, but the four criteria are also commonly used to screen measures as part of the formulation process. Generally, the completeness criterion is not useful for screening individual measures because it is often necessary to combine multiple measures to formulate complete alternatives. The other three criteria were used in the first iteration of measures screening as explained in Sections 3.4, 3.4.1, and 3.4.2.1. Measures that would not address the planning objectives (i.e., lacking effectiveness) or would not be consistent with USACE policy (i.e., lacking acceptability) were screened from further consideration. After the screened measures were further evaluated for costs, outputs and risks, a second iteration of screening was performed (Section 3.4.3) based on efficiency and risk to efficiency. Because the measures had previously been screened for effectiveness and acceptability, it was not necessary to apply those criteria during the second screening.
III-38	Page 34 - "In order to compare the relative costs of measures, cost categories were established to rank measures as Low-Medium-High cost." A series of 10 cost categories are presented, ranging in $200 million increments from a range of "Low" (Ranking Factor 1) of $0 to $200 million upwards to a range of "High" (Ranking Factor 10) of over $1,800 million. Comment As stated in YCWA's August 2, 2017 comments to the Corps on the Corps' draft "Screening of Measures" document (see Attachment 1), YCWA has repeatedly requested detailed descriptions of the	Under USACE's risk-informed decision-making process, the level of detail developed at any point in a feasibility study is limited to what is necessary for the study to progress through the next decision point. As stated in the feasibility report, cost categories were used because of the high degree of uncertainty in the rough order of magnitude (ROM) costs estimates used in the screening process.

Comment	Comment Text	Response
	assumptions associated with the Corps' cost estimates. As previously stated in YCWA's General Comments, the Corps must provide full documentation and rationale for its estimates for the cost rankings in the report to be defensible. Also, YCWA questions the approach of such broad "binning" in $200 million increments, and the resultant loss of specificity.	
III-39	Page 35 - "Although the EC method was intended only for prioritizing projects for budget purposes, the EC provides an unbiased and logical approach to converting area and connectivity factors into a single metric." Comments As previously stated in YCWA's August 2, 2017 comments to the Corps on the Corps' draft "Screening of Measures" document (see Attachment 1), YCWA does not agree with the statement in the second part of this sentence, and does not agree with this approach, particularly if it is to be used for impact/benefit evaluations and other activities to support NEP A/CEQA environmental compliance processes, for the following reasons. o Engineering Circular 11-2-206 states that "the purpose of this budget guidance is to ensure the development of convincing rationale and justification for the budget request." Engineering Circular 11-2-206 indicates that it is relevant to budget issues, not for technical analyses or screening of habitat restoration measures. o Although Engineering Circular 11-2-206 includes a formula to convert stream miles to acres, Engineering Circular 11-2-206 does not present any method that "measures the quantity of habitat restoration in terms of equivalence to acres of habitat restored," as stated on page 35 of the draft report. o Page 35 of the draft report states that "The EC method is an excellent fit because it was developed to compare aquatic habitat improvements, dam removals, and fish passage improvements, which are the same categories as the types of increments being considered in this study." YCWA is not aware of any basis for this conclusionary statement about an "excellent fit".	Comment noted. As quoted in the comment, the feasibility report states that the EC method was not developed for screening measures. The conversion of stream miles of accessible fish habitat to acres using the EC method provides a common unit of measure by expressing ecosystem outputs for fish passage improvement measures in terms of equivalence to acres of habitat restoration. The suitability of the EC method for screening measures in this study is a matter of professional judgment and USACE policy. Internal USACE reviews have found use of the EC method for screening measures in this study to be consistent with USACE's risk-informed decision-making process. The EC method was not used for impact evaluations or to support NEPA compliance.

Comment	Comment Text	Response
III-40	Page 36 - The Corps' Draft Interim Feasibility Report and EA provides a list of habitat quantity ranking categories, which are as follows: • Low (Ranking Factor 1) = 0 to 100 acres • Low-Medium (Ranking Factor 2) = 101 to 200 acres • Medium (Ranking Factor 3) = 201 to 300 acres • Medium-High (Ranking Factor 4) = 301to400 acres • High (Ranking Factor 5) = 401 to 500 acres Comments o Following this list, the Corps' Draft Interim Feasibility Report and EA presents a ranking of the quantity of habitat that purportedly would be restored by each listed measure in Table 3-3. However, no specific number of acres of habitat that would be restored is listed for any of the potential measures, and no explanation is provided regarding how any of the qualitative entries in this table for "Quantity of Habitat Restored" or "Ranking Factor[s]" were determined. Without such numbers and explanations, there is no way for any reader of this report to review the Corps' methods of "measuring the quantity of habitat restoration in terms of equivalence to acres of habitat restored' for each potential measure, and it is unclear: (1) how the acreage estimates were calculated for each potential measure listed in Table 3- 3; and (2) whether they are appropriate. Because the "Ranking Factor[s]" in this table are used as the "Quantity Factor[s]" in Table 3-5, which lists the efficiency rankings, which then are used in Table 3-7 to determine which proposed measures are carried forward for further evaluation, these omissions of any information regarding the Corps' evaluation of the quantities of habitat that would be restored by each potential measure are critical deficiencies in the draft report that need to be corrected before the final report is issued. As an example, the "Quantity of Habitat Restored" in Table 3-3 for the Daguerre Point Dam Step Pools is "Low" and the "Ranking Factor" of this potential measure is 1. YCWA does not agree with these entries in this table. As discussed earlier in these comments, improvements to fish passage at Daguerre Point Dam would improve effective habitat conditions for anadromous salmonids in the entire portion of the lower	Contrary to the comment, the draft report included a detailed explanation of how the Quantity of Habitat Restored and Ranking Factors in Table 3-3 were determined. The explanation appeared immediately above the table. YCWA's disagreement with the results of the method used by USACE is noted.

Comment	Comment Text	Response
	Yuba River upstream of the dam, which indicates that the "Quantity of Habitat Restored" should be higher than "Low" and the "Ranking Factor" should be greater than 1.	
III-41	Pages 37 - The Corps' screening criteria for "Connectivity" states "This ranking represents the extent to which the measure facilitates the movements of native species. For Daguerre Point Dam, the existing and future without-project condition assumes the existing fish ladders remain in place; therefore, scores for measures at Daguerre Point Dam were reduced in order to represent the net improvement from existing conditions. Rankings are as follows: High (Ranking Factor 5) indicates the measure would fully restore a critical direct physical connection between existing habitat areas within a corridor (e .g., removing a dam); Medium-High (Ranking Factor 4) indicates the measure would create a nodal connection between existing habitat areas within a corridor (e.g., ramps or by-pass channels); Medium (Ranking Factor 3) indicates the measure would restore suitability of an existing connection or corridor (e.g., fish ladders [existing condition at Daguerre Point Dam]); Low-Medium (Ranking Factor 2) indicates the measure would provide a large expansion to an existing habitat; and Low (Ranking Factor 1) indicates the measure is an isolated unit." Comments o As stated in YCWA's August 2, 2017 comments to the Corps on the Corps' draft "Screening of Measures" document (see Attachment 1), the meaning of the statement "scores for measures at Daguerre Point Dam were reduced in order to represent the net improvement from existing conditions" is unclear and should be further explained in the report. This explanation should include answers to the following questions: Why did the Corps conclude it necessary to reduce scores associated with Daguerre Point Dam so there could be equitable comparisons with other potential measures? What methodology was used to reduce these	As indicated in the text quoted in the comment, the existing condition at DPD (with existing fish ladder) was assigned to Ranking Factor 3. Dam removal would change the Ranking Factor to 5, an increase of 2 on the ranking factor scale for connectivity. Therefore, the connectivity Ranking Factor used for dam removal in the Quality Ranking was 2 (rather than Ranking Factor 5) because the measures must be evaluated based on net gains relative to without-project conditions. Using the same logic, the DPD step pool and DPD 10% bypass increments were assigned a connectivity Ranking Factor of 1 (Ranking Factor 4 minus Ranking Factor 3), rather than Ranking Factor 4. As described in the draft report, for the purpose of screening measures, habitat quantities for fish passage measures other than dam removal were based on the total area of affected habitat estimated by multiplying the entire affected river length by the full width of the river immediately upstream of the impoundment of the dam obstructing fish passage. Potential fish habitat improvements upstream of the DPD impoundment would not significantly affect that calculation because the width of the river would not be significantly changed. Fish habitat improvements upstream and downstream from DPD were evaluated separately from fish passage improvements during the measures screening process. As explained in the response to [III-35], inclusion of fish passage measures in the CE/ICA would require development, peer review, and approval of a new ecosystem output model that could be applied consistently to multiple fish passage measures. The criteria used to screen measures were developed to allow a consistent set of criteria to be applied to all measures and to result in a final array of measures that could be further evaluated within the study constraints. The Low-Med ranking for connectivity was based on the definition in the text preceding Table 3-4: "the measure would provide a large expansion to an existing habitat." Expansion and improvement of aquatic habitats along the Lower Yuba River will improve

Comment	Comment Text	Response
	scores? How were the reductions applied in comparison to existing conditions? YCWA has previously stated that it would be most appropriate for the Corps: (1) to estimate the benefits to existing juvenile rearing habitat upstream of Daguerre Point Dam that would result from juvenile passage improvements at Daguerre Point Dam; (2) to estimate the additional benefits that would result to the Corps' proposed habitat enhancement projects located upstream of Daguerre Point Dam from juvenile passage improvements at the dam; and (3) to estimate the combined additional benefits that would result from Daguerre Point Dam juvenile passage improvement to both existing habitat and the Corps' proposed habitat enhancement projects upstream of Daguerre Point Dam. At a minimum, YCWA suggested that such evaluations be included in a CE/ICA assessment, rather than removing passage improvements at Daguerre Point Dam from consideration before the CE/ICA process. These evaluations are necessary for the Corps to adequately evaluate the likely benefits of fish passage improvements at Daguerre Point Dam and the associated improvements in longitudinal connectivity. In Table 3-4 on page 41, the "Lower Yuba River Habitat Restoration" measure has a "Low-Med" ranking for "Connectivity". The basis for this ranking is not explained in the draft report and is questionable, because this measure would just create some new habitats without improving any connectivity to existing habitats. In Table 3-4 on page 41, the Daguerre Point Dam step pool measure has a "Low" ranking for "Connectivity". The description of the connectivity ranking on page 37 states that it is supposed to represent the extent to which the measure would facilitate "the movements of native species." However, this description then states that "for Daguerre Point Dam, the existing and future without-project condition assumes the existing fish ladders remain in place,' therefore, scores for measures at Daguerre Point Dam were reduced in order to represent the net improvement from existing conditions." YCWA does not agree with this decision to arbitrarily reduce the ranking criteria for measures that would improve fish passage at Daguerre Point Dam. It also is not appropriate to assume that existing fish ladders would remain in place when conducting an evaluation of the Daguerre Point Dam step pools measure.	longitudinal river connectivity by reducing existing gaps between patches of higher quality habitats for migrating fish. USACE recognizes that Lower Yuba River Habitat Restoration will provide less of an improvement in longitudinal river connectivity than some of the other measures considered. The reduction in the ranking factor for DPD measures to account for existing fish passage was not arbitrary; it was explained in the draft report and is explained above in this response. Under USACE policy, it would be inappropriate to assume that the existing fish ladders will be removed under future without-project conditions when there is no plan to remove them.

Comment	Comment Text	Response
	The "Low" connectivity ranking that was given to the Daguerre Point Dam step pool measure is particularly questionable because the Corps' ranking criteria state that a "Medium" ranking (Ranking Factor 3) is appropriate when "the measure would restore suitability of an existing connection or corridor," and this ranking specifically refers to the existing fish ladders at Daguerre Point Dam. Because the Daguerre Point Dam step pool measure would "restore suitability of an existing connection or corridor", it should have been assigned a connectivity ranking of at least 3.	
III-42	Page 38 - "Hydrologic Character. This ranking represents the degree to which appropriate hydrology is restored in order to maintain the ecological functions of aquatic, wetland, and/or riparian systems. Rankings are as follows: • High (Ranking Factor 5) indicates the measures fully restore the natural hydrology to the system or site,' • Medium-High (Ranking Factor 4) indicates the measures partially restore the natural hydrology to the system or site,' • Medium (Ranking Factor 3) indicates hydrologic impairment does not exist at the site or the hydrology is restored to the best attainable condition, but remains a limiting factor in ecosystem health,' • Low-Medium (Ranking Factor 2) indicates some elements of the system or site hydrology are restored but most conditions necessary for a more natural hydrology are not attained,' and • Low (Ranking Factor 1) indicates the measures do not address hydrologic restoration, although hydrologic impairments exist on the system or critical goals are not attained. Comments o The Corps' Draft Interim Feasibility Report and EA should be edited to add text explaining what "appropriate hydrology" is and how it is evaluated for the various potential measures. o The Corps' Draft Interim Feasibility Report and EA should be edited to add text describing what hydrologic modeling was used to determine the "Hydrologic Character" rankings for each of the potential measures.	The ranking factors quoted in the comment sufficiently clarify the meaning of “appropriate hydrology” and how it was evaluated for the potential measures. Appropriate hydrology refers to natural hydrology that supports ecological functions. The rankings for specific measures were based on the ranking factor definitions and professional judgment, rather than hydrologic modeling. A hydrologic impairment is any condition that detracts from natural hydrology. Dams, levees, and excessive sediment deposition are examples of hydrologic impairments.

Comment	Comment Text	Response
	o Several of the ranking factor descriptions refer to "hydrologic impairment". The Corps' Draft Interim Feasibility Report and EA should be edited to add text describing what this term is intended to mean, and how each potential measure could reduce "hydrologic impairment".	
III-43	Page 38 - Under "Hydrologic Character," the Corps' Draft Interim Feasibility Report and EA includes the following rankings: • High (Ranking Factor 5) indicates the measures fully restore the natural hydrology to the system or site ... • Low (Ranking Factor 1) indicates the measures do not address hydrologic restoration, although hydrologic impairments exist on the system or critical goals are not attained. " Comments In Table 3-4 (Quality Ranking), two potential measures, Englebright Dam Removal and Daguerre Point Dam Removal, each received a "High" score, and all other potential measures received a "Low" score. There are several dams in the Yuba River watershed upstream of both Englebright Dam and Daguerre Point Dam. Therefore, removal of Englebright and Daguerre Point Dams would not result in a condition that would "fully restore the natural hydrology to the system," and thus merit a "High" ranking. The Corps should re-evaluate and adjust these rankings. For the "Low" ranking factor, it is unclear what "hydrologic impairments" and "critical goals" are being referred to in the description of Ranking Factor 1. As discussed earlier in the Corps' Draft Interim Feasibility Report and EA, the potential Lower Yuba Habitat Restoration measures include habitat enhancements like floodplain grading and side-channel and backwater creation. These types of habitat enhancements have the potential for localized, site-specific hydrologic improvements because: (1) depth to- groundwater levels would be reduced by floodplain grading, particularly in the 7-to-10 foot range that has been identified to support riparian vegetation plantings; and (2) floodplain grading, as well as side-channel and backwater creation, would be expected to increase the amount of surface water and groundwater interaction	Because full restoration of natural hydrology to the Yuba River is clearly impractical, the hydrologic character ranking was based on the degree to which appropriate hydrology (water flow) would be restored to a site, consistent with the quoted definition of Ranking Factor 5. Compared to other measures, dam removal measures would fully restore appropriate hydrology at the dam/reservoir sites. Establishment of suitable form and physical processes through floodplain grading and excavation of side channels and backwaters was addressed as part of the geomorphic character ranking. Excavation to reduce depth to groundwater was not considered to be a restoration of natural hydrology. Reducing the hydrologic character rankings of the dam removal measures and increasing the ranking of Lower Yuba Habitat Restoration would increase the difference in the overall Efficiency Ranking Factors (Table 3-5) between Lower Yuba River Habitat Restoration and the next highest ranked increment, DPD removal, so the screening of measures and plan selection would not be affected.

Comment	Comment Text	Response
	occurring in areas of the lower Yuba River where habitat enhancement occurs. Therefore, it is questionable why the potential Lower Yuba Habitat Restoration measure received a "Low" ranking here.	
III-44	Page 38- Under "Geomorphic Character", the Corps' Draft Interim Feasibility Report and EA states that the "High (Ranking Factor 5) indicates the measures fully restore the natural or attainable geomorphic processes and form to the system or site". Comments The draft report does not state what "natural or attainable geomorphic processes" were considered for this evaluation, or what rationale was used for the geomorphic character rankings of the various proposed measures. The draft report should be edited to provide this information. The Corps' Draft Interim Feasibility Report and EA also should describe what natural or attainable geomorphic processes were considered for the evaluations of the various potential measures here and the supporting rationales.	The draft report stated that the Geomorphic Character ranking relates to the establishment of suitable structure and physical processes for successful restoration. Natural geomorphic processes include channel meandering, sediment transport and deposition, and the formation of diverse channel features typical of natural channels. Attainable geomorphic processes were interpreted to mean natural geomorphic processes as constrained by major existing infrastructure, such as urban areas.
III-45	Page 38- For the criteria of "Geomorphic Character", the Corps' document states that the "Medium-High (Ranking Factor 4) indicates the measures restore the key geomorphic processes to the system or site". Comments o The Corps' Draft Interim Feasibility Repo1i and EA should describe what the "key geomorphic processes" were considered for the evaluations of the various potential measures here and the supporting rationales. In Table 3-4 on page 41, the "Lower Yuba Habitat Restoration" measure has a "Med-High" ranking for "Geomorphic Condition". This ranking appears to be incorrect. Because this measure at most would restore the forms of the allocated sites and would not change any "key system processes" (which result from river flows, which would not change), this ranking should be changed to "Low-Medium."	Ranking Factor 4 was only applied to Lower Yuba River Habitat Restoration. It was applied because that measure would not meet Ranking Factor 5 ("…measures fully restore the natural or attainable geomorphic processes and form to the…site"), but would exceed Ranking Factor 3 ("…geomorphology is restored to the best attainable condition, but remains a limiting factor in ecosystem health"). The full definition of Ranking Factor 4 from EC 11-2-206 is "measures restore the key geomorphic processes to the system or site, and the system is expected to recover full ecological function within an appropriate timeframe." The last part of that definition was omitted from the draft feasibility report, but is included in the final feasibility report. Ranking Factor 4 was judged to be the closest fit for the Lower Yuba Habitat Restoration measure because it would establish suitable geomorphic structure and processes to restore full ecological function on the site within an appropriate timeframe.
III-46	Page 39 - "Self-Sustaining" -- "Rankings, based on relative operations and maintenance costs, are as follows:	The rankings for self-sustainability were based on relative annual operations and maintenance costs using engineering judgment based

Comment	Comment Text	Response
	• High (Ranking Factor 5) indicates low relative operations and maintenance costs; • Medium (Ranking Factor 3) indicates medium relative operations and maintenance costs; and • Low (Ranking Factor 1) indicates high relative operations and maintenance costs." Comments On numerous occasions, YCWA has requested that the Corps provide detailed descriptions of the assumptions associated with the Corps' operations and maintenance cost estimates. As previously discussed in these comments, full documentation of these cost estimates is necessary for the Corps final report to be defensible. This includes detailed descriptions of the estimates of annual O&M costs. There is no indication in the Corps' Draft Interim Feasibility Report and EA that potential repairs and reconstructions of habitat enhancement measures were included in the Corps' maintenance cost estimates. YCWA has previously pointed out the likelihood of channel alterations (and thus impacts on Lower Yuba Habitat Restoration measures) due to recurring floods. In Table 3-4 on page 41, the "Lower Yuba Habitat Restoration" measure has a "High" ranking for "Self-Sustaining" while the "Daguerre Point Dam Step Pools" measure has a "Med" ranking. These rankings are incorrect. As discussed in YCWA's General Comments (earlier in these comments), there are serious questions about the sustainability of the potential Lower Yuba Habitat Restoration measures, so a "Low" ranking would be more appropriate. On the other hand, the Daguerre Point Dam Step Pools would be constructed as part of the dam, which has remained in its present condition for over 50 years since it was re-constructed in 1965 (including during very high river flows in 1986 and 1997), so a "High" ranking would be more appropriate.	on the best information available at the time that measure screening occurred. The rankings assumed that subsequent feasibility level design would limit repair and replacement costs resulting from extreme events. All measures were ranked as Low or High, except for DPD step pools, which were judged to be intermediate between the low and high groups. A first order analysis of OMRR&R costs for the TSP was provided in the draft feasibility report, Appendix C, Section C-15. Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
III-47	Page 39 - Efficiency Ranking Factor= (Quality Factor X Quantity Factor) / Cost Factor	See response to III-40 regarding calculation of the quantity of habitat restored for the DPD step pools measure. See previous responses (III-41 through III-46) regarding the quality factors applied to the Lower Yuba River Habitat Restoration measure. YCWA's

Comment	Comment Text	Response
	Comments As discussed in a previous comment on the habitat quantity evaluations, the Daguerre Point Dam step pools measure received a ranking of "low" for quantity of habitat restored, and a ranking factor of "1". YCWA does not agree with this ranking or this ranking factor. Improvements at Daguerre Point Dam would benefit effective habitat conditions for anadromous salmonids in the entire portion of the lower Yuba River upstream of the dam, so a higher ranking and a higher ranking factor are appropriate. As also discussed above, the rankings that were used to determine the "Quality Factor[s]" in Table 3-4 on page 41, which were carried forward to Table 3-5 on page 42, also need to be changed. YCWA believes that Daguerre Point Dam step pools measure has been ranked too low for habitat quantity, and that this measure has been ranked too low and the Yuba River Habitat Restoration measure has been ranked too high in many of the quality categories listed in Table 3-4. The Daguerre Point Dam step pool measure would rank much higher for efficiency if the habitat quality and habitat quantity evaluations were reconsidered to more appropriately represent the ecosystem benefits that would be achieved by implementing an improvement at Daguerre Point Dam. When the rankings in Table 3-4 on page 41 of the Lower Yuba Habitat Restoration measure and the Daguerre Point Dam Step Pool measure for "Connectivity," "Geomorphic Condition" and "Self-Sustaining" are adjusted for the reasons discussed above, the "Quality Score (Total)" and "Average Quality Ranking" for each of these two potential measures will change significantly. These improper rankings have led to improper efficiency ranking factors and efficiency rankings in Table 3-5 on page 42. These changes are critically important to the Corps' analysis, because they are carried forward to Table 3-7 on page 46, which lists the final screening conclusions.	disagreement with the results of the measure screening process is noted.
III-48	Page 39 - Risk and Unce1iainty Regarding Efficiency Ranking Comment	Sustainability of the TSP relative to periodic high flow events has been addressed during feasibility-level design of the recommended plan. Risks to sustainability from natural river scour, bed load movement and sediment deposition will be managed through

Comment	Comment Text	Response
	o As previously stated in YCWA's August 2, 2017 comments to the Corps on the Corps' draft "Screening of Measures" document (see Attachment 1), YCWA suggested that, because of the high flow conditions and dramatic changes in geomorphology that resulted in the lower Yuba River during the winter of 2017, an additional risk factor should be considered with respect to sustainability. Specifically, the Corps' screening process should consider the risks to sustainability associated with the natural river scour, bed load movement and sediment deposition that occur during periods of high flow, like those that occurred during 2017, which have the potential to completely re-contour the lower Yuba River channel. Under this type of a sustainability ranking factor, habitat enhancement measures would rank less favorably than some of the other measures like the Daguerre Point Dam fish passage measures.	appropriate design and adaptive management. The intent of the recommended plan is to reestablish conditions for a naturally resilient river system that will provide high quality habitat with a minimum amount of human intervention despite natural periodic disruptions. Extreme high flows would also pose risks to structural measures like step pools, fish collection facilities, and fish ladders that would have no ability to regenerate themselves. Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
III-49	Page 39-The Corps' Draft Interim Feasibility Report and EA states that "risk and uncertainty factors, described below, were qualitatively ranked as Low, Low-Medium, Medium, Medium-High, or High based on professional judgment." Comment o Unlike all other ranking criteria (e.g., habitat scarcity, connectivity, self-sustaining) described in this section of the Draft Interim Feasibility Report and EA-many of which also rely on "professional judgment", there are no explanations in the draft report of what would constitute a "low", "low-medium", "medium", "medium-high" or "high" ranking associated with the Risk and Uncertainty Regarding Efficiency Ranking criterion. Such explanations should be added to the report before the final version of it is prepared.	As stated in the draft report, the risk rankings are qualitative and based on professional judgment. The measures were ranked in relation to each other as explained for each of the risk criteria in the report.
III-50	Page 39 to 40, and 46 - The Corps' Draft Interim Feasibility Report and EA states that there are several unce1iainties that influenced the Corps' screening process. Additionally, the Corps has informed YCWA that Daguerre Point Dam fish-passage improvements have been eliminated from further consideration in this process due to unce1iainties. However, the only uncertainties referenced in the Draft Interim Feasibility Report and EA pertain to risks related to mercury contamination and sediment disposal.	Risk and uncertainty were considered together in relation to efficiency as part of the measure screening process described in the draft report, Section 3.4.3. The resulting risk rankings, which include uncertainty, are displayed in Table 3-6, which is referenced in the comment. Identified risks related to DPD fish passage improvement measures and other measures include mercury contamination, sediment disposal, water rights, design complexity, and construction complexity. Contrary to the comment, total risks for the DPD step pools and bypass measures were ranked as lower than those of any

Comment	Comment Text	Response
	[see comment text for table, or view draft FR/EA table 3-6] Comments o Because the Englebright Dam Removal and the Daguerre Point Dam Removal measures both would involve considerable sediment removal work, it is understandable that risks associated with mercury contamination and sediment disposal for these two measures were ranked "high". All of the other measures were ranked "low" risk or "medium" risk for mercury contamination and sediment disposal. Specifically, the Daguerre Point Dam Step Pools measure was ranked "medium" for mercury contamination and "low" for sediment disposal, and the Daguerre Point Dam 10% Bypass was ranked "low" for mercury contamination and "medium" for sediment disposal. o YCWA has previously asked the Corps to specifically describe what uncertainties were being referred to (e.g., cost, benefits, etc.). The Corps should edit the draft report to explain whether these unce1tainties pertain only to mercury contamination and sediment disposal, as indicated in the screening document, or whether there are other unce1tainties that also were considered. o YCWA also has asked the Corps to describe how it was determined that these uncertainties apparently were determined to be greater for Daguerre Point Dam passage measures than for the measures associated with Englebright Dam passage, collect and transport to the upper watershed (Middle and South Yuba rivers), reintroduction specifically into the North Yuba River, or even the anticipated responses of juvenile anadromous salmonids to habitat enhancement measures. This determination does not appear to be consistent with information presented in the Corps' Draft Interim Feasibility Report and EA. o YCWA has previously suggested to the Corps that uncertainties associated with Daguerre Point Dam passage improvement measures were not necessarily greater than those for habitat enhancement measures (persistence, geomorphic stability, species response, etc.), and that it was not logical for Daguerre Point Dam passage improvement measures be the only measures eliminated from evaluation due to " uncertainties". Consequently, because the screening	other measures except Lower Yuba Habitat Restoration. Total risks for DPD removal were ranked as lower than for Englebright Dam removal. Contrary to the comment, DPD passage improvement measures were not the only measures eliminated from further evaluation based on risk to efficiency, in combination with efficiency, as is shown in Table 3-7. In addition to risk and uncertainty related to costs, uncertainty regarding existing conditions and potential benefits associated with fish passage improvements at DPD is specifically highlighted in Section 3.4.4 of the report. Section 3.4.3 has been revised to clarify that each of the risk rankings includes consideration of uncertainty.

Comment	Comment Text	Response
	results do not appear to support this determination, the risk and uncertainty rankings should be reconsidered.	
III-51	Page 45 - Risk Ranking [see table 3-6 in FR/EA or original comment Text for table] Comments o The list of risks considered in the ranking process does not appear to be complete. For example, the risk that potential redirected impacts could adversely affect downstream areas was not sufficiently addressed, particularly risks to: (1) the environment (e.g., listed species and their critical habitats); (2) existing beneficial uses and water quality objectives (e.g., dissolved oxygen, sediment and turbidity, recreation, fishing); (3) other watershed considerations (e.g. flood control, hydropower generation); and (4) sustainability of alternatives. o The Corps did not incorporate YCWA's input on the "risk rankings", nor did YCWA have an opportunity to participate in the Corps' "professional judgment" process of assigning risk levels to specific categories for specific increments. The Corps should describe in the report what constituted professional judgment, the basis and considerations for that judgment, and how it was used to differentiate among alternatives. o Considering the approach used for Table 3-4 (Quality Ranking), which presented several ranking considerations that were then averaged to obtain a single score, it is not clear why the risk rankings in Table 3-6 were treated separately and not averaged. o Because these risk rankings were not averaged, it would appear that these rankings received greater weightings than the "efficiency" criteria, which were averaged. The draft report should be edited to explain this discrepancy, because the draft report does not describe the screening-methodology weighting procedure, and because the methodology indicates that both the "efficiency" and "risk to efficiency" criteria should be treated equally. o Except for the "Lower Yuba Habitat Restoration" measure, the Daguerre Point Dam Step Pools measure has the lowest risk ranking of all of the potential measures. Because this measure has the second lowest risk ranking, YCWA believes that it should be carried forward	The risks included in the ranking process were identified as risk and uncertainty regarding the efficiency ranking, with efficiency based on benefits relative to costs. Under USACE's NER objective, efficiency is the primary criterion for plan selection. The risks included in the ranking process were not intended to be exhaustive, but were identified as the most important risk categories relative to efficiency. Effects on the environment, including listed species, critical habitats, water quality, and other watershed considerations are addressed elsewhere in the feasibility report and environmental assessment. See response to [III-47] regarding risks to sustainability. YCWA's previous comments regarding the risk rankings were considered in the draft feasibility report. Professional judgment is the application of the collective training, knowledge and experience of the Project Delivery Team, within the context of USACE policy and this particular study. Efficiency and risk to efficiency were both considered in deciding which measures to carry forward, in a sequential process. As can be seen in Table 3-6, efficiency was first used to rank the measures, because maximizing total benefits relative to costs is the primary criterion used by USACE to select a plan. Risks to efficiency were then used to help determine the screening limit for measures to be carried forward for more detailed evaluation. Current USACE planning policy emphasizes risk-informed decision-making. Because the risks are additive, they were not averaged. Displaying five separate risk categories is much more informative than averaging the categories, and more clearly shows the distinction between the measures carried forward and the other measures. Risk and efficiency were considered separately and were not weighted relative to each other. The DPD step pools measure was not carried forward for more detailed evaluation because of the reasons stated in Sections 3.4.4 and 3.4.5 of the feasibility report, including a definitive breakpoint in efficiency, risk rankings across all categories of risk, and uncertainty regarding without-project conditions for fish passage.

Comment	Comment Text	Response
	for detailed evaluation along with the "Lower Yuba Habitat Restoration", so that at least two types of potential measures are evaluated.	
III-52	SCREENING RESULTS General - Overall, the Draft Interim Feasibility Report and EA states that professional judgment was used to assign the ranking values to specific criteria considered for each potential measure. However, the professional judgment that was the basis for, and led to, those numerical decisions cannot be ascertained or evaluated, because the Draft Interim Feasibility Report and EA just provides the qualitative results of the elements of the screening process without any explanations. YCWA requests that the draft report be edited to provide descriptions of the details of the processes that were used to develop these results. The format for such explanations could be similar to the formats in previous screening documents for other Corps' projects (e.g., Table 3-5 in 2014 West Sacramento Project General Reevaluation Report; Table 3-1 in Sutter Basin Pilot Feasibility Final Report - Final EIR/Supplemental EIS; Skagit River Flood Risk Management Draft Feasibility Repo1i and EIS Appendix A - Plan Formulation).	Contrary to the comment, explanations of the ranking factors for each of the ranking criterion is included in the text of the feasibility report. The report examples cited by YCWA were initial screenings of measures in which measures were often eliminated based on a single factor. In this report, the initial screening of measures is presented in Section 3.4.2 at a similar level of detail as the cited examples. This report also has a second level of measure screening presented in Section 3.4.3 that uses multiple criteria and therefore provides more detailed screening process than the examples cited by YCWA. The second level of measure screening is consistent with USACE's recently developed SMART planning process, which requires eliminating measures or alternatives from more detailed evaluation as early in the planning process as possible.
III-53	Page 46 - Screening Results Table [see original comment text or Table 3-7 in the draft FR/EA] Comments o Table 3-7 indicates that the Daguerre Point Dam step pools measure has in the same efficiency ranking ("low-med") as the Daguerre Point Dam removal measure. YCWA does not agree with these rankings and, for the reasons discussed above, requests that the determinations of the factors that were used to determine these rankings be reconsidered. o The screening results table (Table 3-7) indicates that the only measure carried forward for additional analyses was the "Lower Yuba Habitat Restoration" measure. In Section 3.4.4 of the Draft Interim Feasibility Report and EA, the text states "As shown in Table 3-7 below, Lower Yuba River Habitat Restoration was the most efficient measure by a factor of 3: the Lower Yuba Habitat Restoration ranking	The efficiency rankings use quantity and cost factors that are directly proportional to estimated outputs and costs. However, the quality factors used in the efficiency rankings are based on ordinal scales with assigned numerical values. Therefore, the numerical values used for the quality factors are subjective weights and the calculated efficiency factors are not entirely quantitative. The use of subjective weights is a common technique in multi-criteria decision-making. To provide transparency, calculation of the efficiency rankings is explained in detail in Section 3.4.3 of the feasibility report. Because calculation of a ratio based on ordinal measurements implies a degree of precision that does not exist, we have changed the statement that "Lower Yuba River Habitat Restoration was the most efficient measure by a factor of 3" to "Lower Yuba River Habitat Restoration was the most efficient measure by a significant margin."

Comment	Comment Text	Response
	factor was 12, while the next most efficient measure (Daguerre Point Dam Removal) ranking factor was 4. The Lower Yuba Habitat Restoration measure was also the only measure to rank as low risk in all risk categories. For these reasons, the Lower Yuba Habitat Restoration measure was retained for further evaluation and all other measures were screenedfromfi1rther consideration under this study." The statement that the Lower Yuba River Habitat Restoration "was the most efficient measure by a factor of 3" suggests that the efficiency rankings were quantitative. However, the rankings that were used to calculate the efficiency rankings all were just qualitative (on l-to-5 scales), so the draft report's suggestion that there are any quantitative differences between the efficiency rankings of the various potential measures is incorrect. It appears that the only screening criteria used to select increments carried forward were the overall efficiency rankings and the five "risk rankings" criteria (page 46 and Table 3-7), all of which were "based on professional judgment". It also appears that a decision was made to only carry forward measures that resulted in a "low" rankings in all risk categories. If this is correct, then the draft report should state that only increments with "low" rankings in all "risk" categories will be considered for further evaluation, leading to selection of the Tentatively Selected Plan. As discussed above, YCWA does not agree with the Corps' conclusion that only the Lower Yuba River Habitat Restoration measure should be retained for further evaluation.	Contrary to the comment, no decision was made to carry forward only measures with low risk rankings in all categories. Consistent with USACE's NER objective, the efficiency rankings, which do not consider risk, were the primary criteria used in the second level of measure screening. As stated in Section 3.4.4., a definitive breakpoint exists in the overall efficiency ranking, with Lower Yuba River Habitat Restoration being substantially more efficient in providing benefits relative to costs than the next most efficient measure. Lower Yuba River Habitat Restoration was also the only measure ranked as low risk in all risk categories, which supported the use of the efficiency breakpoint to screen measures. For those reasons, the Lower Yuba River Habitat Restoration measures was retained for further evaluation and all other measures were screened from further consideration.
III-54	UNRESOLVED ECOLOGICAL PROBLEM Page 43 - In Section 3.4.4, the text under the heading titled "Unresolved Ecological Problem" states "At Daguerre Point Dam, the extent to which the presence of the dam creates ecological problems is at present poorly defined. While there are perceived problems with fish passage at Daguerre Point Dam, existing fish ladders at the dam currently facilitate upstream passage of salmonids. Downstream passage of juvenile salmonids appears to be potentially impacted to some extent, based on limited screw trap data. In order to quantify ecological outputs that could result from any action at Daguerre Point Dam (i.e., fish bypass, step pools, rock riffle, dam removal, etc.), existing conditions must first be better defined and quantified.	The statements in Section 3.4.5, Unresolved Issues, emphasize the lack of sufficient data to enable the quantification of ecological outputs from fish passage measures at DPD as would be required by USACE policy to support the recommendation of a project. Although the YCWA comment asserts that there is sufficient information, USACE has not found or been provided with sufficient information to meet USACE planning requirements. The lack of sufficient data regarding existing conditions and potential outputs cannot be weighed against cost uncertainties as the comment suggests. USACE policy requires the quantification of both benefits and costs to support a project recommendation. As noted in the previous response, the second level screening of measures was primarily based on efficiency, with risk to efficiency as a secondary consideration.

Comment	Comment Text	Response
	Additional study would be required to: • Better define and quantify specific ecological problems associated with longitudinal river connectivity within the study area; • Better define specific measures to address these specific ecological problems; and • Develop a methodology to quantify ecological outputs of specific measures." Comments YCWA disagrees with these statements. There is sufficient information for the Corps to analyze the specific ecological problems associated with longitudinal connectivity at Daguerre Point Dam, regarding specific measures that could address these problems and the ecological benefits of such measures. Overall, the uncertainties associated with these issues are not significantly greater than the uncertainties associated with the corresponding issues for the Lower Yuba Habitat Restoration measures, and those uncertainties did not stop the Corps from evaluating those measures in the draft report. In fact, the draft report appears to have downplayed some significant uncertainties regarding the potential Lower Yuba Habitat Restoration measures, which makes the draft report seem biased and incomplete. For example, Table 3-6 (on page 45 of the draft report) states that the risk ranking for mercury contamination is "Low". This is questionable, because if transportation and treatment of mercury contaminated sediments is required, then the costs of such transportation and treatment, and thus the total costs of the Lower Yuba Habitat Restoration measure, will be vastly increased. Similarly, the cost risk of acquisition of property rights for lands where Lower Yuba Habitat Restoration measures would occur has only been minimally addressed, and such costs could be significant. Also, as discussed above, the risk of Lower Yuba Habitat Restoration measures being destroyed by high river flows, which may occur on a frequency of at least one in ten years, has not been adequately incorporated into the risk factors in Table 3-7. In summary, the cost-uncertainty risks for the Lower Yuba Habitat Restoration measures actually are equal to or greater than the cost-uncertainty risks associated with the Daguerre	Potential risks associated with the TSP have been addressed during feasibility-level design of the recommended plan. Cost risk for acquisition of property rights has been addressed by inclusion of a cost contingency in the real estate cost estimate.

Comment	Comment Text	Response
	Point Dam Step Pool measure, so the Corps should not have eliminated this measure from further evaluation.	
III-55	FINAL INCREMENTS Page 44 and Figure 3-2 and Table 3-8 on page 47 - "Habitat Increments that would be impacted by potential future actions at Daguerre Point Dam were also eliminated, as shown below in Table 3-8 and Figure 3-2." Comments o Several entries in the "Notes" column in Table 3-8 state "No anticipated effects from potential future action at Daguerre Point Dam." It is not clear why the potential habitat increments that have this statement in Table 3-8 were eliminated from further study. The draft report should be edited to explain this. o The draft report should be edited to explain what hydrologic or hydraulic modeling was used to evaluate potential effects and the extent of those effects upstream and downstream of Daguerre Point Dam. o The draft report should be edited to explain why the potential habitat increments listed in Table 3-8 were removed from further consideration based on potential future actions at Daguerre Point Dam, when the draft report also indicates that potential measures to improve conditions at Daguerre Point Dam will not be considered further in the YRERFS.	Contrary to the comment, only increments that were retained have the annotation “No anticipated effects from potential future action at Daguerre Point Dam” in Table 3-8. The extent of potential effects upstream and downstream of DPD was based on the 2013 Stillwater Sciences report “Modeling Sediment Transport Dynamics and Evaluating Flooding Risks in the Yuba and Feather Rivers, California, Following Modifications to Englebright and Daguerre Point Dams,” prepared for NMFS. That report found that full removal of DPD would result in erosion and deposition effects extending approximately 3 km upstream and downstream of the dam. Future actions at DPD may be considered in a future USACE feasibility study or may be implemented other interests, such as YCWA, without USACE cost-sharing.
III-56	EVALUATION OF ALTERNATIVES • Page 48 - "Number of boulders needed per site will be determined using a hydraulic model." Comment o The document should describe the hydraulic model that would be used and provide documentation regarding model input assumptions and model application.	A USACE approved hydraulic model that is state of the practice or better would be used in PED. Please reference Engineering Appendix C - Section C-6 Civil Design for a discussion of modeling used to date and proposed future modeling efforts.
III-57	AIR QUALITY ENVIRONMENTAL CONSEQUENCES (Draft Report Section 4.3.1)	The assumptions applied to the Air Quality Modeling are adequately documented in the Environmental Appendix D - Attachment 10.

Comment	Comment Text	Response
	Environmental Appendix D Attachment 10 - Air Quality Emissions Modeling states that estimates for quantities and equipment were based on an assumption that the work completed in year 1 would represent approximately a third of the total effort. Comments o YCWA requests that the draft report be edited to explain the basis for this assumption, and to discuss other completed river restoration projects that support this assumption. o The Corps' Proposed Action (NER and TSP, Alternative 5) includes 178.6 acres. It seems highly unlikely that restoration activities for the entire lower Yuba River (i.e., 178.6 acres) could be completed within three years.	
III-58	In Environmental Appendix D Attachment 10 - Air Quality Emissions Modeling, there appear to be some serious misrepresentations in the assumptions that were input into the model. For example: Comments o There is a total of 178.6 acres associated with Alternative 5 and a total of 192.8 acres associated with Alternative 6. o In the Road Construction Emissions Model Data Entry Worksheet on page 4 of Attachment 10, the total project area is repo1ted to be 59.53 acres and the project length is 2.63 miles for Alternative 5. For Alternative 6 (which includes additional habitat enhancement measures), the total project area is reported to be 59.53 acres and the project length is 2.63 miles (page 15 of Attachment 10). Alternative 6 appears to be mischaracterized in the air quality emissions modeling and evaluation. o On page 4 of Attachment 10, the project construction time is reportedly 7 months (for 59.53 acres). To actually construct the 178.6 acres comprising the Proposed Action (i.e., Alternative 5), a much longer construction period probably would be necessary. Also, the in-river work period associated with ESA-listed anadromous salmonids typically extends from July 1 through September 30. It is unclear whether the Corps' assumption of a 7-month per year	Air Quality emissions modeling was scaled to a single construction year, which given a set of worst case scenario assumptions, provides an appropriate estimate of potential project effects evaluated against annualized emission thresholds. The assumptions made in the emissions modeling are described in Appendix D - Attachment 10a. To provide clarification, discussion of the local SMAQMD threshold for GHG emissions were removed from the FR/EA and the a threshold consistent with Federal EPA reporting standards for GHG emissions will be adopted as the basis for significance for project related effects of GHG emissions to climate change. It is the responsibility of the non-federal sponsor to comply with local GHG emission thresholds and it is anticipated that an analysis would be conducted as part of a CEQA compliant analysis, for which the non-Federal sponsor is also responsible. The Final FONSI would be identified as a Mitigated FONSI if appropriate.

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construction period considered this constraint. If not, a 7-month per year construction period may not be realistic. Because nearly all of the proposed measures would involve some component of in river work (or work directly adjacent to the river channel), YCWA suggests that the project construction period for each year be carefully reconsidered. Based upon the assumption of project construction time, the emissions modeling results may be considerably underestimated.
o The Corps' Draft Interim Feasibility Study and EA states Page 68 - ". .. Federal activities may not cause or contribute to new violations of air quality standards, exacerbate existing violations, or interfere with timely attainment or required interim emissions reductions toward attainment."
On page 80, the draft report states "The recommended thresholds adopted by SMAQMD for both the construction phase and operational phase are 1,100 me/Tic tons of C02e, per year. GHG emissions above this level would be considered significant."
On page 81, the draft report states "Although, modeling indicates that Alternative 5 would exceed the SMAQMD recommended thresholds for GHG emissions (Table 4-8.) .. . With the implementation of proper BMPs, improvements to project design and implementation, and acquisition of GHG em1ss10n reduction credits if necessary, it is anticipated that project impacts to climate change would be less than significant. "
Table 4-8. Estimated GHG Emissions from Alternative 5.
<table>
<tr><th>Site Preparation & Construction</th><th>CO_{2e} (metric tons/year)</th></tr>
<tr><td>Total emissions (metric tons/year) in 2022</td><td>1657.72</td></tr>
<tr><td>SMAQMD Recommended Threshold (Metric tons/year)</td><td>1,100</td></tr>
<tr><td>USEPA Reporting Threshold</td><td>25,000</td></tr>
</table>
If the above statement were accurate, then the FONSI would need to be a "Mitigated Finding of No Significant Impact". As described in the CEQ's Final Guidance on Federal Departments and Agencies on the Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact (2011 , 76 FR 3843), "When a FONSI depends on successful mitigation, the requisite mitigation commitments should be made public."
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Comment	Comment Text	Response
	The Draft FONSI simply states "Best management practices, avoidance protocols, and minimization and mitigation measures as summarized within this FR/EA, would be implemented." Although the Corps' Draft Interim Feasibility Study and EA includes some general statements about implementing BMPs and improving project design, there are no descriptions of the specific project design improvements that would be implemented to reduce emissions impacts. Additionally, although there is a general list of air quality BMPs (p. 73 and p. 74), presumably these BMPs were identified based upon the level of impact identified from the air quality emissions modeling results. However, because the emissions modeling does not seem to be correct, it is uncertain whether the listed BMPs will be adequate to minimize and avoid impacts to reduce emissions below the SMAQMD threshold. According to 76 FR 3846, "When agencies do not document and, in important cases, monitor mitigation commitments to determine if the mitigation was implemented or effective, the use of mitigation may fail to advance NEPA 's purpose of ensuring informed and transparent environmental decision making. Failure to document and monitor mitigation may also undermine the integrity of the NEPA review."	
III-59	LOWER YUBA RIVER FLOWS Page 88-89 - YCWA requests that the second paragraph of this section be edited as indicated here. Englebright is a 260 ft concrete arch dam originally constructed to trap mining sediments and debris. The dam also maintains water elevations that are used for the generation of hydroelectric power and recreational activities, and the reservoir serves as an afterbay for peak power generation at the New Colgate Powerhouse. During normal flow conditions, water is released from Englebright reservoir through PG&E's Narrows I Powerhouse and YCWA's Narrows II Powerhouse. These water releases are administered by PG&E and YCWA to maintain Yuba Accord instream flows for fisheries, while also generating hydroelectric power, providing surface water for irrigation, maintaining Englebright Reservoir water surface elevations within a range suitable for recreation, and other beneficial uses. During high	The Affected Environment description for Englebright and Daguerre Point dams has been revised. The statement regarding water diversions at DPD has been revised to remove the implication that none of the diversions existed prior to the dam.

Comment	Comment Text	Response
	flows, unregulated flows pass over <u>the top of</u> Englebright dam into the lower Yuba River. Approximately halfway between Englebright Dam and the Yuba-Feather River confluence is Daguerre Point Dam. This 25 ft. dam was originally constructed to trap hydraulic mining debris. ~~In later years, the head of water created by the dam was leveraged to support several water diversions.~~ Daguerre Point Dam affects the hydrology and hydraulics of the lower Yuba River by providing base level control for incision for the reach immediately upstream. The dam also creates a river stage differential; the river stage above Daguerre Point Dam is more than 20 feet greater than the river stage below the dam. As a result of this differential and as a result of the high permeability of the Goldfield's rocky soil, water from the Yuba River enters the Goldfield area from above Daguerre Point Dam and then migrates down gradient through the Goldfields, forming interconnected ponds and canals throughout the area (DWR, 1999). ~~During all flows, 'Water passes over the crest of the dam.~~ The draft report's statement that "*In later years, the head of water created by the dam was leveraged to support several water diversions*" is not correct and should be deleted. The Hallwood-Cordua Diversion preceded the construction of Daguerre Point Dam and its intake was incorporated into the north side of the dam. The statement "*During all flows, water passes over the crest of the dam*", is not accurate and should be deleted.	
III-60	CALIFORNIA CENTRAL VALLEY STEELHEAD DPS Page 110-"When NMFS completed a 5-year status review of the species, indicated that the biological status of the species has declined since the previous 5-year review (NMFS 2011)." Comment o It is unclear why the draft report refers to an outdated status review report (NMFS 2011) and not to the best available information regarding the status of steelhead in the Central Valley. In May 2016, NMFS completed a 5-year status review of the Central Valley steelhead DPS, which should be used to describe the status of steelhead.	The citation and supporting information will be updated in the Final FR/EA as appropriate.

Comment	Comment Text	Response
III-61	CENTRAL VALLEY SPRING-RUN CHINOOK SALMON Page 110 - "Status: On September 16, 1999, the central valley Spring-run Chinook salmon was listed as a Federally "threatened" species by the NMFS (64 FR 50394). After review, NMFS updated this listing on April 14, 2014 (79 FR 20802)." Comment o It is unclear why the draft report does not refer to the best available information regarding the status of spring-run Chinook salmon in the Central Valley. In April 2016, NMFS completed a third 5-year status review of the Central Valley spring-run Chinook salmon ESU. The draft report does not refer to the NMFS (2016) document, and does not describe the conclusions presented in it regarding the status of spring-run Chinook salmon.	The citation and supporting information will be updated in the Final FR/EA as appropriate.
III-62	Page 110 - "The adult holding period in the lower Yuba River is typically from August through March ... " Comment o This statement is not correct, and it is unclear why the draft report does not refer to the most recent, best available information regarding spring-run Chinook salmon life history periodicities in the lower Yuba River. As part of the FERC relicensing process for YCWA's Yuba River Development Project (FERC Project No. 2246), YCWA submitted an Amended Application for a New License to FERC in June 2017 http://www.ycwa-relicensing.com, which included an Applicant-Prepared Draft Biological Assessment (BA). As described in the Applicant-Prepared Draft BA, the steelhead adult immigration and holding period extends from August through March in the lower Yuba River.	Text in the report will be revised as recommended.
III-63	Page 111 - "In April and June, adult spring-run Chinook salmon will migrate into the lower Yuba River." Comment o This statement is not correct, and it is unclear why the draft report does not refer to the best available information regarding spring-run Chinook salmon life history periodicities in the lower Yuba River. As described in the Applicant-Prepared Draft BA, the spring-run Chinook	Text in the report will be revised as recommended.

Comment	Comment Text	Response
	salmon adult immigration and holding period extends from April through September in the lower Yuba River.	
III-64	Page 111 - "Spawning will begin in September and continue through October." Comment o This statement is not correct, and it is unclear why the draft repo1t does not refer to the best available information regarding spring-run Chinook salmon life history periodicities in the lower Yuba River. As described in the Applicant-Prepared Draft BA (YCWA 2017), the spring-run Chinook salmon adult spawning period extends from September through mid-October in the lower Yuba River.	Text in the report will be revised as recommended.
III-65	Page 111 - "Although dependent upon water temperatures, central valley Spring-run Chinook salmon embryo incubation occurs September through March within the lower Yuba River (HDRISWRI 2007) and the fry then disperse downstream after emerging." Comment o This statement is not correct, and it is unclear why the draft report does not refer to the most recent, best available information regarding spring-run Chinook salmon life history periodicities in the lower Yuba River. As described in the Applicant-Prepared Draft BA (YCWA 2017), the spring-run Chinook salmon embryo incubation period extends from September through December in the lower Yuba River. Fry rearing in the lower Yuba River occurs from mid-November through mid-February (YCWA 2017).	Text in the report will be revised as recommended.
III-66	AFFECTED ENVIRONMENT Page 117 - "The lower Yuba River is currently operating under the lower Yuba River Accord flow regime, which is a joint project between the Yuba County Water Agency and the United States Department of the Interior-Bureau of Reclamation to manage the interests of approximately 17 stakeholders in the area to balance interests of irrigation, conservation, water supply, and fisheries concerns (USACE 2014)." Comments	The description of the Yuba Accord will be revised as recommended: "In 2007, minimum instream-flow requirements were established by the Yuba Accord (YCWA 2007) to balance consumptive water use with the habitat needs of fish and wildlife. YCWA developed and negotiated an innovative set of agreements that together form a framework- the Lower Yuba River Accord (Yuba Accord)- that resolved nearly 20 years of controversy and litigation over instream flow requirements for the lower Yuba River. The Yuba Accord enables YCWA to operate the Yuba River Development Project (FERC No. 2246) for hydropower, irrigation, flood control, recreation

Comment	Comment Text	Response
	o The above statement is not correct. The Yuba Accord is not a "joint project between YCWA and the Bureau of Reclamation to manage the interests of approximately 17 stakeholders .... " o YCWA developed and negotiated an innovative set of agreements that together form a framework- the Lower Yuba River Accord (Yuba Accord)- that resolved nearly 20 years of controversy and litigation over instream flow requirements for the lower Yuba River. The Yuba Accord enables YCWA to operate the Yuba River Development Project (FERC No. 2246) for hydropower, irrigation, flood control, recreation and fisheries benefits in an innovative manner that surpasses the YRDP's original requirements. As a comprehensive settlement agreement, the Yuba Accord was the final product of nearly three years of intense negotiations among 17 stakeholders, including local irrigation districts, state and federal resource agencies, and conservation groups. The Yuba Accord is composed of three interrelated agreements: (1) the Lower Yuba River Fisheries Agreement, which specifies lower Yuba River minimum stream flows and creates a detailed fisheries monitoring and evaluation program; (2) the Water Purchase Agreement, under which YCWA provides annual water supplies for fish and wildlife purposes in the Bay-Delta, CALFED's Environmental Water Account, the State Water Project and the Central Valley Project; and (3) the Conjunctive Use Agreements, which specify the terms of the Yuba Accord's conjunctive use program. The State Water Resources Control Board (SWRCB), in Corrected Water Right Order 2008-0014, amended YCWA's water-right permits to add the Yuba Accord minimum instream-flow requirements, which YCWA had been implementing under pilot programs since 2006.	and fisheries benefits in an innovative manner that surpasses the YRDP's original requirements. As a comprehensive settlement agreement, the Yuba Accord was the final product of nearly three years of intense negotiations among 17 stakeholders, including local irrigation districts, state and federal resource agencies, and conservation groups. The Yuba Accord is composed of three interrelated agreements: (1) the Lower Yuba River Fisheries Agreement, which specifies lower Yuba River minimum stream flows and creates a detailed fisheries monitoring and evaluation program; (2) the Water Purchase Agreement, under which YCWA provides annual water supplies for fish and wildlife purposes in the Bay-Delta, CALFED's Environmental Water Account, the State Water Project and the Central Valley Project; and (3) the Conjunctive Use Agreements, which specify the terms of the Yuba Accord's conjunctive use program. The State Water Resources Control Board (SWRCB), in Corrected Water Right Order 2008-0014, amended YCWA's water-right permits to add the Yuba Accord minimum instream-flow requirements, which YCWA had been implementing under pilot programs since 2006."
III-67	Page 117-"In 2007, Instream flow requirements were codified by the Yuba Accord (YCWA 2007) to maintain suitable habitat in the lower Yuba River for fish and wildlife." Comments o This statement is not correct, for several reasons. • The instream flow requirements for the lower Yuba River were not "codified" by the Yuba Accord.	The description of the Yuba Accord will be revised and combined with recommended revisions under response III-66.

Comment	Comment Text	Response
	• The Yuba Accord instream flow requirements were not developed to maintain suitable habitat for wildlife. • The State Water Resources Control Board amended YCWA's water-right permits to add the Yuba Accord minimum instream-flow requirements in 2008.	
III-68	KNOWN CULTURAL RESOURCES Page 130 - "Daguerre Point Dam appears to represent a rather unique and old water and sediment control feature associated with a significant aspect of California's history. Portions of the dam are likely more than 100 years old, dam modifications were completed more than fifty years ago, it largely functions as originally intended, and fish passages were added relatively early. The dam is therefore potentially eligible for NRHP listing. However, Daguerre Point Dam has not been fully recorded using the California State Department of Recreation Form 523B for buildings, structures, or objects and it has not been formally evaluated using NRHP Criteria A, BC, or D." Comment o The concept that Daguerre Point Dam is a historical structure never has been suggested before. Because these statements are not necessary for the draft report and could have unintended legal consequences, YCWA recommends that they be deleted from the draft report.	The assessment of Daguerre Point Dam's potential eligibility for NRHP listing is relevant in the context of this study and given its location in the APE may require evaluation under the Programmatic Agreement executed for this study in compliance with the National Historic Preservation Act.
III-69	MIGRATORY BIRD TREATY ACT OF 1928, AS AMENDED; 16 U.S.C. 715, ET SEQ Page 151-The section addressing the Migratory Bird Treaty Act states "Unless permitted by regulations, this law prohibits anyone to "pursue, hunt, take, capture, kill, attempt to take, capture or kill ... any migratory bird ... or any part, nest, or egg of any such bird'. Comments o The parts of this statement regarding incidental take are incorrect and should be updated. o On Dec. 22, 2017, the U.S. Department of the Interior (USDOI) issued Memorandum M-370501, which concludes that the Migratory Bird Treaty Act (MBTA), 16 U.S.C. § 703, does not prohibit the	The MEMORANDUM FOR COMMANDERS, MAJOR SUBORDINANTE COMMANDS AND DISTRICT COMMANDS, CHIEFS, OPERATIONS DIVISIONS; SUBJECT: Migratory Bird Treaty Act and Incidental Take; issued by the Corps of Engineers Director of Civil Works on March 22, 2018, describes USACE's Policy with regard to the Migratory Bird Treaty Act. 1. The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712) makes it unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, or kill any migratory bird, any part, nest, or egg of any such bird, or to attempt to do the same, among other prohibited activities. The Act protects nearly all species native to the United States, approximately ten percent of which are also protected

Comment	Comment Text	Response
	incidental taking of migratory birds. USDOI reads the MBTA's prohibitions on pursuing, hunting, taking, capturing, killing or attempting to do the same as applying only to affirmative actions that have as their purpose the taking or killing of migratory birds, their nests or their eggs. The opinion is significant because it reverses USDOI's prior interpretation of the MBTA as prohibiting incidental taking or killing of migratory birds.	by the Endangered Species Act. Historically, this prohibition had been interpreted by the U.S. Department of the Interior (DOI) to apply to both deliberate acts intended to take or kill migratory birds as well as the incidental taking or killing of such birds. That interpretation was overturned on December 22, 2017, when the DOI Office of the Solicitor issued Solicitor's Opinion M-37050 that interpreted the statute as not prohibiting incidental take but instead only applying to "direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing, to human control." This change in the DOI interpretation raises the question of whether other federal agencies can or should change their approach to avoiding the incidental take of migratory birds. 2. Any consideration of a new approach to protecting migratory birds also needs to take into account the courts' interpretation of the MBTA, other authorities that require migratory birds to be protected, and the agency's own authorities and missions. To date, five Circuit Courts of Appeal have addressed the question of whether the MBTA prohibits incidental take or only intentional take. The courts are spilt in how they interpret the statute. Only the Supreme Court can provide a definitive interpretation. Separately, the Fish and Wildlife Coordination Act (16 U.S.C. 661-666c) and Executive Order 13186 impose upon federal agencies certain requirements aimed at conserving migratory birds. Additionally, the U.S. Army Corps of Engineers Environmental Operating Principles provide that the Corps will "proactively consider environmental consequences of all Corps activities and act accordingly." 3. In light of the uncertainty regarding the correct interpretation of how the MBTA applies to incidental take and in light of the other authorities and policies that encourage or require the conservation of migratory birds, the Corps will continue to work to minimize the incidental take of migratory birds to the extent practicable, and will coordinate as appropriate with the U.S. Fish and Wildlife Service, until further clarification is provided. This is consistent with direction provided by the Deputy Assistant Secretary of Defense for Environment, Safety and Occupational Health in a memo dated February 6, 2018 (enclosed).

Comment	Comment Text	Response
III-70	SCOPING COMMENTS Page 156 - "Many commenters expressed a specific interest in the study evaluating potential fish passage opportunities associated with USA CE owned dams (Daguerre Point Dam and Englebright Dam). Fish passage at these and other barriers in the watershed is complicated by ongoing resource use and legacy environmental challenges. There is a general desire and expectation for this feasibility study to evaluate and recommend a plan that progresses or ends the ongoing debate over the natural resource management in the watershed. Participation in public meetings and submission of comments reflects an engaged public with a high level of awareness of issues and interest in outcomes. Although the range of proposed restoration actions included in the TSP would result in significant ecosystem restoration outcomes, the absence of proposed solutions to fish passage (connectivity) problems may be perceived as disappointing." Comments o The statement that "fish passage (connectivity) problems may be perceived as disappointing" is a huge understatement. Not only were there numerous public scoping comments regarding the need for fish-passage improvements, the Corps identified fish passage options as potential measures to be implemented by the YRERFS during the public scoping that was conducted in 2015. Also, as discussed earlier in these comments, it appears that the draft report's screening analysis gave improperly low rankings to the Daguerre Point Dam Step Pool measure. For these reasons, YCWA strongly encourages the Corps to reconsider the Daguerre Point Dam Step Pools measure and to include it in the Corps' final array of alternatives for evaluation in the Report of the Chief of Engineers.	Comment noted.
III-71	FEATURES AND ACCOMPLISHMENTS Page 160-" ... a draft Monitoring and Adaptive Management Plan is included as Appendix D, Attachment 6 of this report. Monitoring and Adaptive Management costs are currently estimated to be $739,200 for monitoring and $3,011,500 for adaptive management." Comments	Comment noted.

Comment	Comment Text	Response
	o YCWA was not involved in the development of the cost estimate associated with a Monitoring and Adaptive Management Plan, and YCWA has not received the Corps' cost estimates that were used to develop the monitoring and adaptive management cost estimates that are specified on page 160 of the Corps Draft Interim Feasibility Report and EA. YCWA requests a copy of the Corps' cost estimating materials for review, or the Corps should include this information as an attachment to the draft report.	
III-72	ENVIRONMENTAL OPERA TING PRINCIPLES Page 161- "The proposed habitat restoration is a sustainable solution." Comments o There is not sufficient support for this statement in the draft report, so YCWA recommends it be deleted. o YCWA and others have questioned the sustainability of the potential Lower Yuba Habitat Restoration measures, and have inquired as to what eff01ts have been undertaken by the Corps to identify areas of the river channel where such measures could be persistent and unstainable. Considering that the high 2017 river flows substantially altered the lower Yuba River channel in some areas, this should be an important consideration when potential habitat increments are developed and evaluated.	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.
III-73	MONITORING AND ADAPTIVE MANAGEMENT Page 163 - "Per Section 2039 of Water Resources Development Act (WRDA) of 2007, as amended, monitoring will continue until the Secretary of the Army determines the criteria for ecosystem restoration success have been met. Necessary monitoring for a period not to exceed ten years from the completion of construction will be cost-shared as a construction cost. Any additional monitoring beyond ten years will be the responsibility of the non-Federal sponsor." Comment o The fact that, under the Corps' proposed approach, YCWA as the non-Federal sponsor would be responsible for any additional monitoring beyond ten years, highlights the critical importance of the need for the Corps to consider YCWA's comments regarding the	Comment noted.

Comment	Comment Text	Response
	sustainability of the potential Lower Yuba Habitat Restoration measures and the costs of maintaining, repairing, replacing and rehabilitating them.	
III-74	OPERATION, MAINTENANCE, REP AIR, REPLACEMENT, AND REHABILITATION • Page 163 - "The non-Federal sponsor will need to periodically inspect the project to prevent encroachments or other damage caused by human activities and to determine whether any repair, replacement, or rehabilitation of project features is needed." • Page 164 - "Repair, Replacement and Rehabilitation actions are to conform to the project as-built plans and specifications unless other arrangements are made with the district commander." If rehabilitation of the project is required because of natural changes in the morphology of the river channel and floodplain, conforming the project to the original plans and specifications may not be the most practical or ecologically preferable method of providing the intended ecological outputs of the project. Therefore, the Sacramento District commander would consider other plans proposed by the non-Federal sponsor for rehabilitation of the project that would provide equivalent ecological outputs within the project site." • Page 164 - "Subsequent to the completion of the design of the project features and prior to construction, a draft OMRR&R manual would be prepared in coordination with the non-Federal sponsor and affected resource agencies. A final OMRR&R manual would be prepared after the completion of construction and provided to the non-Federal sponsor." Comments o The draft report should be edited to explain how "equivalent ecological outputs" would be determined. o If YCWA were to be the entity responsible for conducting OMRR&R, then YCWA must have a substantial role in the development of the OMRR&R Manual. Simply being provided with the final manual from the Corps would not be acceptable to YCWA,	Criteria for post-construction evaluation of ecological outputs have been included in the Monitoring and Adaptive Management (MAM) Plan. It is anticipated that similar criteria will be included in the OMRR&R manual to define OMRR&R requirements after MAM has been completed. The OMRR&R manual will be prepared in consultation with YCWA, as the non-Federal sponsor, as required by USACE regulation. Section 103 of the Water Resources Development Act of 1986, as amended, requires the non-Federal sponsor for an ecosystem restoration project to accept full responsibility for OMRR&R of the project. USACE does not have the authority to modify that requirement.

Comment	Comment Text	Response
	nor would YCWA being fully responsible for OMRR&R be acceptable to YCWA.	
III-75	REAL ESTATE o Page 164 - "The non-Federal sponsor will be responsible for the acquisition of about 176 acres in fee title along with about 12 acres of temporary work area easements and 8 acres of staging sites and access routes to implement the TSP. In addition, implementation of the TSP would require acquisition of 24 parcels with severed mineral rights. Mineral rights would be acquired at fair market value." Comments o Appendix E (Real Estate) to the Corps' Feasibility Report estimates a total cost of about $6M to purchase the requisite 196 acres of land, plus 24 parcels of mineral rights at fair market value. The real estate appendix (p. 14) indicates that the cost estimate was approved on November 24, 2017. YCWA does not have sufficient information on the current or future fair market value of these land acquisition costs, or whether $6M accurately reflects cost estimates as of November 2017. o Appendix C (Engineering) states on page C-40 "Due to significant uncertainties regarding real estate costs and mineral rights, a 50% contingency was used for Land and Damages." However, there is no reference to a 50% contingency in Appendix E (Real Estate), and it does not appear that a 50% contingency was applied to the cost estimates in the real estate appendix. Thus, the actual costs that would be incurred by YCWA associated with acquiring 196 acres of land, plus 24 parcels of mineral rights at fair market value are highly questionable, and require further consideration and cost refinement.	Real Estate Costs were re-evaluated for the recommended plan and Class III cost estimates. The recommended Real Estate cost with contingency was incorporated directly into Total Project Cost Summary Sheets and escalated for the time of expected acquisition.
III-76	PLAN ECONOMICS AND COST SHARING As described on page ES-5, the National Environmental Restoration (NER) plan (Alternative 5) has been identified as the plan that would reasonably maximize ecosystem restoration benefits in the Yuba River watershed relative to costs, restoring about 178.6 acres at an estimated cost of $96.76 million. (See also p. 165, Table 8-1.) The estimated annual OMRR&R cost is $1,470,000 (see p. ES-7).	The final feasibility report includes a certified cost estimate based upon the feasibility level design for the recommended plan that is more detailed than the preliminary cost estimate for the TSP that was presented in the draft report. Estimated OMRR&R costs have also been reevaluated based on the feasibility level design and final MAM Plan. If the recommended plan is authorized by Congress, the total first project cost will be limited by Section 902 of WRDA 1986, as amended; however, there will be no predetermined limit to non-federal sponsor’s OMRR&R costs. The requirement for the non-

Comment	Comment Text	Response
	The Federal portion of the estimated first cost, based on October 2017 price levels, is $62,891,000. The non-Federal portion of the estimated first cost is $33,864,000 (see p. ES-7). Monitoring and Adaptive Management costs are currently estimated to be $739,200 for monitoring and $3,011,500 for adaptive management (see p. 160). Necessary monitoring for a period not to exceed ten years from the completion of construction would be cost-shared as a construction cost. Any additional monitoring beyond ten years would be the responsibility of the non-Federal sponsor (see p. 163) under the Corps' approach. The non-Federal sponsor would be responsible for the acquisition of about 176 acres in fee title along with about 12 acres of temporary work area easements and 8 acres of staging sites and access routes to implement the TSP. The Corps' estimate of non-Federal sponsor real estate costs is about $5.9 million. In addition, implementation of the TSP would require acquisition of 24 parcels with severed mineral rights. Mineral rights would be acquired at fair market value (seep. 164). As stated on page 23, removal of any Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulated wastes would be a responsibility of the non-Federal sponsor (e.g., contaminated sediment). Comment o As YCWA's previous comments indicate, much work needs to be done to better estimate costs in numerous categories, including those that YCWA would be responsible for as the non-Federal sponsor under the Corps' proposed approach. YCWA will not agree to open ended funding responsibilities as the non-Federal sponsor. Instead, YCWA is willing to work with the Corps to develop methodologies for developing program components that would be cost effective and sustainable, for estimating costs and an approach to OMRR&R and related issues. As the non-Federal sponsor, YCWA understands the cost sharing requirements required by law for implementation of a federally authorized ecosystem restoration project, such as the proposed Yuba	federal sponsor to perform OMRR&R of the nonstructural and non-mechanical features of the project will cease ten years after the ecological restoration success criteria for MAM Plan have been met.

Comment	Comment Text	Response
	River Ecosystem Restoration Project. However, YCWA is also aware that the estimates presented in this draft report are preliminary and were developed to support a recommendation for authorization. After project authorization, and prior to construction, YCWA expects to partner with the Corps in the design phase to develop detailed designs and develop the final OMRR&R Manual. A Project Partnership Agreement, detailing the required cost sharing requirement for the project and updated cost estimates will be executed prior to project construction, including LERRD acquisition, and OMRR&R of the completed project.	
III-77	RISK AND UNCERTAINTY o Page 166 - "There is a risk that severe conditions may alter restoration features and potentially reduce the effectiveness of the proposed project. However, the proposed habitat restoration measures were designed based on extensive hydrologic and geomorphic analysis. Flooding during the winter of 2016-2017 demonstrated the fidelity of project designs. Record setting precipitation and snow pack run-off caused the Yuba River to flood, which created an anabranching channel at river mile 4 as previously proposed in project designs. Essentially, hydrologic and geomorphic analysis adequately influenced the measures to mimic natural processes. Although the flooding event validated the likely performance of restoration designs, risk still remains. Currently, this risk is addressed through cost contingency." Comments o The draft report should be edited to describe the "extensive hydrologic and geomorphic analysis" that was conducted by the Corps and purportedly demonstrated the fidelity of project designs. o The statement that "the flooding event validated the likely performance of restoration designs" does not appear to be correct, pa1ticularly when many of the proposed habitat measures are no longer even feasible at their identified site locations because the river channel changed so dramatically as a result of the 2017 high river flows (see example photos in YCWA's general comment on sustainability, above). o The draft report refers to a anabranching channel at River Mile 4, which was created when high river flows during 2017 eroded many	Please refer to the discussion of the major thematic concern "Habitat Measure Design, Risk, and Resiliency" at the beginning of the Public Involvement Attachment 9B - Response to Public Comments.

Comment	Comment Text	Response
	acres of a long-established orchard adjacent to the lower Yuba River (see figures below from 2013 and 2017). This dramatic change in channel configurations that occurred as a result of the 2017 high flow event did not "validate the likely performance of restoration designs". To the contrary, the example at this location clearly demonstrates the dynamic nature of the lower Yuba River and the need for a thorough analysis of physical sustainability and persistence of proposed habitat enhancement measures. If the planform geometry of the river so dramatically changed at this location (despite the establishment of mature terrestrial vegetation in the form of orchards) during just one high flow event, this planfo1m geometry is subject to dramatically change again during the next high flow event. Clearly, the imagery below demonstrates that a more rigorous analysis of geomorphic conditions (e.g., bed shear stress, minimum stable grain diameter, Froude number, energy slope) needs to be conducted to determine whether the proposed habitat enhancement measures in the lower Yuba River actually would be sustainable.	
III-78	Page 168- Under "Non-Federal Responsibilities", the draft report should be edited to refer to YCWA's responsibilities under the California Environmental Quality Act. Comment The following language should be added under the header titled "Non-Federal Responsibilities": "It is the intention of the non-Federal sponsor to implement analysis and consultation under the California Environmental Quality Act (CEQA) after Congressional authorization and before the PPA is signed."	Section 8.2.4 has been revised to identify the sponsor's responsibility for CEQA compliance.
III-79	The Corps' Draft Interim Feasibility Report and EA includes the following references to modeling: Page 59 - "The steelhead Habitat Suitability Model was developed based on information specific to the Yuba River. YCWA and the Yuba River Development Project Relicensing Participants collaborated in the development of habitat suitability criteria for fish species and life stages to be used in the lower Yuba River instream flow model. These criteria were used to develop the Juvenile Steelhead Habitat Suitability	As a measure to ensure quality in decision making, USACE Policy (EC 1105-2-412) requires that planning models used in support of USACE studies be certified by USACE. No suitable certified model was available for use in the development of ecosystem outputs. The 2-D model (hydraulic model) mentioned in the comment is considered to be an 'engineering model' rather than a 'planning model'and does not, independent of a planning model, facilitate development of ecosystem outputs. The Juvenile steelhead HSI does require inputs from a hydraulic model and while the 2-D model

Comment	Comment Text	Response
	Index (HSI) Model, which has been reviewed by the Eco-PCX and recommended to USACE Headquarters for approval for one time use." Comments A readily available 2-D model for the lower Yuba River was not used, and the Corps instead undertook an independent process to develop its own 2-D model (with a much lower resolution) for the YRERFS. It is unclear how, or even if, the Corps actually used the model they developed to identify or evaluate alternatives. In developing a new "Juvenile Steelhead Habitat Suitability Index (HSI) Model", when a far superior model (SRH-2D) for the lower Yuba River was already available that already incorporated the Relicensing Participants' habitat suitability criteria, the Corps did not use the best available science in supporting its evaluations.	mentioned in the comment is capable of providing inputs, engineering models are also subject to review/ approval requirements. USACE determined that the effort required in the review and approval for use of the 2-D model developed by YCWA would exceed the effort required for the PDT to develop a new model using a USACE approved HEC-RAS model. The development of the HEC-RAS model was expedited by incorporating supporting information from the 2-D model as appropriate.
III-80	In Environmental Appendix D, Attachment 7 - Model Approval Documents, the text states "The Juvenile Steelhead HSI Model was approved for use by the USACE HQ Model Certification Panel for single-use in the Yuba River Ecosystem Restoration Feasibility Study. An official memo documenting the approval is being drafted [to be dated October 31, 2017] and will be included in the Final Feasibility Report/ Environmental Assessment. " Comments It is concerning that, as part of both the feasibility study process and the NEPA review process, the Corps did not provide YCWA or other stakeholders any opportunity to review or provide input to the Corps' modeling documentation that was developed for the YRERFS. YCWA, as the non-Federal sponsor for this study, recommends that project documentation accurately represent the process undertaken leading to this draft report.	Comment noted.
III-81	The Corps' Draft Interim Feasibility Report and EA does not provide the hydraulic modeling results that presumably were used to evaluate project impacts. Environmental Appendix D Attachment 8 - Habitat Evaluation Assessment Approach Technical Memorandum makes numerous references to the use of a "hydraulic model", which was used to provide various inputs for the evaluation. The document (p. 15)	Appendix C - Engineering of the Draft FR/EA described the RAS2D modeling that was used for benefit calculations and plan selection. For the Final FR/EA, the RAS2D modeling discussion was moved to Appendix D Attachment 8 to integrate the discussion with other benefit modeling information.

Comment	Comment Text	Response
	indicates that the "USACE's Hydro logic Engineering Center River Analysis System 2D (HEC-RAS- 2D)" hydraulic model was used to develop depth and velocity estimates, and that the "hydraulic model was developed based on an existing digital elevation model developed collaboratively by YCWA". However, neither Attachment 8 nor any other part of the Corps' Interim Draft Feasibility Repo1t and EA provides: (1) a description of the Corps' HECRAS- 2D hydraulic model that was used; (2) a detailed description of the inputs and assumptions used in the modeling application; or (3) a modeling appendix to characterize the details of the model. Additionally, the statement on page 15 of Attachment 8 is not correct. YCWA provides the following recommended edits. " ... hydraulic model was developed based on an existing digital elevation model developed by YCWA in collaboration with the Yuba Accord River Management Team".	The statement on page 15 of Attachment 8 has been updated as recommended.
III-82	Page C-5 of Appendix C (Engineering) states "42 years of flow record representing the Yuba River below Deer Creek were obtained from the Proposed Project and Base Case scenarios from the YCWA relicensing website (YCWA 2012a, 2012b). The flow record was utilized to develop an annual average flow and bins of flow frequency over the period of record. 42 years of mean daily data is a robust data set that allows for a straightforward frequency analysis based on number of observations in a range vs total observations for the data set." Comment The statements above regarding 42 years of flow record are not correct. YCWA's Yuba River Development Project Water Balance and Operations Model simulates operations on a daily time step over 41 years of hydrology (i.e., WYs 1970 through 2010).	The report will be updated to reflect the correct model period as recommended.
III-83	Appendix C (Engineering) states the following: Page C-5 - "Flow observations for each calendar year were averaged, giving a data set of 42 average annual flow rates. Outlier flows greater than bankfull flow were assigned a bankfull value of 5, 000 cfs for purposes of determining an average annual flow, so that outliers (extreme, infrequent events) did not disproportionately skew the	The flows used in RAS2D modeling utilized analysis in "modeled Flow Considerations" and "Design Criteria" Technical Memos as a guide to probable and ecologically relevant flows. In accordance with SMART Planning principles, the flow scenarios for RAS2D scenarios needed to be of sufficient detail to inform the GIS-based HEP calculation workflow while balancing l time, budget

Comment	Comment Text	Response
	average. The 42 average annual flow rates were then averaged, yielding an annual average of 1816 cfs. This average annual value was rounded to 1,850 cfs and was chosen as the target value for a bin, since average annual is an intuitive and representative value for the system." Page C-6 - "summary of the bins and the observations within them for the 750, 1,850, and 5,000 cfs flow scenarios" in Table 2 titled "Summary of hydraulic modeling representative flows and binning of observations, Yuba River below Deer Creek. Comments There are several errors in the selection of flows for modeling application in the Corps' Draft Interim Feasibility Report and EA. First, given the fact that a daily operations model is readily available to simulate daily flow conditions in the lower Yuba River over a 41-year period of record (1970 through 2010), the Corps' approach of "binning" flows into only three representative categories does not appropriate or technically robust for impact evaluation purposes. Second, averaging all of the flows for a given year is not an appropriate technique for determining a flow category for evaluation purposes. Using an annual average flow as the basis of the analysis compromises the integrity of the analysis because: (1) averaging loses indicators of magnitude, duration and frequency - which are important considerations in a hydrologic analysis; and (2) averaging over an entire year masks the flows that would be occurring and inundating habitat measures during target time periods - whether the spring time rearing period, or the critical juvenile anadromous salmonid over-summer rearing period. Third, the Corps' approach of capping flows greater than 5,000 cfs is not appropriate because it is a misrepresentation of the true average. Fourth, the appropriateness of the Corps' approach of "rounding" from 1,816 cfs up to 1,850 cfs is unsubstantiated. Fifth, over several months during 2016, YCWA met with the Corps to discuss flow-related modeling considerations. YCWA informed the Corps that YCWA (2013) developed datasets containing modeled depth and velocity values for the lower Yuba River that were created	and resource constraints and allowing for flexibility in integrating RAS2D modeling with the GIS-based HEP calculation workflow. Three flow scenarios that were binned and frequency weighted were concluded to be an adequate compromise between these factors. Simplifying assumptions (e.g. rounding 1816 cfs to 1850 cfs, a change of less than 2%) were concluded of a comparable scale as uncertainties in topography, HEP relationships, etc. Use of the frequency-weighted three flow scenarios as part of the overall GIS-based HEP calculation workflow was approved by the USACE Eco PCX.

Comment	Comment Text	Response
	from YCWA's 2D hydraulic model, which was run for between 21and28 different flows ranging from 300 cfs to 110,400 cfs, depending upon specific hydro logic zones. YCWA also prepared a Modeled Flow Considerations technical memorandum (a copy of which is the third document in Attachment 1) that described the modeled flows as input to the 2D model, along with descriptions of the "significance" of each flow. YCWA's technical memorandum then provided the percent exceedance for flows proposed to be modeled for the YRERFS, as determined in YCWA (2013). Neither of the two lower flows (750 and 1,850 cfs) selected by the Corps were flows identified in YCWA's memorandum. Because the Corps' representative flows of 750 and 1,850 cfs are not included in YCWA's Modeled Flow Considerations technical memorandum, the significance of why the Corps' believes that 750 and 1,850 cfs are representative of conditions in the lower Yuba River should be described in the assessment approach presented in Appendix C of the Corps Draft Interim Feasibility Report and EA. YCWA previously provided this comment to the Corps in YCWA's August 11, 2017 comments on the Corps' Habitat Evaluation Assessment Approach Technical Memorandum, which are also provided in Attachment 1.	
III-84	Appendix C (Engineering) states: "The topography for the HEC-RAS 2D model was previously collected by I) the University of California at Davis and 2) Under contract for the Central Valley Floodplain Evaluation and Delineation (CVFED) Task Order 24. Base Terrain was taken from the Central Valley Floodplain Evaluation Delineation (CVFED) LIDAR 2008 data set for without-project ... " Comment LIDAR data specific to the lower Yuba River were collected in 2008. Therefore, it is unclear why the Corps chose to use a LIDAR dataset for the Central Valley, rather than utilizing the LID AR dataset for the lower Yuba River.	The base terrain from the Central Valley Floodplain Evaluation Delineation (CVFED) LIDAR 2008 data set was determined to be of sufficient level of detail to support ecosystem benefits modeling.
III-85	"The model mesh for YRERFS was generated from a combination of available terrain along with the project related features to be evaluated ... The model mesh was generated over the supplied terrain with a	The RAS2D modeling performed was of sufficient detail to calculate benefits of different flow scenarios while balancing computational time and flexibility in integrating RAS2D modeling with the GIS-

Comment	Comment Text	Response
	Computational Points Spacing of DX=IOO and DY=IOO. This JOO (ft.) grid contains 39, 199 cells where the average cell size is 7,907 square feet (sq.ft.), the maximum cell size is 25,343 feet, minimum cell size is I 03 sq. ft." Comment As discussed during over a year of model-related discussions with the Corps, and because a 2-D hydrodynamic model (SRH2D) with a 3 x 3 ft computational mesh resolution is available for the lower Yuba River, YCWA continues to disagree with the Corps' approach of developing a different hydraulic model that has a 100 x 100 ft computational mesh to represent conditions in the lower Yuba River. Given the extremely large disparity in the resolution of the 2-D modeling used in the Corps' analysis, the Corps' Interim Draft Feasibility Report and EA does not utilize the best available information.	based HEP calculation workflow, in accordance with SMART Planning principles. Use of this model and the overall GIS-based HEP calculation workflow was approved by the USACE Eco PCX.
III-86	Appendix C (Engineering) states "Due to the lack of available calibration data from previous modeling, a downstream boundary rating curve was created for this modelling effort using iterative normal depth calculations using the Manning's equation." Comment No "previous modeling" has been conducted for the YRERFS. The draft report should be edited to describe this "previous modeling".	Text in the report has been adjusted: "Due to the lack of available calibration data, a downstream boundary rating curve was created for this modelling effort using iterative normal depth calculations using the Manning's equation."
III-87	ATTACHMENTS TO YCWA COMMENTS ON THE CORPS JANUARY 4, 2018 DRAFT INTERIM FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT The four documents listed below are included in Attachment 1: YCWA August 2, 2017 Comments on the U.S. Army Corps of Engineers Yuba River Ecosystem Restoration Feasibility Study "Screening of Measures" Document YCWA August 11, 2017 Comments on the Corps' Yuba River Ecosystem Restoration Feasibility Study Habitat Evaluation Assessment Approach Technical Memorandum	Comment noted.

Comment	Comment Text	Response
	YCWA October 2016 Modeled Flow Considerations Technical Memorandum YCWA February 3, 3017 Integration of Daguerre Point Dam Passage Improvement Actions with Habitat Improvement Measures to Provide Habitat Benefit Outputs for the Lower Yuba River Attachment 2 Correspondence between USACE and YCWA	

Environmental Appendix D
Attachment 10a

Air Quality Emissions Modeling

Yuba River Ecosystem Restoration Feasibility Study

Prepared By:

U.S. Army Corps of Engineers

Sacramento District

October 2018

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Contents

1.0 Introduction D10a-5
2.0 Methodology D10a-5
3.0 Assumptions D10a-6
3.1 Work Considered Under a Reasonable Worst Case Scenario D10a-6
3.2 Construction Schedule D10a-6
3.3 Equipment D10a-7
3.3.1 Staging Phase D10a-7
3.3.2 Excavation Phase D10a-8
3.3.3 Planting Phase D10a-9
3.3.4 Equipment Standards D10a-9
4.0 Results D10a-10

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1.0 Introduction

This attachment to the environmental appendix documents the methods, assumptions, and results of the emissions analysis used to evaluate potential project impacts to air quality.

2.0 Methodology

The methods for evaluating impacts are intended to satisfy the Federal air quality requirements, including the Federal General Conformity Rule, and to disclose effects to fulfill requirements set forth in accordance with NEPA. It was determined through internal discussions, as well as discussions with staff from the FRAQMD and SMAQMD, that a reasonable approach to evaluate the projects potential for compliance with Federal standards was to utilize the SMAQMD's Road Construction Emission Model Version (RCEM) 8.1.0. Although the RCEM was not developed specifically for application to ecosystem restoration projects it provides a good framework for evaluating projects in which the primary source of emissions are related to the construction phase and in particular are related to hauling of material. A newer version of the RCEM (v9.0) was released in May 2018, however, the model update has not been approved at this time by the U.S. Environmental Protection Agency (EPA) and therefore for the purpose of this analysis, the U.S. EPA approved v8.1.0 will be utilized.

To complete the analysis, information was collected on projected construction activities, duration, and timing, equipment use, and activities for each construction year. Construction equipment usage from similar projects was analyzed to estimate daily and annual exhaust emissions. Emissions are considered significant if emissions exceed the thresholds established by the applicable air quality agencies (discussed in Section 4.3.1 of the FR/EA)

The RCEM is limited in its capacity to efficiently evaluate multiyear projects with gaps in construction (i.e., no construction during wet season or sensitive biological work windows). To address this issue, a modeling approach was developed that would focus on a annual year of construction only so as to preclude the necessity to model gaps in construction. In general this modeling approach was developed using a set of reasonable worst case scenario assumptions. A set of reasonable worst case scenario assumptions for a single year would provide an adequate evaluation of annual project emissions for comparison to the National Ambient Air Quality Standards (NAAQS) annual emission thresholds. to determine the significance of project effects to air quality.

There is no anticipated difference between the worst case annual emissions of Alternative 5 and Alternative 6. Although Alternative 6 includes additional proposed features compared to Alternative 5 and the overall duration of construction for Alternative 6 would require an additional year to complete, the activities in any given year would follow the same sequencing (Section 4.2 of the FR/EA). Therefore a single analysis was sufficient to evaluate the potential effects associated with both alternatives. The assumptions used in the air quality emissions analysis for the YRERFS are described in the following sections.

3.0 Assumptions

This section documents the assumptions that were used in the development of the air quality emissions analysis for Alternative 5 and Alternative 6. The following sections discuss general assumptions followed by a presentation of the specific model inputs and discussion of more nuanced assumptions. Assumptions incorporated into this analysis were based on feasibility level design and cost estimates and emissions from implementation of the project may vary due to preconstruction engineering and design (PED) level refinements.

3.1 Work Considered Under a Reasonable Worst Case Scenario

This analysis is designed to estimate emissions associated with a reasonable worst case scenario. The project team determined that construction that would take place in the first year would be the construction season that would likely result in the most combined air emissions. The first year of construction is representative of the highest potential for emissions, as the schedule is designed to accomplish as much work as soon as possible to reduce the risk of needing to extend the overall schedule. Furthermore, advances in technology and equipment as well as improvements to implementation through lessons learned in initial years of construction are expected to result in reduced emissions in later years of construction.

During year 1, it is anticipated that construction would occur in 5 locations within Habitat Increments 3a, 5a, and 5b. Construction at 3a would include development of 2 staging areas and access to support construction of riparian planting features. Construction at 5a would include development of 1 staging area and access to support construction of excavation and riparian planting features. Construction at 5b would require development of 2 staging areas and access to support construction of excavation and riparian planting features. No installation of hydraulic roughness elements is anticipated in year 1. In summary, this analysis includes assumption for work to occur simultaneously at 5 locations.

3.2 Construction Schedule

The general assumptions applied in developing a worst case scenario for construction schedule include:

- Alternative 5 would require 4 separate years to construct the required features
- Alternative 6 would require 5 years of construction;
- General construction would occur over 6 months (June 1 to November 30);
- In water construction would occur over 4 months (July 1 to October 30);
- Construction will begin in 2021;
- Annual construction would include: staging/clearing, excavation, installation of hydraulic roughness/structural complexity elements, and harvesting and planting of riparian vegetation. For the purpose of emissions modeling this work will be analyzed in 3 phases proscribed in the RCEM: (1) staging/clearing (Grubbing/Land Clearing), (2) excavation

and installation of hydraulic roughness/ structural complexity elements (Grading/Excavation), and (3) planting of vegetation (Drainage/Utilities/Sub-Grade). The Drainage/Utilities/Sub-Grade phase of the RCEM was used to evaluate emissions associated with planting of riparian vegetation and will be referred to in this document as the Planting Phase.

- The conceptual annual construction schedule in Figure 1 below would be applied to Alternative 5 and Alternative 6. The typical high emissions would likely occur during June - September when excavation is underway. The maximum emissions would likely occur during October, when excavation and planting phases overlap.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Vegetation Removal and Trimming				Staging/ Site Prep	Excavation and Installation of non-vegetative restoration features (in water work limited to July 1 – October 31)						
								Preparation for planting	Harvest and Planting of Vegetative Features		

Figure 1. Conceptual construction schedule

3.3 Equipment

Estimates for equipment were made for each modeled phase: Staging, Excavation, and planting. Cost and feasibility level design estimates of work and equipment were developed by staging site and associated features, however, the RCEM calculates emissions by phase, therefore, for the purpose of this analysis, the sum of all construction equipment for each was developed for input into the RCEM. In some cases the summarization of equipment use across 5 sites required some additional assumptions to be made and or some reshaping of data.

For example, the hours of use of excavators may not be the same at each of the 5 sites. Therefore, while the project anticipates that 5 excavators would be required, the model would by default calculate the total emissions from 5 excavators running for the full duration of the project phase. This scenario would not be appropriately representative of the anticipated emissions. To account for the fact that 3 of the excavators may only run for a small portion of the project phase, the total hours (effort) of all full and part time excavators was calculated and translated into an equivalent number of "full time excavators". The modified # of excavators was then utilized in the emissions modeling. Other data manipulations were required to best represent the level of effort and equipment type associated with anticipated project emissions. The general assumptions for equipment estimates are documented below, additional assumptions are incorporated into the input tables to facilitate a better understanding of inputs.

3.3.1 Staging Phase

The staging phase would require development of access and preparation of staging areas. Although no excavation work is anticipated, material would be hauled onsite to prepare the staging area and to repair portions of the access road. The assumptions of equipment required during the staging phase are summarized in Table 1 below. For the purpose of this analysis, the staging phase is represented by the "Grubbing/Land Clearing" phase in the RCEM.

Table 1. Equipment Assumptions for Staging

Equipment	Level of Effort	Model Inputs
Generator	Generators would be required at the 2 sites associated with excavation features.	2 generators
72,000 lbs. excavator	Assume one per site, 5 total.	For emissions modeling do not differentiate between excavators; assume 10 excavators.
45,000 lbs. excavator	Assume one per site, 5 total.	
Water Truck	Assume 1 per site, 5 total.	5 water trucks
Roller Compactor	Assume 1 per site, 5 total.	For emissions modeling use 5 'rollers'
Small dozer	Assume 1 per site, 5 total.	For emissions modeling use 5 'rubber tired dozer'
grader	Assume 1 per site, 5 total.	For emissions modeling use 5 'grader'
Sweeper	Assume 1 per site, 5 total.	For emissions modeling use 5 'sweeper/scrubber'
Skip loader	Assume 1 per site, 5 total.	For emissions modeling use 5 'tractor/loader/backhoe'
Crew	Assume 13 people per crew per site, 65 total.	For emissions modeling use 65 crew.

3.3.2 Excavation Phase

The excavation phase would require excavation and hauling of substrate as well as maintenance of haul roads. The assumptions of equipment required during the excavation phase are summarized in Table 2 below. The number of equipment represented in the "model inputs" column has been adjusted to be representative of "full time efforts" to account for the default emissions calculations as described above. A full time effort for the excavation phase is 130 days (5 months x 26 working days). For the purpose of this analysis, the excavation phase is represented by the "Grading/Excavation" phase in the RCEM.

Table 2. Equipment Assumptions for Excavation

Equipment	Level of Effort	Model Inputs
72,000 lbs. excavator	Assume 2 full time efforts at excavations sites, 2 total	For emissions modeling do not differentiate between excavators; assume 4 excavators.
45,000 lbs. excavator	Assume 2 full time efforts at excavations sites, 2 total	
Water Truck	Assume 2 full time efforts for road maintenance at excavations sites, and partial efforts at planting sites; adjusted to 2.6 full time efforts.	For emissions modeling, fractions of water trucks not suitable for input, round up to 3 water trucks.
Grader	Assume 2 full time efforts for road maintenance at excavations sites, and partial efforts at planting sites; adjusted to 2.6 full time efforts.	For emissions modeling use 2.6 'grader'
Sweeper	Assume 2 full time efforts for road maintenance at excavations sites, and partial efforts at planting sites; adjusted to 2.6 full time efforts.	For emissions modeling use 2.6 'sweeper/scrubber'
Dozer	Assume 2 full time efforts at material placement sites, 2 total	For emissions modeling use 2 'rubber tired dozer'
Crew	Assume 11 full time efforts for road maintenance and 16 full time efforts for excavation. Total 27 crew.	For emissions modeling use 27 crew.

3.3.3 Planting Phase

The planting phase would require excavation and hauling of substrate as well as maintenance of haul roads. The assumptions of equipment required during the planting phase are summarized in Table 3 below. The number of equipment represented in the “model inputs” column has been adjusted to be representative of “full time efforts” to account for the default emissions calculations as described above. A full time effort for the planting phase is 52 days (2 months x 26 working days). For the purpose of this analysis, the excavation phase is represented by the “Drainage/Utilities/Sub-Grade” phase in the RCEM.

Table 3. Equipment Assumptions for Planting

Equipment	Level of Effort	Model Inputs
45,000 lbs. excavator	Assume 6 full time efforts with stinger attachment.	For emissions modeling use 6 excavators.
Water Truck	Assume 3 full time efforts for road maintenance at planting sites.	For emissions modeling use 3 water trucks.
Grader	Assume 2 full time efforts for road maintenance at excavations sites, and partial efforts at planting sites; adjusted to 2.6 full time efforts.	For emissions modeling use 2.6 ‘grader’
Sweeper	Assume 2 full time efforts for road maintenance at excavations sites, and partial efforts at planting sites; adjusted to 2.6 full time efforts.	For emissions modeling use 2.6 ‘sweeper/scrubber’
Pick-ups & Flat Beds	Pick-ups and Flat beds would be required during marking, harvesting, and planting of plant materials. The number of flatbeds and pick-ups are associated with number of crews and planting sites. The RCEM doesn’t provide a good opportunity for additional emissions associated with small trucks. The most comparable emissions calculations are related to worker commute trips; therefore, for the purpose of this analysis, the anticipated use of pick-ups and flatbeds during the planting stage were translated into worker commute trips, which were then translated into additional workers for the purpose of model inputs.	For emissions modeling add 9 workers to planting phase.
Crew	Assume 32 full time equivalent efforts for marking and harvesting and 36 full time equivalent efforts people for planting site. Work related crew = 68 total. Add 9 crew to Planting phase to account for use of pick-ups and flat beds. Adjusted total 77 full time efforts.	For emissions modeling use 77 crew.

3.3.4 Equipment Standards

All project plans and specifications will require that construction contractors use only offroad equipment that implements the Feather River Air Quality Management Districts’ (FRAQMD) Enhanced Exhaust Control Practices and only use on-road hauling equipment that was manufactured in 2010, or later. In addition all offroad equipment would meet CARB Tier 4 standards. If the off-road equipment and on-road hauling specifications stated above are not met, it cannot be assured that the project air emissions can meet the Federal applicability rates (*de minimis* emission levels).

4.0 Results

The results for the emissions modeling are presented in Figure 3 below. The results are representative of a worst case scenario for annual emissions for construction of Alternative 5 (Recommended Plan) and Alternative 6. Given a set of assumptions representative of a reasonable worst case scenario of annual emissions, Alternative 5 and Alternative 6 would not exceed any NAAQS and are in conformity with Federal applicability rates. Results from this analysis were discussed in Section 4.3.1 of the integrated Feasibility Report/ Environmental Assessment.

Road Construction Emissions Model **Version 8.1.0**

Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells D10 through D24, E28 through G35, and D38 through D41 for all project types.
Please use "Clear Data Input & User Overrides" button first before changing the Project Type or begin a new project.

Clear Data Input & User Overrides

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Input Type

Project Name	Yuba River Ecosystem Restoration Feasibility Study	
Construction Start Year	2021	Enter a Year between 2014 and 2025 (inclusive)
Project Type For 4: Other Linear Project Type, please provide project specific off-road equipment population and vehicle trip data	4	1) New Road Construction : Project to build a roadway from bare ground, which generally requires more site preparation than widening an existing roadway 2) Road Widening : Project to add a new lane to an existing roadway 3) Bridge/Overpass Construction : Project to build an elevated roadway, which generally requires some different equipment than a new roadway, such as a crane 4) Other Linear Project Type: Non-roadway project such as a pipeline, transmission line, or levee construction
Project Construction Time	7.00	months
Working Days per Month	26.00	days (assume 22 if unknown)
Predominant Soil/Site Type: Enter 1, 2, or 3 (for project within "Sacramento County", follow soil type selection instructions in cells E18 to E20 otherwise see instructions provided in cells J18 to J22)	1	1) Sand Gravel : Use for quaternary deposits (Delta/West County) 2) Weathered Rock-Earth : Use for Laguna formation (Jackson Highway area) or the Ione formation (Scott Road, Rancho Murieta) 3) Blasted Rock : Use for Salt Springs Slate or Copper Hill Volcanics (Folsom South of Highway 50, Rancho Murieta)
Project Length	3.40	miles
Total Project Area	191.43	acres
Maximum Area Disturbed/Day	1.50	acres
Water Trucks Used?	1	1. Yes 2. No

Please note that the soil type instructions provided in cells E18 to E20 are specific to Sacramento County. Maps available from the California Geologic Survey (see weblink below) can be used to determine soil type outside Sacramento County.

http://www.conservation.ca.gov/cgs/information/geologic_mapping/Pages/googlemaps.aspx#regionalseries

Material Hauling Quantity Input

Material Type	Phase	Haul Truck Capacity (yd^3) (assume 20 if unknown)	Import Volume (yd^3/day)	Export Volume (yd^3/day)
Soil	Grubbing/Land Clearing	11.00		1642.00
	Grading/Excavation	11.00		2640.00
	Drainage/Utilities/Sub-Grade			
	Paving			
Asphalt	Grubbing/Land Clearing			
	Grading/Excavation			
	Drainage/Utilities/Sub-Grade			
	Paving			

Mitigation Options

On-road Fleet Emissions Mitigation	2010 and Newer On-road Vehicles Fleet	Select "2010 and Newer On-road Vehicles Fleet" option when the on-road heavy-duty truck fleet for the project will be limited to vehicles of model year 2010 or newer
Off-road Equipment Emissions Mitigation	Tier 4 Equipment	Select "20% NOx and 45% Exhaust PM reduction" option if the project will be required to use a lower emitting off-road construction fleet. The SMAQMD Construction Mitigation Calculator can be used to confirm compliance with this mitigation measure (http://www.airquality.org/ceqa/mitigation.shtml). Select "Tier 4 Equipment" option if some or all off-road equipment used for the project meets CARB Tier 4 Standard
Will all off-road equipment be tier 4?	All Tier 4 Equipment	

Figure 2a. Inputs for Air Quality Emissions Analysis – Alternative 5 and Alternative 6

Construction Periods	User Override of Construction Months	Program Calculated Months	User Override of Phase Starting Date	Program Default Phase Starting Date
Grubbing/Land Clearing	1.00	0.70	5/1/2021	1/1/2021
Grading/Excavation	5.00	2.80	6/1/2021	2/1/2021
Drainage/Utilities/Sub-Grade	2.00	2.45	10/1/2021	7/4/2021
Paving	0.00	1.05	10/1/2021	9/3/2021
Totals (Months)	8			

Figure 2b. Inputs for Air Quality Emissions Analysis – Alternative 5 and Alternative 6 (cont.)

- For the purpose of this analysis, the project construction time was input as 7 months, which is representative of the staging, excavation, and planting activities that would occur on an annual basis. Clearing and trimming of vegetation that would take place in January – February is not expected to contribute significantly to project emissions and is not included in this analysis.
- The project length and areas were calculated as the approximate length and area associated with various excavation and planting features and staging of Habitat Increments 3a, 5a, and 5b, which are anticipated to be the most intensive unit of construction to take place. Therefore, this assumption is representative of a worst case scenario to evaluate annual emissions.

Soil Hauling Emissions **User Input**	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing	30.00			150	4500.00
Miles/round trip: Grading/Excavation	30.00			240	7200.00
Miles/round trip: Drainage/Utilities/Sub-Grade				0	0.00
Miles/round trip: Paving				0	0.00

2010+ Model Year Mitigation Option Emission Rates	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Grubbing/Land Clearing (grams/mile)	0.07	0.37	1.43	0.10	0.04	0.01	1,559.57	0.00	0.05	1,574.93
Grading/Excavation (grams/mile)	0.07	0.37	1.43	0.10	0.04	0.01	1,559.57	0.00	0.05	1,574.93
Draining/Utilities/Sub-Grade (grams/mile)	0.07	0.37	1.43	0.10	0.04	0.01	1,559.57	0.00	0.05	1,574.93
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.66	3.67	14.17	1.02	0.40	0.15	15,472.17	0.03	0.51	15,624.62
Tons per const. Period - Grubbing/Land Clearing	0.01	0.05	0.18	0.01	0.01	0.00	201.14	0.00	0.01	203.12
Pounds per day - Grading/Excavation	1.06	5.87	22.67	1.63	0.64	0.24	24,755.47	0.05	0.81	24,999.39
Tons per const. Period - Grading/Excavation	0.07	0.38	1.47	0.11	0.04	0.02	1,609.11	0.00	0.05	1,624.96
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.08	0.43	1.66	0.12	0.05	0.02	1,810.24	0.00	0.06	1,828.08

Figure 2c. Inputs for Air Quality Emissions Analysis – Alternative 5 and Alternative 6 (cont.)

- Soil hauling round trip distances were estimated as 30 miles round trip. A 15 mile round trip estimate is conservative; the average distance from proposed staging areas to the nearest available disposal site is around 11 miles.

Worker Commute Emissions	User Override of Worker			
User Input	Commute Default Values	Default Values		
Miles/ one-way trip	50		Calculated	Calculated
One-way trips/day	2		Daily Trips	Daily VMT
No. of employees: Grubbing/Land Clearing	65		130	6,500.00
No. of employees: Grading/Excavation	27		54	2,700.00
No. of employees: Drainage/Utilities/Sub-Grade	77		154	7,700.00
No. of employees: Paving			0	0.00

Emission Rates	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Grubbing/Land Clearing (grams/mile)	0.02	0.99	0.10	0.05	0.02	0.00	360.03	0.01	0.00	361.48
Grading/Excavation (grams/mile)	0.02	0.99	0.10	0.05	0.02	0.00	360.03	0.01	0.00	361.48
Draining/Utilities/Sub-Grade (grams/mile)	0.02	0.99	0.10	0.05	0.02	0.00	360.03	0.01	0.00	361.48
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grubbing/Land Clearing (grams/trip)	0.93	2.28	0.18	0.00	0.00	0.00	81.88	0.01	0.01	84.35
Grading/Excavation (grams/trip)	0.93	2.28	0.18	0.00	0.00	0.00	81.88	0.01	0.01	84.35
Draining/Utilities/Sub-Grade (grams/trip)	0.93	2.28	0.18	0.00	0.00	0.00	81.88	0.01	0.01	84.35
Paving (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.54	14.85	1.51	0.67	0.28	0.05	5,182.74	0.11	0.06	5,204.22
Tons per const. Period - Grubbing/Land Clearing	0.01	0.19	0.02	0.01	0.00	0.00	67.38	0.00	0.00	67.65
Pounds per day - Grading/Excavation	0.22	6.17	0.63	0.28	0.12	0.02	2,152.83	0.05	0.03	2,161.75
Tons per const. Period - Grading/Excavation	0.01	0.40	0.04	0.02	0.01	0.00	139.93	0.00	0.00	140.51
Pounds per day - Drainage/Utilities/Sub-Grade	0.64	17.59	1.78	0.79	0.33	0.06	6,139.56	0.13	0.07	6,165.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.02	0.46	0.05	0.02	0.01	0.00	159.63	0.00	0.00	160.29
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.04	1.05	0.11	0.05	0.02	0.00	366.94	0.01	0.00	368.46

Figure 2d. Inputs for Air Quality Emissions Analysis – Alternative 5 and Alternative 6 (cont.)

- 50 miles one way trip is representative of distances that may be travelled from nearby major population centers (Sacramento, Ca and Chico, Ca).
- Number of employees estimated does not include truck drivers as their emissions are included in the soil hauling emissions estimate.

Water Truck Emissions	User Override of	Program Estimate of	User Override of Truck	Default Values	Calculated
User Input	Default # Water Trucks	Number of Water Trucks	Miles Traveled/Vehicle/Day	Miles Traveled/Vehicle/Day	Daily VMT
Grubbing/Land Clearing - Exhaust	5		15.00		75.00
Grading/Excavation - Exhaust	3		150.00		450.00
Drainage/Utilities/Subgrade	3		50.00		150.00
Paving					0.00

2010+ Model Year Mitigation Option Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.07	0.37	1.43	0.10	0.04	0.01	1,559.57	0.00	0.05	1,574.93
Grading/Excavation (grams/mile)	0.07	0.37	1.43	0.10	0.04	0.01	1,559.57	0.00	0.05	1,574.93
Draining/Utilities/Sub-Grade (grams/mile)	0.07	0.37	1.43	0.10	0.04	0.01	1,559.57	0.00	0.05	1,574.93
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.01	0.06	0.24	0.02	0.01	0.00	257.87	0.00	0.01	260.41
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	3.35	0.00	0.00	3.39
Pounds per day - Grading/Excavation	0.07	0.37	1.42	0.10	0.04	0.01	1,547.22	0.00	0.05	1,562.46
Tons per const. Period - Grading/Excavation	0.00	0.02	0.09	0.01	0.00	0.00	100.57	0.00	0.00	101.56
Pounds per day - Drainage/Utilities/Sub-Grade	0.02	0.12	0.47	0.03	0.01	0.00	515.74	0.00	0.02	520.82
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.01	0.00	0.00	0.00	13.41	0.00	0.00	13.54
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.01	0.03	0.11	0.01	0.00	0.00	117.33	0.00	0.00	118.49

Figure 2e. Inputs for Air Quality Emissions Analysis – Alternative 5 and Alternative 6 (cont.)

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing	1.00		10.00	0.13	2.08	0.03
Fugitive Dust - Grading/Excavation	1.50		15.00	0.98	3.12	0.20
Fugitive Dust - Drainage/Utilities/Subgrade	1.00		10.00	0.26	2.08	0.05

Figure 2f. Inputs for Air Quality Emissions Analysis – Alternative 5 and Alternative 6 (cont.)

Off-Road Equipment Emissions

Grubbing/Land Clearing Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00			Tier 4	Excavators	2.05	50.53	4.10	0.20	0.19	0.07	6,450.27	2.09	0.06	6,519.82
			Tier 4	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Tier 4	Generator Sets	0.33	8.11	0.66	0.03	0.03	0.01	1,246.07	0.06	0.01	1,250.45
5.00			Tier 4	Graders	1.18	20.56	2.37	0.12	0.11	0.04	3,784.73	1.22	0.03	3,825.41
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipme	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Material Handling Equipmer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Tier 4	Rollers	0.41	10.04	0.81	0.04	0.04	0.01	1,286.33	0.42	0.01	1,300.19
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Tier 4	Rubber Tired Dozers	1.35	23.39	2.70	0.13	0.12	0.04	4,308.42	1.39	0.04	4,354.71
			Tier 4	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00			Tier 4	Sweepers/Scrubbers	0.49	9.61	8.63	0.05	0.05	0.01	1,230.88	0.40	0.01	1,244.14
5.00			Tier 4	Tractors/Loaders/Backhoes	0.60	14.79	1.20	0.06	0.06	0.02	1,900.01	0.61	0.02	1,920.46
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing	pounds per day	6.40	137.03	20.47	0.64	0.59	0.21	20,206.71	6.20	0.18	20,415.18
Grubbing/Land Clearing	tons per phase	0.08	1.78	0.27	0.01	0.01	0.00	262.69	0.08	0.00	265.40

Figure 2g. Inputs for Air Quality Emissions Analysis – Alternative 5 and Alternative 6 (cont.)

Grading/Excavation Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00			Tier 4	Excavators	0.82	20.21	1.64	0.08	0.08	0.03	2,580.11	0.83	0.02	2,607.93
			Tier 4	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.60			Tier 4	Graders	0.62	10.69	1.23	0.06	0.06	0.02	1,968.06	0.64	0.02	1,989.21
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipme	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Material Handling Equipmer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Tier 4	Rubber Tired Dozers	0.54	9.35	1.08	0.05	0.05	0.02	1,723.37	0.56	0.02	1,741.88
			Tier 4	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.60			Tier 4	Sweepers/Scrubbers	0.25	5.00	4.49	0.03	0.02	0.01	640.06	0.21	0.01	646.95
			Tier 4	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment — If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grading/Excavation	pounds per day	2.23	45.25	8.44	0.22	0.21	0.07	6,911.59	2.24	0.06	6,985.98
Grading/Excavation	tons per phase	0.14	2.94	0.55	0.01	0.01	0.00	449.25	0.15	0.00	454.09

Figure 2h. Inputs for Air Quality Emissions Analysis – Alternative 5 and Alternative 6 (cont.)

Drainage/Utilities/Subgrade Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00			Tier 4	Excavators	1.23	30.32	2.46	0.12	0.11	0.04	3,870.16	1.25	0.04	3,911.89
			Tier 4	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.60			Tier 4	Graders	0.62	10.69	1.23	0.06	0.06	0.02	1,968.06	0.64	0.02	1,989.21
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipme	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Material Handling Equipmer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.60			Tier 4	Sweepers/Scrubbers	0.25	5.00	4.49	0.03	0.02	0.01	640.06	0.21	0.01	646.95
4.00			Tier 4	Tractors/Loaders/Backhoes	0.48	11.83	0.96	0.05	0.04	0.02	1,520.01	0.49	0.01	1,536.37
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment — If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Drainage/Utilities/Sub-Grade	pounds per day	2.58	57.83	9.14	0.26	0.24	0.08	7,998.29	2.59	0.07	8,084.43
Drainage/Utilities/Sub-Grade	tons per phase	0.07	1.50	0.24	0.01	0.01	0.00	207.96	0.07	0.00	210.20

Figure 2i. Inputs for Air Quality Emissions Analysis – Alternative 5 and Alternative 6 (cont.)

Equipment	User Override of Horsepower	Default Values Horsepower	User Override of Hours/day	Default Values Hours/day
Aerial Lifts		63		8
Air Compressors		78		8
Bore/Drill Rigs		206		8
Cement and Mortar Mixers		9		8
Concrete/Industrial Saws		81		8
Cranes		226		8
Crawler Tractors		208		8
Crushing/Proc. Equipment		85		8
Excavators		163	10.00	8
Forklifts		89		8
Generator Sets		84		8
Graders		175	10.00	8
Off-Highway Tractors		123		8
Off-Highway Trucks		400		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		167		8
Pavers		126		8
Paving Equipment		131		8
Plate Compactors		8		8
Pressure Washers		13		8
Pumps		84		8
Rollers		81		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		255		8
Rubber Tired Loaders		200	10.00	8
Scrapers		362		8
Signal Boards		6		8
Skid Steer Loaders		65		8
Surfacing Equipment		254		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		98	10.00	8
Trenchers		81		8
Welders		46		8

Figure 2j. Inputs for Air Quality Emissions Analysis – Alternative 5 and Alternative 6 (cont.)

- All equipment is assumed to be operated over 10 hour days.

Daily Emission Estimates for -> Yuba River Ecosystem Restoration Feasibility Study Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	7.61	155.60	36.38	12.35	2.35	10.00	3.36	1.28	2.08	0.41	41,119.49	6.34	0.76	41,504.44
Grading/Excavation	3.58	57.66	33.15	17.23	2.23	15.00	4.12	1.00	3.12	0.34	35,367.12	2.33	0.95	35,709.59
Drainage/Utilities/Sub-Grade	3.23	75.54	11.40	11.09	1.09	10.00	2.66	0.58	2.08	0.15	14,653.59	2.72	0.16	14,770.25
Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum (pounds/day)	7.61	155.60	44.55	28.32	3.32	25.00	6.78	1.58	5.20	0.49	50,020.70	6.34	1.12	50,479.84
Total (tons/construction project)	0.42	7.73	2.92	1.57	0.20	1.37	0.38	0.10	0.28	0.03	3,214.41	0.30	0.08	3,244.71

Notes: Project Start Year -> 2021

Project Length (months) -> 7

Total Project Area (acres) -> 191

Maximum Area Disturbed/Day (acres) -> 2

Water Truck Used? -> Yes

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	1642	0	4,500	0	6,500	75
Grading/Excavation	2,640	0	7,200	0	2,700	450
Drainage/Utilities/Sub-Grade	0	0	0	0	7,700	150
Paving	0	0	0	0	0	0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from w atering and associated dust control measures if a minimum number of w ater trucks are specified.

Total PM10 emissions show n in column F are the sum of exhaust and fugitive dust emissions show n in columns G and H. Total PM2.5 emissions show n in Column I are the sum of exhaust and fugitive dust emissions show n in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global w arming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> Yuba River Ecosystem Restoration Feasibility Study Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	Total PM10 (tons/phase)	Exhaust PM10 (tons/phase)	Fugitive Dust PM10 (tons/phase)	Total PM2.5 (tons/phase)	Exhaust PM2.5 (tons/phase)	Fugitive Dust PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.10	2.02	0.47	0.16	0.03	0.13	0.04	0.02	0.03	0.01	534.55	0.08	0.01	489.48
Grading/Excavation	0.23	3.75	2.16	1.12	0.15	0.98	0.27	0.07	0.20	0.02	2,298.86	0.15	0.06	2,105.71
Drainage/Utilities/Sub-Grade	0.08	1.96	0.30	0.29	0.03	0.26	0.07	0.02	0.05	0.00	380.99	0.07	0.00	348.39
Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum (tons/phase)	0.23	3.75	2.16	1.12	0.15	0.98	0.27	0.07	0.20	0.02	2298.86	0.15	0.06	2,105.71
Total (tons/construction project)	0.42	7.73	2.92	1.57	0.20	1.37	0.38	0.10	0.28	0.03	3214.41	0.30	0.08	2,943.58

PM10 and PM2.5 estimates assume 50% control of fugitive dust from w atering and associated dust control measures if a minimum number of w ater trucks are specified.

Total PM10 emissions show n in column F are the sum of exhaust and fugitive dust emissions show n in columns G and H. Total PM2.5 emissions show n in Column I are the sum of exhaust and fugitive dust emissions show n in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global w arming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

Figure 3. Road Construction Emissions Model v8.1.0 Results for Reasonable Worst Case Annual Emissions Analysis - Alternative 5 (Recommended Plan) and Alternative 6

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Environmental Appendix D
Attachment 10b

Carbon Sequestration Analysis

Yuba River Ecosystem Restoration Feasibility Study

Prepared By

U.S. Army Corps of Engineers

Sacramento District

October 2018

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Contents

1.0 Introduction ... D10a-5
2.0 Methods ... D10a-5
Step 1 ... D10a-5
Step 2 ... D10a-6
Step 3 ... D10a-9
Step 4 ... D10a-10
3.0 Results ... D10a-10
4.0 References ... D10a-11

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1.0 Introduction

The proposed alternatives would emit greenhouse gases (GHGs) from the earth moving equipment used for the restoration activities which contribute to climate change. The Air Quality Emissions Modeling documented in Attachment 10a supported an analysis of potential annual GHG emissions which was used as a metric for evaluating the significance of potential project effects on climate change. The modeling was conducted using the Sacramento Metropolitan Air Quality Management District (SMAQMD) Road Construction Emissions Model 8.1.0 and assumed a worst case scenario for annual emissions which did not take into consideration any potential mitigating actions. The purpose of this carbon sequestration analysis is to support a quantitative and qualitative evaluation of potential beneficial impacts of the proposed alternatives 5 and 6 on climate change. This analysis was conducted based on methods employed on the Hallwood Side Channel and Floodplain Restoration Project on the Lower Yuba River, Environmental Assessment/Initial Study Public Draft (USFWS 2017), which is a very similar project to the proposed alternatives.

2.0 Methods

The potential carbon sequestration benefits associated with each alternative based on the proposed planting quantities, species, biomass equations used in Jenkins et al. 2004, and carbon content biomass values described in Schlesinger 1991. Sequestered carbon would then be compared to the anticipated GHG emissions (CO_2e) for each Alternative to evaluate the net effect on carbon in the environment.

Step 1

Assumptions for planting quantities are summarized in Table 1 below. The basis for planting quantities is documented in Engineering Appendix C. The planting assumptions were used to estimate the total number and species of plantings. The total number of plantings was estimated by multiplying the proposed planting density for each species by the total anticipated planting acreage (136 acres for alternative 5). Carbon sequestration modeling utilizes generalized species/carbon relationships and for the purpose of this analysis, Fremont cottonwoods were assumed to utilize cottonwood formulas and all other species were assumed to be willows.

Table 1. Planting Assumptions for Proposed Alternatives

Common/Scientific	Plantings per acre	Alternative 5 Total Plantings (136 acres total planting area)	Alternative 6 Total Plantings (144 acres total planting area)
Fremont Cottonwood	450	61,200	64,800
Black Willow	300	40,800	43,200
Red Willow	250	34,000	36,000
Arroyo Willow	250	34,000	36,000
Associate plants	250	34,000	36,000

Planting assumptions are based on Engineering Appendix C – Attachment CV-C Riparian Planting

Step 2

After establishing planting assumptions, the quantities and species were used paired with simplified survivorship assumptions to estimate the anticipated biomass produced under each alternative. Biomass equation ID#2 for species 740 (cottonwood) and species #920 (willow) were used to calculate the biomass (kg per tree) for each species (Jenkins et al. 2004) as shown in Table 2 below. The biomass estimates were then used to estimate total carbon content based on the total number of trees planted, survivorship, and a simplified assumption for the typical carbon content of vegetation. Schlesinger (1991) noted that the carbon content of vegetative biomass is typically between 45 and 50% therefore for the purpose of this analysis carbon content was estimated as a fraction (0.475) of the total biomass. The estimate of carbon content was then converted to CO2e (metric tons) for comparison to GHG emissions. Table 3 and 4 summarize the estimate of carbon content for key years of analysis for Alternatives 5 and 6. The formula and inputs used to calculate biomass are described below.

Biomass Equation ID#2

$$\ln(\text{biomass}) = a + b * \text{dia} + c * (\ln(\text{d.b.h.}^\wedge d))$$

(Table 6. Jenkins et al. 2004)
Biomass is calculated in grams
d.b.h – Diameter of tree at Breast Height in inches

Table 2. Inputs for Biomass Equation

Species #	Common Name	a	b	c	d
740	cottonwood	6.933	0	1.1529	1
920	willow	7.489	0	1.4393	1

All inputs are documented in (Table 3. Jenkins et al. 2004)
Values for a, b, c, and d are coefficients for the biomass regression equations developed by Young et al. 1980.

Table 3. Summary of Carbon Sequestration for Alternative 5

Years Post Project	Tree Species	Survivorship of total planted (%)	Number of Trees Planted	DBH (inches)	Biomass per tree (kg)	Total Carbon (kg)	Total Carbon (metric ton)	Total CO2e (metric tons)
1	Willow	100	142,800	0.7874	1.26772609	85,989.86	85.99	315.58
1	Cottonwood	100	61,200	0.7874	0.77855147	22,632.49	22.63	83.06
					Year 1 Total =	108,622.35	108.62	398.64
5	Willow	70	99,960	1.5748	3.437936905	163,236.68	163.24	599.08
5	Cottonwood	70	42,840	1.77165	1.98298101	40,351.68	40.35	148.09
					Year 5 Total =	203,588.36	203.59	747.17
20	Willow	50	71,400.0	3.937	12.8544339	435,958.13	435.96	1,599.97
20	Cottonwood	50	30,600.0	4.7244	6.14352893	89,296.19	89.30	327.72
					Year 20 Total =	525,254.32	525.25	1,927.68
50	Willow	30	42,840.0	19.685	130.340830	2,652,305.5	2,652.31	9,733.96
50	Cottonwood	30	18,360.0	30.3149	52.3799412	456,805.47	456.81	1,676.48
					Year 50 Total =	3,109,111.0	3,109.11	11,410.44

Table 4. Summary of Carbon Sequestration for Alternative 6

Years Post Project	Tree Species	Survivorship of total planted (%)	Number of Trees Planted	DBH (inches)	Biomass per tree (kg)	Total Carbon (kg)	Total Carbon (metric ton)	Total CO2e (metric tons)
1	Willow	100	151,200	0.7874	1.267726093	91,048.09	91.05	334.15
1	Cottonwood	100	64,800	0.7874	0.778551475	23,963.81	23.96	87.95
					Year 1 Total =	115,011.90	115.01	422.09
5	Willow	70	105,840	1.5748	3.437936905	172,838.84	172.84	634.32
5	Cottonwood	70	45,360	1.77165	1.982981018	42,725.31	42.73	156.80
					Year 5 Total =	215,564.15	215.56	791.12
20	Willow	50	75,600.0	3.937	12.85443393	461,602.72	461.60	1,694.08
20	Cottonwood	50	32,400.0	4.7244	6.143528938	94,548.91	94.55	346.99
					Year 20 Total =	556,151.63	556.15	2,041.08
50	Willow	30	45,360.0	19.685	130.3408305	2,808,323.53	2,808.32	10,306.55
50	Cottonwood	30	19,440.0	30.3149	52.37994123	483,676.38	483.68	1,775.09
					Year 50 Total =	3,291,999.91	3,292.00	12,081.64

Step 3

Prior to the final step of this analysis, total project emissions need to be estimated. The initial air quality emissions analysis (Environmental Appendix D – Attachment 10a) evaluated project emissions associated with a worst-case/highest potential emissions scenario. For the purpose of that analysis, the work anticipated in year 1 of construction was used to develop assumptions regarding hauling quantities, required equipment, and crew. It is unlikely that the level of effort in the remaining years of construction for either Alternative 5 or Alternative 6 would result in a level of effort equal to that in year 1. A maximum effort conducted annually for each year of the project would represent approximately 200% the proposed excavation effort. Therefore, additional assumptions were made in evaluating potential emissions associated with the remaining years of construction to arrive at a more representative estimate of total project emissions.

The general strategy for determining total project GHG emissions would be to add the emissions calculated for year 1 (worst case scenario) to average emissions calculated for each remaining year of construction. Alternative 5 would require 4 years to construct and Alternative 6 would require 5 years to construct, therefore, following year 1, the Alternatives, respectively, would have 3 and 4 years of construction remaining. The potential average emissions for each remaining year were estimated by revising the air quality model inputs (for the year 1 worst case scenario evaluated in Environmental Appendix D – Attachment 10a) for the soil hauling quantities anticipated during remaining years. All other inputs for equipment, crew, and sequencing were assumed to remain unchanged. Revised daily hauling quantities for staging were developed for each alternative using the assumption that 3 staging sites would be developed during each remaining year of construction. Revised daily hauling quantities for excavation were developed for each alternative by dividing the remaining need of excavation following year 1 by the remaining duration of excavation.

The revised daily hauling assumptions (emissions modeling inputs) and results are presented in Table 5. The estimated total project emissions of GHG is presented in Table 6.

Table 5. Revised Inputs and Results of Average Emissions for Remaining Years of Construction

Alternative	Revised Inputs		Results Average GHG Emissions during remaining years (metric tons CO_2e)
	Daily Hauling Quantity CY (Staging Phase)	Daily Hauling Quantity CY (Excavation Phase)	
Alternative 5 (Recommended Plan)	106	850	1,777
Alternative 6	106	1,125	1,930

Table 6. Estimated Total GHG Emissions

Alternative	Annual GHG Emissions (metric tons CO_2e)					
	Year 1[1]	Year 2[2]	Year 3[2]	Year 4[2]	Year 5[2]	Total
Alternative 5 (Recommended Plan)	2,945	1,777	1,777	1,777	NA	8,276
Alternative 6	2,945	1,930	1,930	1,930	1,930	10,665

1 – Emissions for year 1 estimated under a reasonable worst-case/ maximum emissions scenario (Environmental Appendix D – Attachment 10a).

2 – Emissions estimated for remaining years of construction representative of anticipated average annual emissions.

Step 4

The final step in this analysis compares modeled emissions against potential sequestered carbon in common units of CO2e (metric tons). The values for potential carbon sequestration in key years of analysis were then compared to the total emissions estimate to evaluate the mitigating value of carbon sequestration from planting of riparian vegetation on GHG emissions as they relate to climate change. The results of this comparison are summarized in Table 7 below.

3.0 Results

Table 7 summarizes the results of the carbon sequestration analysis. Over the 50 year period of analysis, both Alternative 5 and 6 would result in a long term net carbon sequestration from tree production alone. For both Alternatives, the total modeled emissions of GHG CO_2e from the project would be offset by sequestered carbon related to planted vegetation between year 20 and 50 following construction. The results are further discussion is Section 4.3.2 of the FR/EA.

Table 7. Summary of Carbon Sequestration for Alternative 5 and Alternative 6

	year 1	**year 5**	**year 20**	**year 50**
Alternative 5 (Recommended Plan)				
Estimated Project Emissions (metric tons CO_2e)	2,945	8,276	8,276	8,276
Estimated sequestered Carbon (metric tons CO_2e)	399	747	1,928	11,410
Net Carbon Produced (metric tons CO_2e)	+2,546	+7,529	+6,348	-3,134
Alternative 6				
Estimated Project Emissions (metric tons CO_2e)	2,945	10,665	10,665	10,665
Estimated sequestered Carbon (metric tons CO_2e)	422	791	2041	12,082
Net Carbon Produced (metric tons CO_2e)	+2,523	+9,874	+8,624	-1,417

4.0 References

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Environmental Appendix D
Attachment 11

Traffic Analysis

Yuba River Ecosystem Restoration Feasibility Study

Prepared By

U.S. Army Corps of Engineers

Sacramento District

October 2018

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Contents

1.0 Introduction D11-5

2.0 Methods D11-5

2.0 Assumptions D11-5

2.1 Alternatives D11-5

2.2 Anticipated Work D11-6

2.2 Construction Schedule D11-6

2.5 Equipment D11-7

2.5.1 Staging Phase D11-7

2.5.2 Excavation Phase D11-7

2.5.3 Planting Phase D11-8

3.0 Results D11-8

4.0 References D11-10

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1.0 Introduction

This attachment documents the methods, assumptions, and results of the analysis used to evaluate potential construction related impacts from Alternatives 5 (Recommended Alternative) and Alternative 6 to traffic in the project area.

2.0 Methods

Evaluation of the project's potential impacts on transportation resources was based on a review of transportation infrastructure in the area that could be affected by short and long term project-related activities and elements. The traffic analysis is a comparison of the traffic conditions during project construction against the rated level of service of project area roads. The project would be considered to have a significant adverse effect if construction related traffic increased the traffic beyond the level of service for any road in the project area. Impacts to level of service is evaluated as increases to daily average traffic conditions and daily peak traffic conditions.

Although Alternative 6 would require an additional season to construct, activities in any given year would follow the same sequencing (Figure 1). Furthermore, both alternatives would be constructed using the same equipment and level of effort in any given year. Therefore, a single analysis provides a suitable assessment of the potential project effects to traffic for both Alternative 5 and Alternative 6. To complete the analysis, information was collected on projected construction activities, duration, and timing, equipment use, and activities for each construction year. Assumptions incorporated into this analysis were based on feasibility level design and cost estimates.

2.0 Assumptions

This section documents the assumptions that were used in the development of the traffic analysis for Alternative 5 and Alternative 6. Assumptions incorporated into this analysis were based on feasibility level design and cost estimates.

2.1 Alternatives

Alternatives 5 and 6 are similar in the type and scope of proposed restoration measures; Alternative 5 is the Recommended Plan and Alternative 6 includes an additional habitat increment (increment 1) that reduces the overall cost effectiveness of implementation. Alternative 5 includes increments 2, 5b, 5a, and 3a at Upper Gilt Edge Bar, Unnamed Bar, Narrow Bar, River Mile 6.5, Bar E, Island B, Bar C, Lower Gilt Edge Bar, Hidden Island, First Island, Silica Bar, and North Silica Bar, which would result in 173.5 acres of restored habitat by lowering the floodplain to facilitate inundation and planting riparian vegetation, as described above. The total cost of this alternative is $89.4 million. Alternative 6 includes increments 2, 5b, 5a, 3a, and 1 at Upper Gilt Edge Bar, Unnamed Bar, Narrow Bar, River Mile 6.5, Bar E, Island B, Bar C, Lower Gilt Edge Bar, Hidden Island, First Island, Silica Bar, North Silica Bar, and Upstream of Highway 20, which would result in 192.8 acres of restored habitat by lowering the floodplain to facilitate inundation and planting riparian vegetation, as described above. The total cost of this alternative is $109.6 million.

2.2 Anticipated Work

This analysis is designed to estimate traffic conditions under a reasonable worst case scenario. It is anticipated that the work that would occur in year 1 of construction would result in the highest increases to annual and peak traffic. During year 1, it is construction would occur in 5 locations within Habitat Increments 3a, 5a, and 5b. Construction at 3a would include development of 2 staging areas and access to support construction of riparian planting features. Construction at 5a would include development of 1 staging area and access to support construction of excavation and riparian planting features. Construction at 5b would require development of 2 staging areas and access to support construction of excavation and riparian planting features. No installation of hydraulic roughness/ structural habitat elements is anticipated in year 1. In summary, this analysis includes assumption for work to occur simultaneously at 5 locations. Although the traffic associated with work during year 1 would utilize separate roads for access due to locations of work and staging sites on both the north and south sides of the Yuba River, for the purpose of this analysis, the total traffic generated from project activities will be used to evaluate impacts to level of service on all roads. Therefore, it is anticipated that during PED, the use of road ways on the north and south of the river will result in lower impacts to traffic conditions than those estimated under this analysis.

2.2 Construction Schedule

The general assumptions applied in developing a worst case scenario for construction schedule include:

- Alternative 5 would require 4 separate years to construct the required features
- Alternative 6 would require 5 years of construction;
- General construction would occur over 6 months (June 1 to November 30);
- In water construction would occur over 4 months (July 1 to October 30);
- Construction will begin in 2021;
- All required administrative, legal, real estate and environmental clearances/approvals will be acquired prior to initiation of construction;
- Annual construction would include: staging/clearing, excavation, installation of hydraulic roughness/structural complexity elements, and harvesting and planting of riparian vegetation.
- The conceptual annual construction schedule in Figure 1 below would be applied to Alternative 5 and Alternative 6. The high average construction related traffic would occur during June - September when excavation is underway. The peak construction related traffic would occur during October, when excavation and planting phases overlap.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Vegetation Removal and Trimming				Staging/ Site Prep	Excavation and Installation of non-vegetative restoration features (in water work limited to July 1 – October 31)						
								Preparation for planting	Harvest and Planting of Vegetative Features		

Figure 1. Annual Construction Sequencing

2.5 Equipment

Estimates for equipment were made for each modeled phase: Staging, Excavation, and planting. Estimates of work and equipment were developed by staging site and associated features to support development of feasibility level designs and associated costs. For the purpose of this analysis increases to traffic focused on the number of workers and associated commute trips as well as the number of hauling trips (export or import of material). A buffer of 100 daily vehicle trips was added as a buffer, to account for other construction related trips (i.e., transport of equipment, import of associated supplies, monitoring, site meetings/ inspections, etc.).

2.5.1 Staging Phase

The staging phase would require development of access and preparation of staging areas. Although no excavation work is anticipated, material would be hauled onsite to prepare the staging area and to repair portions of the access road. The assumptions of construction related trips required during the staging phase are summarized in Table 1 below.

Table 1. Equipment and Crew Assumptions for Staging Phase

Equipment	Level of Effort
Haul Trips	Assume 15 trucks running for 10 hours per day at a rate of 1 round trip (2 trips) per hour. 300 daily trips.
Crew Trips	Assume 13 people per crew per site, 65 total crew, with 1 round trip (2 trips) per day. 130 daily trips.
Other Trips	Assume 100 additional trips per day to account for other potential trips associated with staging. 100 daily trips.
Total daily Trips	530 daily trips.

2.5.2 Excavation Phase

The excavation phase would require excavation and hauling of substrate as well as maintenance of haul roads. The assumptions of construction related trips required during the excavation phase are summarized in Table 2 below.

Table 2. Equipment Assumptions for Excavation Phase

Equipment	Level of Effort
Haul Trips	Assume 25 trucks running for 10 hours per day at a rate of 1 round trip (2 trips) per hour. Total 500
Crew	Assume 11 full time efforts for road maintenance and 16 full time efforts for excavation (total 27 crew) with 1 round trip (2 trips) per day. 54 daily trips.
Other Trips	Assume 100 additional trips per day to account for other potential trips associated with excavation.
Total daily Trips	654 daily trips.

2.5.3 Planting Phase

The planting phase would require the identification, harvest, and planting of riparian vegetation as well as maintenance of haul roads. The assumptions of construction related trips required during the planting phase are summarized in Table 3 below.

Table 3. Equipment Assumptions for Planting Phase

Equipment	Level of Effort
Haul Trips	For the planting phase, no import or export of substrate is anticipated, however, pick-ups and flat beds would be required during the marking, harvesting, and planting of riparian vegetation. The number of flatbeds and pick-ups would be associated with number of crews and planting sites. Assume 22 trucks for identification, harvest, and planting with 1 round trip (2 trips) per day and 4 additional on road trips per day to move between sites. 500 daily trips.
Crew	Assume 32 full time equivalent efforts for marking and harvesting and 36 full time equivalent efforts people for planting site. Assume 11 full time equivalent crew for road maintenance. 79 total crew with 1 round trip (2 trips) per day. 158 daily trips.
Other Trips	Assume 100 additional trips per day to account for other potential trips associated with planting phase.
Total daily Trips	390 daily trips.

3.0 Results

The excavation phase would result in the greatest number of construction related traffic at 654 daily trips. For the purpose of this analysis, the excavation phase will be used as a representative of the average increase to traffic conditions. The staging phase would result in an increase of 530 daily trips and the planting phase would result in an increase of 390 daily trips. The peak daily trips would occur during October when the excavation phase and the planting phase overlap. Therefore, the peak traffic conditions can be estimated as the sum of estimated increase to daily trips under the excavation phase and the planting phase; 1044 daily trips. This estimate is conservative as it includes buffers of 100 daily trips for both the excavation and the planting phase and also double counts some daily trips associated with road maintenance activities. The analysis also assumes that all traffic would be routed down the same road which adds to the conservative nature of the estimated increase to traffic conditions. Under this analysis, neither increases to average daily traffic conditions nor increases to peak daily traffic conditions would result in an exceedance of the level of service for any road in the project area (Table 5). The results of this analysis are further discussed in Section 4.3.8 of the Final Feasibility Report/ Environmental Assessment.

Table 5. Summary of Traffic Analysis for Alternative 5 and Alternative 6

Roadway	Peak Daily Traffic Count	Level of Service Threshold	With-Project Average Daily Traffic	With-Project Peak Daily Traffic
Highway 20	10,300	13,500 (LOS D)	10,954	11,344
Highway 20	7,600	13,500 (LOS D)	8,254	8,644
Highway 70	17,600	77,400 (LOS D)	18,254	18,644
Hammonton Smartsville Road	2,100*	7,800 (LOS D)	2,754	3,144

Source: Caltrans 2015; Yuba County 2011

* Average Daily Traffic rather than Peak Daily Traffic

4.0 References

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