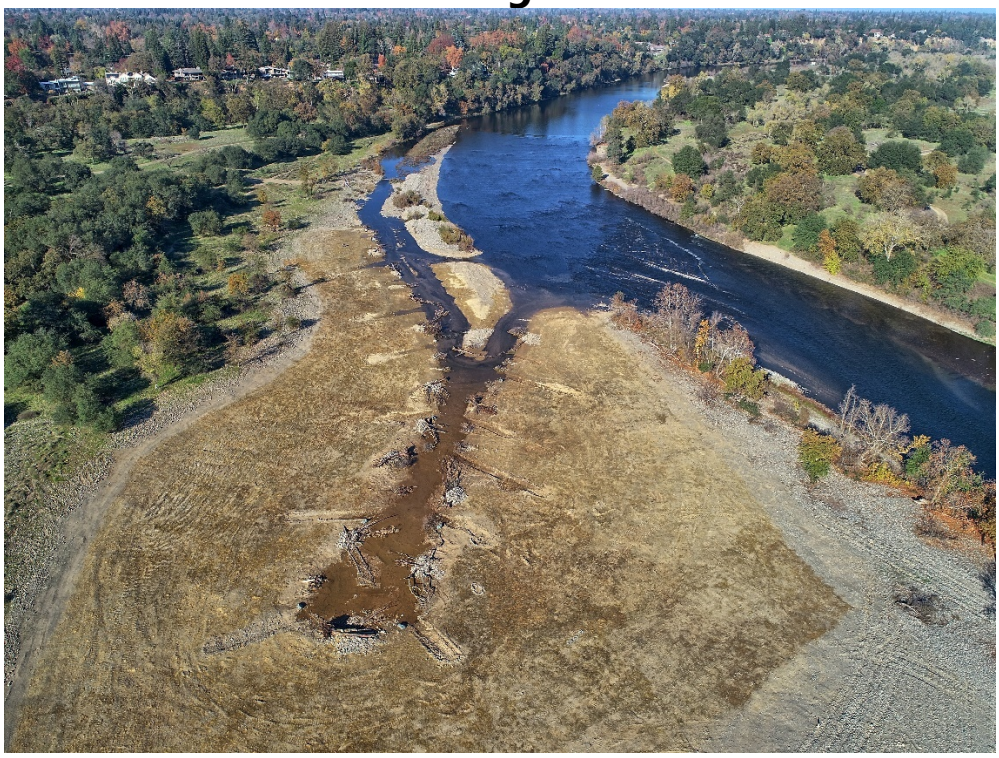
BUREAU OF RECLAMATION

2021 Long-Term Operations Habitat Restoration Report

Central Valley Project, California
California-Great Basin Region



U.S. Department of the Interior

December 2021

Mission Statements

The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated Island Communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

2021 Long-Term Operations Habitat Restoration Report

Central Valley Project, California
California-Great Basin Region

prepared by

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Cover Photo: Completed Ancil Hoffman spawning and rearing habitat restoration on the American River, looking upstream with a good view of the rearing habitat. (Reclamation/John Hannon)

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Purpose

This 2021 Long-Term Operations Seasonal Habitat Restoration Report summarizes the habitat restoration work that was implemented in water years (WY) 2020 and 2021 and planned work for WY 2022 that contributes toward the conservation measures outlined in the Proposed Action (PA) and associated National Marine Fisheries Service's (NMFS) and U.S. Fish and Wildlife Service's (USFWS) respective biological opinions for the Long-Term Operations of the Central Valley Project (CVP) and State Water Project (SWP). As part of the PA, the U.S. Bureau of Reclamation (Reclamation) and the California Department of Water Resources (DWR) proposed conservation measures to avoid and minimize or compensate for CVP and SWP project effects on listed species. These conservation measures include non-flow, habitat restoration actions to improve spawning and rearing habitat and improve food web conditions. *Exhibit F - Habitat Restoration Updates* of *Appendix C - Real-Time Water Operations Charter* of the October 2019 Biological Assessment for the 2019 PA describe the requirements for reporting on habitat restoration actions outlined as part of the Proposed Action. The requirements are as follows:

> Annually and/or as needed, Reclamation and DWR would list the planned, under construction, and recently completed habitat restoration actions. For each action, the list would include:
>
> - Name of Project
> - Completion Date (Planned and Actual)
> - Changes to Operational Metrics (e.g., Acres Inundated, X2 Relationship)
> - Changes to Habitat Metrics (e.g., Rearing, Spawning, Foraging)
> - Relevant Flow Experiments

Background

The CVP, which runs approximately 400 miles from the southern end of the Cascade Mountains in the north to the Tehachapi Mountains in the south, allows Reclamation to deliver about 7 million acre-feet of water annually for agricultural, urban, and wildlife uses. The 2020 Record of Decision implementing the coordinated Long-Term Operation of the CVP and SWP included non-flow, habitat restoration actions to increase and maintain spawning and rearing habitat, including creation, expansion, and grading of floodplains and side channels; adding spawning and large cobble; adding large, woody materials for salmonids; and increasing food web support for tidal habitat for Delta Smelt. In 2013, responding to Listen to the River, and Independent Review of the Anadromous Fish Programs, Reclamation and the USFWS began a structured decision making process to improve the scientific basis for restoration for salmonids. A Science Integration Team (SIT) comprised of local, state, and federal agencies and interested parties develop and maintain a decision support model to inform restoration needs.

This report includes calculations of the number of fry and Redds able to utilize the amount of habitat created and maintained for the habitat actions completed in the American River, Clear Creek, the Sacramento River, and the Stanislaus River in WY 2020 and 2021. These calculations are based on territory requirement values developed by the SIT. The SIT based their estimate for fry territory

requirement (roughly 0.054 square meters) on the Grant & Kramer equation for territory size (m2) as a function of fork length (cm); (log10 territory size = 2.61 log10 fork length — 2.83, $r2 = 0.87$, $n = 23$). (James W. A. Grant and Donald L. Kramer. Territory Size as a Predictor of the Upper Limit to Population Density of Juvenile Salmonids in Streams. *Canadian Journal of Fisheries and Aquatic Sciences*. **47**(9): 1724-1737. https://doi.org/10.1139/f90-197). The SIT as a whole now uses roughly 9.29 square meters for Redd size based on studies originating in the north portion of the Sacramento Valley. These calculations of fry and Redds are static estimates of the number of fish able to use the available habitat. They are based solely on the amount of available territory and are not intended as an estimate of the number of fish that will be present in the restored area.

The PA includes a mix of standard consultation (which includes an Incidental Take Statement [ITS]) and programmatic consultation (for which an ITS is not required at the programmatic stage). This report includes discussion of permitting and consultation for each completed project that was addressed programmatically in the PA.

Summary of Habitat Restoration Projects

Attachment A includes a list of habitat restoration work implemented in WY 2020 and 2021 and planned for WY 2022 that contribute toward the habitat restoration conservation measures identified in the 2019 PA. The sections below summarize the habitat restoration work implemented in WY 2020 and 2021 and planned for WY 2022.

Upper Sacramento River (Shasta and Sacramento Divisions)

Battle Creek Salmon and Steelhead Restoration Project and Battle Creek Reintroduction Plan

Battle Creek - Habitat Restoration Conservation Measures

Conservation measures for Battle Creek (PA page 4-41, Section 4.10.1.5.2) are as follows:

Reclamation will provide funding for ten years towards reintroduction of Winter-run Chinook Salmon to Battle Creek. Reclamation will accelerate implementation of the Battle Creek Salmon and Steelhead Restoration Project, which is intended to reestablish approximately 42 miles of prime salmon and Steelhead habitat on Battle Creek, and an additional 6 miles on its tributaries. The Battle Creek Restoration Project is a collaborative effort among several federal and state agencies and Pacific Gas & Electric Company. The partnership provides a framework for expanding Winter-Run Chinook Salmon spawning to cold water habitat not in the Sacramento River.

Battle Creek - Implemented in WY 2020 and 2021

Implementation of the Battle Creek Salmon and Steelhead Restoration Project is ongoing. During WY 2021, Reclamation completed a value engineering (VE) study on the design of a new fish trap and sorter for Coleman Hatchery. The fish trap and sorter would reduce handling stress associated with handling adult winter-run salmon returning to Battle Creek. The VE team developed two

proposals (i.e., design changes) and eleven design considerations and completed a final VE study report.

Reclamation funded USFWS Red Bluff office for reintroduction monitoring activities as follows:

1. Adult Winter-run Chinook Salmon stream surveys
2. Adult winter-run Chinook telemetry
3. Juvenile winter-run Chinook Salmon acoustic telemetry
4. Eagle Canyon Diversion Dam Canal Gate Monitoring
5. Evaluation of genetic diversity and life-history strategies in upper Sacramento River and tributary Chinook Salmon and Central Valley steelhead

The deliverables from these activities include an annual report detailing each activity and the results along with useable data files of all raw data collected including analyses used in preparation of the report. The due date for each annual report is September 30 of the year following the sample year and the due date for task 5 is 9/30/2024.

USFWS completed removal of a barrier upstream of Eagle Canyon Dam in 2021. This will provide volitional access for winter-run to cold water in north fork of Battle Creek once fish passage through two downstream barriers is established.

Battle Creek - Planned for 2022

- The winter-run Chinook salmon reintroduction will continue in 2022 utilizing offspring of the captive broodstock and adult returns to Battle Creek from prior year winter-run releases. Spawning and incubation will occur at LSNFH and juvenile rearing will likely occur at a private facility in the Battle Creek watershed.
- Final design for Coleman Dam removal is planned for 2022
- A natural barrier blocks fish passage in the north fork below Eagle Canyon Dam and a contract is in place to remove the barrier. Entities are working to obtain landowner permission to access the barrier for the project so that work can occur in 2022.
- The Eagle Canyon Dam Fish Ladder operation is pending acceptance of the project by PG&E due to uncertainty over fish being diverted into the water diversion when the ladder operates. The agencies will continue to devise a solution there.
- The monitoring funded in 2021 will occur in 2022.
- The estimated total cost of the Battle Creek Restoration Project is $165.35 million and is fully funded except for $0.5 million for Coleman Dam removal.
- PG&E filed an intent not to renew the FERC license for the Battle Creek Hydroelectric Project in 2026 and the existing license expires July 31, 2026. The principal Battle Creek Hydroelectric project works consist of: (1) Two small upstream storage reservoirs; (2) three forebays; (3) twenty canals and pipelines and associated diversion dams; (4) penstocks leading to five powerhouses; (5) five 60-kV transmission lines with a total length of 50.3 miles; and (6) five substations.

Sacramento River Spawning and Rearing Habitat Restoration

Sacramento River - Habitat Restoration Conservation Measures

Conservation measures for spawning and rearing habitat restoration in the Sacramento River (PA page 4-41, Section 4.10.1.5.2) are as follows:

Reclamation proposes to create additional spawning habitat by injecting approximately 15,000 – 40,000 tons of gravel annually into the Sacramento River to 2030, using the following sites: Keswick Dam Gravel Injection Site, Market Street Injection Site, Redding Riffle, Turtle Bay, Tobiasson Island, Shea Levee sites, and Kapusta.

Reclamation, in coordination with the Sacramento River Settlement Contractors proposes to create 40–60 acres of side channel and floodplain habitat at 10 sites in the Sacramento River by 2030. The potential sites include Salt Creek, Turtle Bay Island, Kutras Lake Rearing Structures, Painter's Riffle maintenance, North Cypress maintenance, Cypress South maintenance, North Tobiasson Rearing Structures maintenance, Tobiasson Side Channel, Shea Side Channel, Kapusta Side Channel, Kapusta 1-A Side Channel maintenance, Kapusta 1-B Side Channel, Anderson River Park Side Channels maintenance, Cow Creek Side Channel, I-5 Side Channel, China Gardens, Rancheria Island Side Channel maintenance, Rancho Breisgau, Lake California Side Channel maintenance, Rio Vista Side Channel maintenance, East Sand Slough Side Channel, La Barranca Side Channel, Woodson Bridge Bank Rearing Improvement, Jellys Ferry, Dog Island, Altube Island, Blackberry Island, Oklahoma Avenue, Mooney Island, McClure Creek, Blethen Island, Wilsons Landing, McIntosh Island, Shaw, Larkins, Reilly Island, Hanson Island, and Broderick.

Sacramento River - Implemented in WY 2020 and 2021

The October 2019 PA identified the creation of 40 – 60 acres of rearing habitat in the Sacramento River by 2030, which would have the potential to support 3 million to 4.5 million fry respectively. In WY 2020 and 2021, habitat restoration activities on the Sacramento River created roughly 26.6 acres of rearing habitat, which has the potential to support roughly 2 million fry. The October 2019 PA also identified the injection of approximately 15,000 – 40,000 tons of gravel annually into the Sacramento River to create and maintain spawning habitat in the Sacramento River through 2030. In WY 2020 and 2021, gravel augmentation using spawning sized gravel excavated from rearing habitat project sites created 2.5 acres of spawning habitat, which has the potential to support roughly 1,090 Redds. According to population estimates by DWR's Fisheries Branch Anadromous Resource Assessment Unit, escapement in 2019 in the Sacramento River was roughly 25,500 (GrandTab 2021.06.30). Additional details about each habitat restoration project completed in WY 2020 and 2021 on the Sacramento River are identified below.

In WY 2020, in accordance with the charter for LTO Implementation of the Sacramento River Spawning and Rearing Habitat, rearing habitat restoration was completed at Rio Vista Side Channel and Rancheria Island Side Channel Phase II.

Rio Vista Side Channel
In January 2020, construction was completed on two acres of perennial rearing habitat at Rio Vista Side Channel by excavating a historic side channel to create perennial flow and adding 15 clusters of large wood for cover. This multi-objective project also added a portion of excavated materials to the

Sacramento River as a source of spawning sized gravel, creating 0.25 acres of spawning habitat. The two acres of rearing habitat created by this project have the potential to support roughly 150,000 fry and the 0.25 acres of spawning habitat added have the potential to support roughly 110 Redds. Site specific ESA consultation for this project through USFWS was completed on June 15, 2016 in the Upper Sacramento River Anadromous Fish Programmatic USFWS Concurrence Letter (ID #: 08FBDT00-2016-I-0166). Site specific ESA consultation for this project through NMFS was completed on October 2015 in the Upper Sacramento River Anadromous Fish Habitat Restoration Project NMFS Biological Opinion.

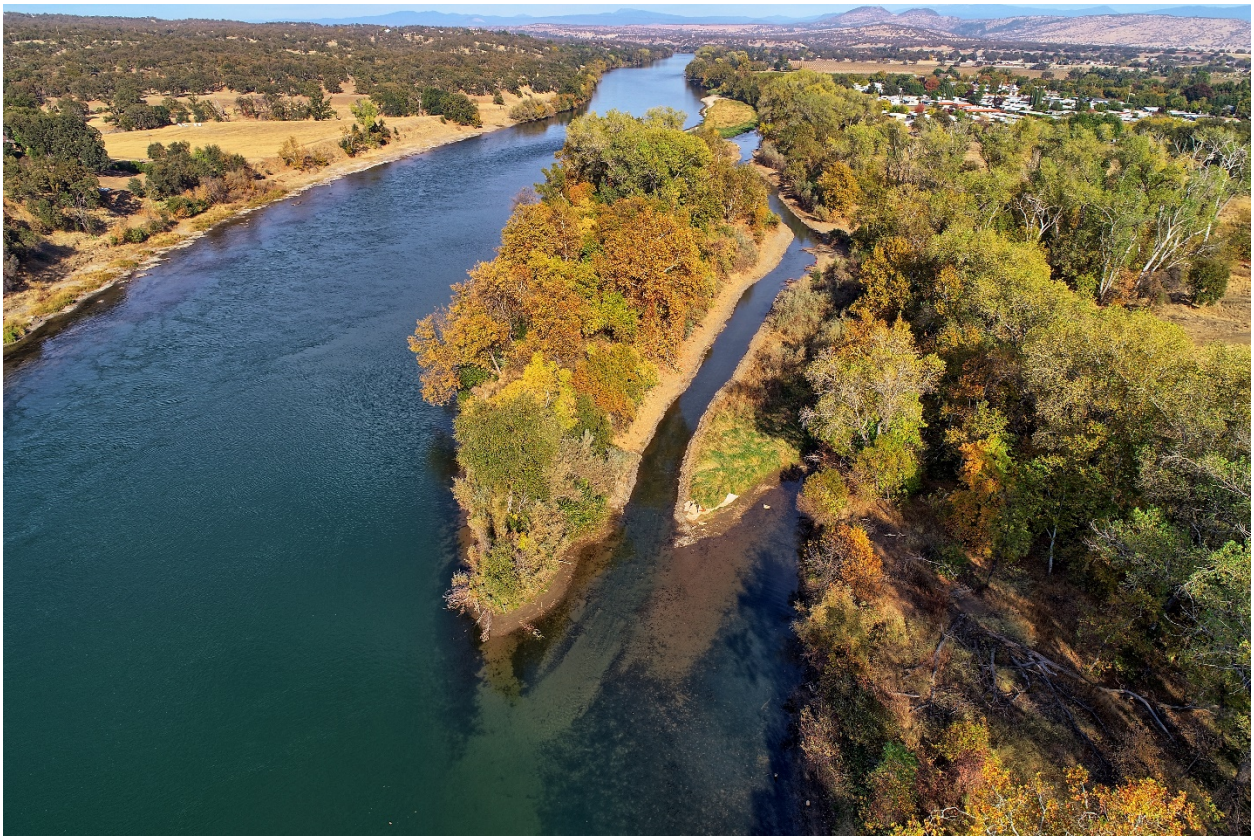


Figure 1. Looking upstream at the Rio Vista Side Channel.

Rancheria Island Side Channel (Reading Island)

In May 2020, construction was completed on eight acres of perennial rearing habitat, five acres of floodplain rearing habitat, and 0.25 acre of spawning habitat at Rancheria Island Side Channel Phase II by opening a farmer berm, excavating 0.9 mile of channel, and the landowner installed a bridge over the channel at the farmer berm. Additionally, the multi-objective project removed 12 acres of predator hot spot and added over 100 clusters of large wood for cover. The 13 acres of rearing habitat created by this project have the potential to support roughly 974,000 fry and the 0.25 acres of spawning habitat added have the potential to support roughly 110 Redds. Site specific ESA consultation for this project through USFWS was completed on June 15, 2016 in the Upper Sacramento River Anadromous Fish Programmatic USFWS Concurrence Letter (ID #: 08FBDT00-2016-I-0166). Site specific ESA consultation for this project through NMFS was completed on October 2015 in the Upper Sacramento River Anadromous Fish Habitat Restoration Project NMFS Biological Opinion.

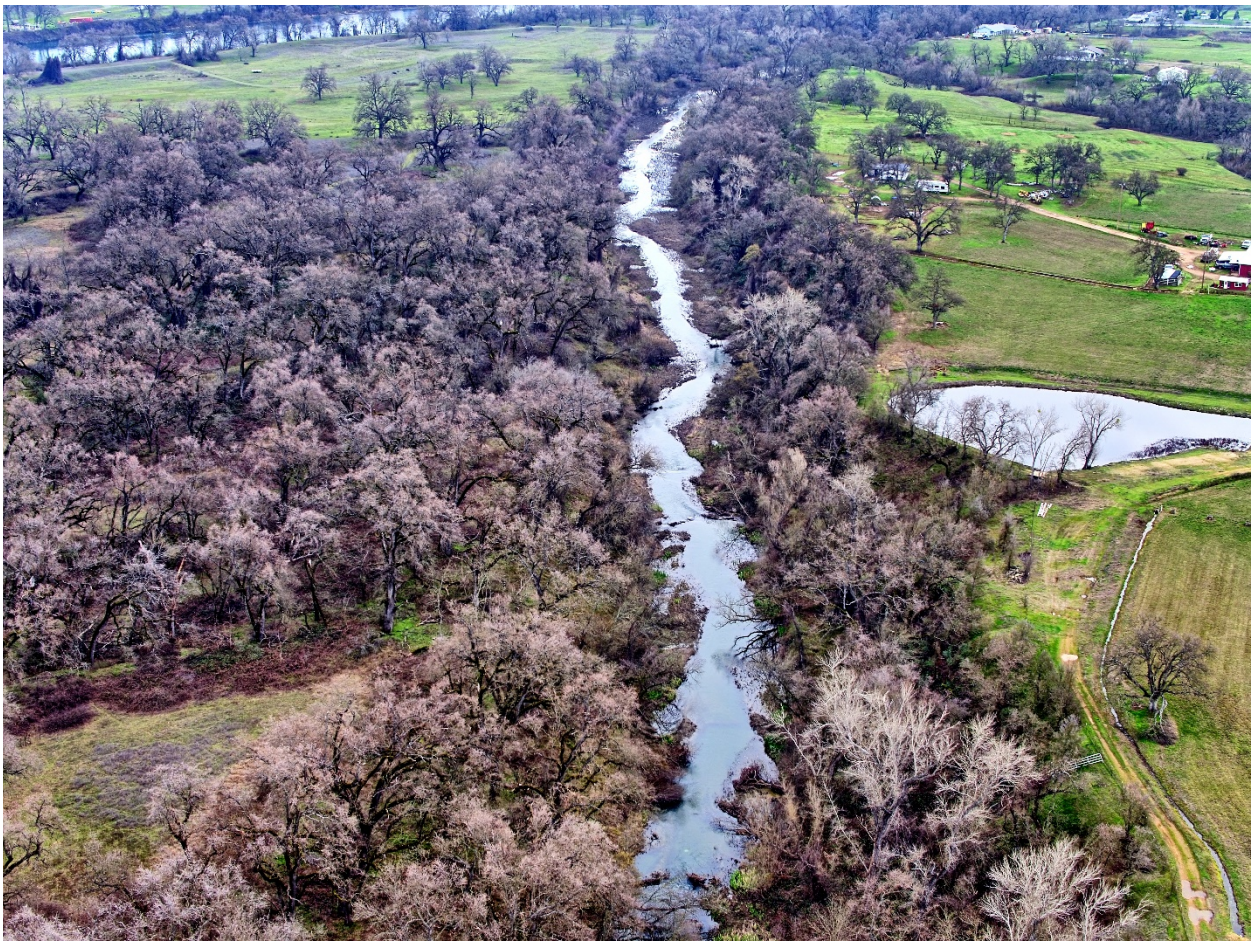


Figure 2. Looking downstream at habitat opened by the Rancheria Island Side Channel project.

In WY 2021, in accordance with the charter for LTO Implementation of the Sacramento River Spawning and Rearing Habitat, rearing habitat restoration was completed at Anderson River Park Side Channels and Cypress South.

Anderson River Park Side Channels

In March 2021, construction at the Anderson River Park Side Channels was completed to create 4.4 acres of perennial rearing habitat and two acres of floodplain rearing habitat by excavating three side channels and adding 200 clusters of large wood to provide perennial flow and remove six acres of predator hot spot at an existing channel at the downstream end of the project. Additionally, some of the excavated gravel was added to the adjacent Sacramento River channel for mobilization under high flows to create one acre of spawning habitat. The 6.4 acres of rearing habitat created by this project have the potential to support roughly 480,000 fry and the one acre of spawning habitat added has the potential to support roughly 435 Redds. Site specific ESA consultation for this project through USFWS was completed on June 15, 2016 in the Upper Sacramento River Anadromous Fish Programmatic USFWS Concurrence Letter (ID #: 08FBDT00-2016-I-0166). Site specific ESA consultation for this project through NMFS was completed on October 2015 in the Upper Sacramento River Anadromous Fish Habitat Restoration Project NMFS Biological Opinion.

Figure 3. Looking upstream at the Anderson River Park Side Channels project with phase I channel on the right and phase II channel on the left.

Cypress South Maintenance

In June 2021, construction at Cypress South was completed to create 5.2 acres of perennial rearing habitat by excavating a perennial side channel through existing isolated ponds. This multi-objective project also added a portion of excavated materials to a designed riffle in the Sacramento River adjacent to the site to create one acre of spawning habitat. Additionally, the project reduced 2.9 acres of predator hot spot and added over 40 clusters of large wood for cover. The 5.2 acres of rearing habitat created by this project have the potential to support roughly 390,000 fry and the one acre of spawning habitat added have the potential to support roughly 435 Redds. Site specific ESA consultation for this project through USFWS was completed on June 15, 2016 in the Upper Sacramento River Anadromous Fish Programmatic USFWS Concurrence Letter (ID #: 08FBDT00-2016-I-0166). Site specific ESA consultation for this project through NMFS was completed on October 2015 in the Upper Sacramento River Anadromous Fish Habitat Restoration Project NMFS Biological Opinion.

Figure 4. Looking downstream toward the lower end of the Cypress South (Nur Pon) Side Channel.

Sacramento River - Planned for 2022

Gravel Augmentation
In WY 2022, approximately 20,000 tons of gravel is anticipated to be injected into the Sacramento River. Sites for injection are currently under review Site specific ESA consultation for this project through USFWS was completed on June 15, 2016 in the Upper Sacramento River Anadromous Fish Programmatic USFWS Concurrence Letter (ID #: 08FBDT00-2016-I-0166). Site specific ESA consultation for this project through NMFS was completed on October 2015 in the Upper Sacramento River Anadromous Fish Habitat Restoration Project NMFS Biological Opinion.

East Sand Slough Side Channel
In WY 2022, rearing habitat restoration will be completed at East Sand Slough Side Channel. This project was originally identified to be completed in 2021 in the charter for LTO Implementation of the Sacramento River Spawning and Rearing Habitat. The project will create 7.1 acres of perennial rearing habitat and seven acres of more frequently inundated floodplain rearing habitat by excavating a low flow channel through the former inundation area of Red Bluff Diversion Dam. The project will also add over 400 clusters of large wood for cover and reduce one acre of predator hot spot. The 14.1 acres of rearing habitat anticipated to be created through this project will have the potential to support roughly 1 million fry. Site specific ESA consultation for this project through USFWS was completed on April 20, 2020 in the USFWS concurrence letter (ID #: 08FBDT00-2020-I-0126) related to East Sand Slough. The USFWS concurrence letter was amended in June 16, 2020 and

concluded USFWS ESA Section 7 consultation (ID #: 08FBDT00-2020-I-0126-R001). Site specific ESA consultation for this project through NMFS was completed on April 2020 through the NMFS NOAA Restoration Center's (RC's) Central Valley Office Programmatic Approach Biological Opinion.

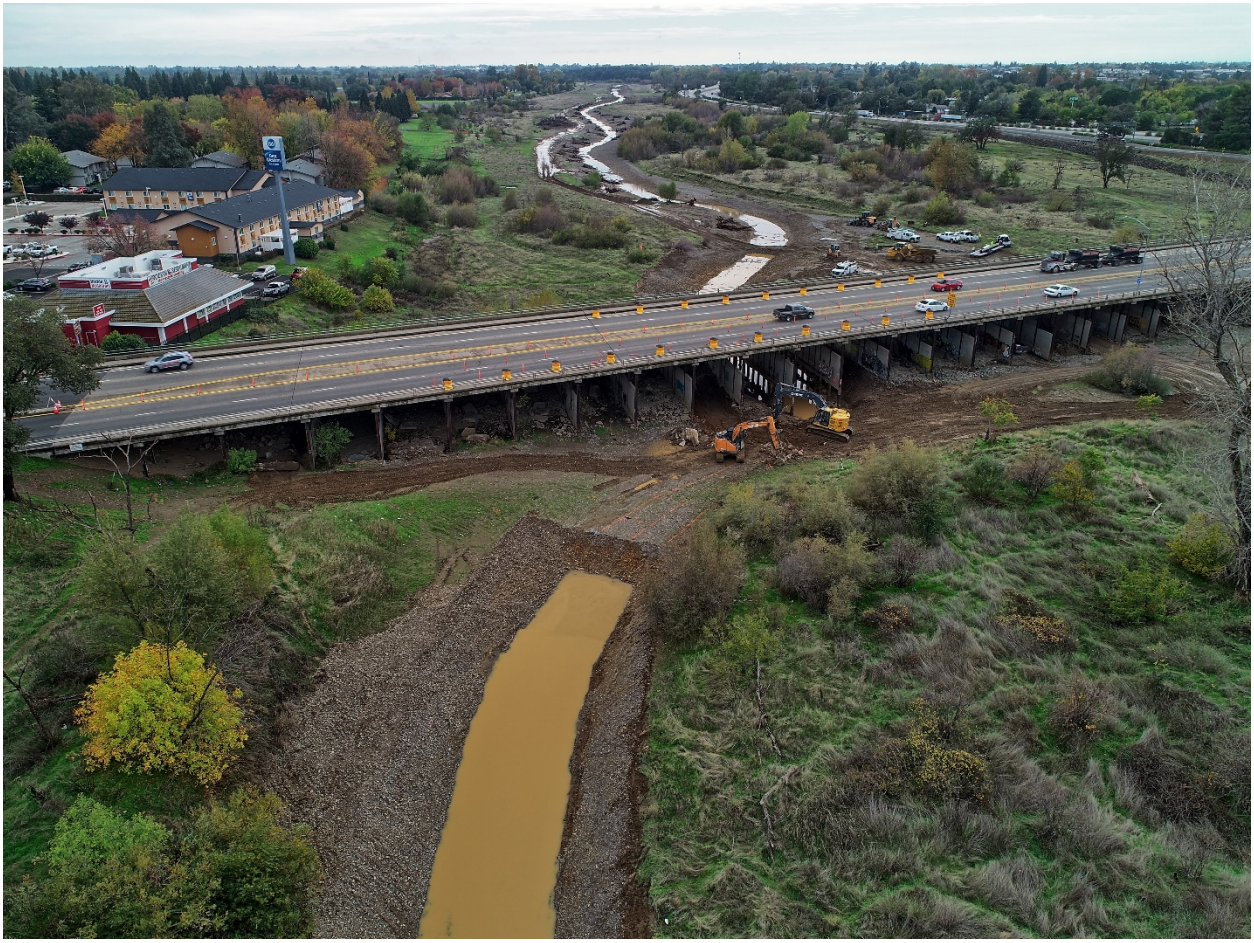


Figure 5. Looking downstream at the East Sand Slough project across the Highway 36 bridge with construction underway in November 2021.

Clear Creek

Clear Creek - Channel Maintenance

Clear Creek - Habitat Restoration Conservation Measures

Conservation measures for Clear Creek (PA page 4-48, Section 4.10.2) are as follows:

Reclamation and DWR propose to continue channel maintenance under the Clear Creek Restoration Program.

Clear Creek - Implemented in WY 2020 and 2021

According to population estimates by DWR's Fisheries Branch Anadromous Resource Assessment Unit, escapement in 2019 in Clear Creek was roughly 5,700 (GrandTab 2021.06.30). In WY 2020 and 2021, habitat restoration activities in Clear Creek created roughly 19 acres of rearing habitat and 0.8 acres of spawning habitat, which have the potential to support roughly 1.34 million fry and roughly 350 Redds respectively. In addition, the augmentation of 9,418 tons of gravel maintained the 20.7 acres of existing spawning habitat in Clear Creek, which has the potential to support 9,000 Redds.

Clear Creek Gravel Augmentation

In WY 2020, in accordance with the Lower Clear Creek Anadromous Fish Habitat Restoration and Management Project charter, in July and August 2020, a total of 6,407 tons of gravel were augmented at three sites in Clear Creek (Guardian Rock 2,505 tons, Clear Creek Road Bridge 1,006 tons, 2A/Gold Dredge 2,896). Other desirable materials included in the 2020 augmentations were 14 pieces of large wood and 8 boulders, of which boulders were used for the first time in this long-standing project. Augmented gravel interacts with flows to restore natural alluvial processes, which build and maintain habitat for anadromous fish species. The project maintained the 20.7 acres of spawning habitat in Clear Creek, with the potential to support roughly 9,000 Redds, and added 0.3 acres of perennial rearing habitat, with the potential to support 22,000 additional fry. The gravel augmentation program was permitted through a programmatic approach. This project is formally titled Lower Clear Creek Anadromous Fish Habitat Restoration and Management Project (LCCAFHRMP), though "gravel augmentations" remains the most commonly use name for the project.

A Biological Assessment for the LCCAFHRMP was completed in 2011. The NMFS issued a Biological Opinion that addresses potential impacts to aquatic species under their jurisdiction from the LCCAFHRMP in 2014, based on the findings of the BA (WCR-2014-955). Various Clean Water Act permits, from the Army Corps and Water Quality Control Board, cover the individual project sites, with each permit covering 5 years of implementation. In 2020, the Phase 2A/Gold Dredge site received new permits for gravel augmentation implementation, adding to the list of approved augmentation sites.

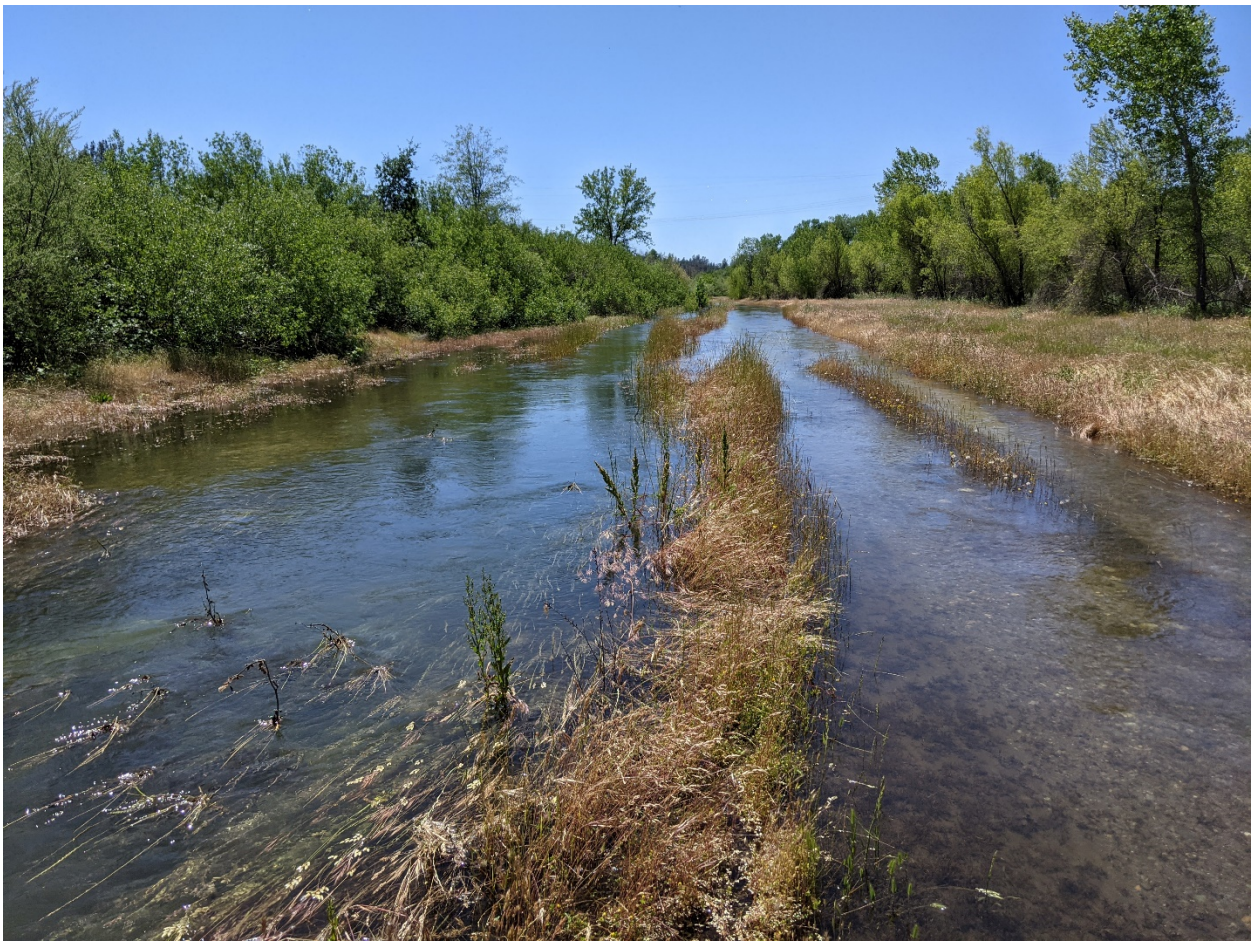
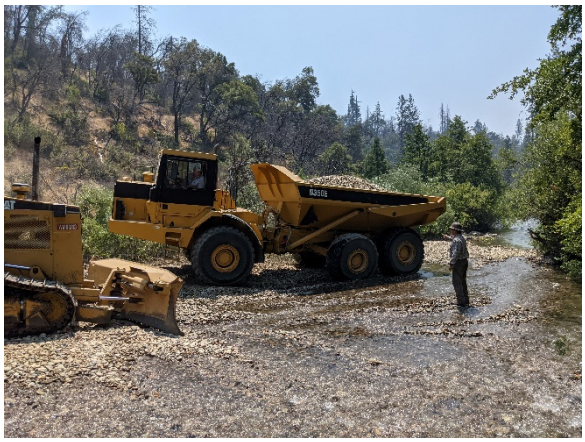


Figure 6. The 2020 gravel augmentation at Phase 2A allowed managed pulse flows to access floodplain areas. Although these managed pulses have a short duration, it shows that gravel augmentations are positively affecting juvenile rearing habitat conditions.

In WY 2021, in accordance with the Lower Clear Creek Anadromous Fish Habitat Restoration and Management Project charter, a total of 5,011 tons of gravel were augmented at three sites in Clear Creek (Whiskeytown Dam 1,013 tons, below Dog Gulch 1,976 tons, and above Phase 3A 2,022 tons) in June and July 2021. The project maintained the 20.7 acres of spawning habitat in Clear Creek, with the potential to support roughly 9,000 Redds, and added 0.25 acres of perennial rearing habitat and six large boulder clusters for cover, with the potential to support, roughly 19,000 fry. In 2021, the Whiskeytown Dam and Reading Bar sites received new Clean Water Act permits (from the

Army Corps and Water Quality Control Board) for gravel augmentation implementation, adding to the list of approved augmentation sites.



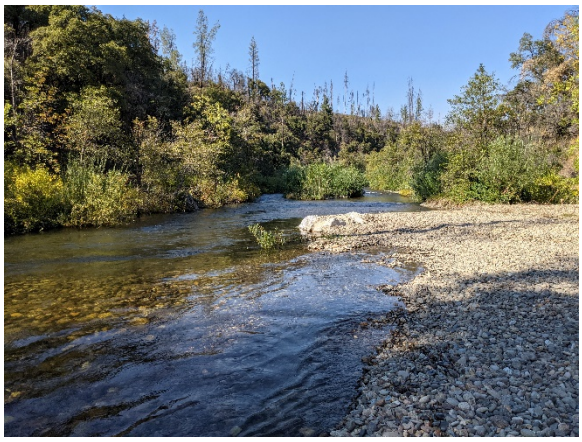


Figure 7. The 2021 gravel augmentations at Dog Gulch. This riffle supplementation-style augmentation produces immediate spawning habitat and improve floodplain inundation. Six large boulders were incorporated into the site.

Lower Clear Creek Floodplain Restoration Project Phase 3C

In addition, in accordance with the Lower Clear Creek mechanical (Non-Flow) Channel Maintenance charter, the construction of the Lower Clear Creek Floodplain Restoration Project Phase 3C was completed in December 2020. Phase 3C returned Clear Creek to its historic channel alignment by placing a large earthen plug at the top end of the ditch that enclosed this section of Clear Creek, allowing the stream to flow through its original channel location. The remaining portion of the ditch was transformed into a series of step pools, separated by beaver dam analogs, that provide additional fish habitat. The project created roughly 18.5 acres of juvenile salmonid rearing habitat with over 100 clusters of large wood for cover. Additionally, the project added 0.8 acres of spawning habitat. The 18.5 acres of rearing habitat created by this project have the potential to support roughly 1.3 million fry and the 0.8 acre of spawning habitat added have the potential to support roughly 350 Redds. ESA consultation for the Phase 3C project was completed under the NMFS Biological Opinion WCRO-2019-01994, which was completed in September 2019.

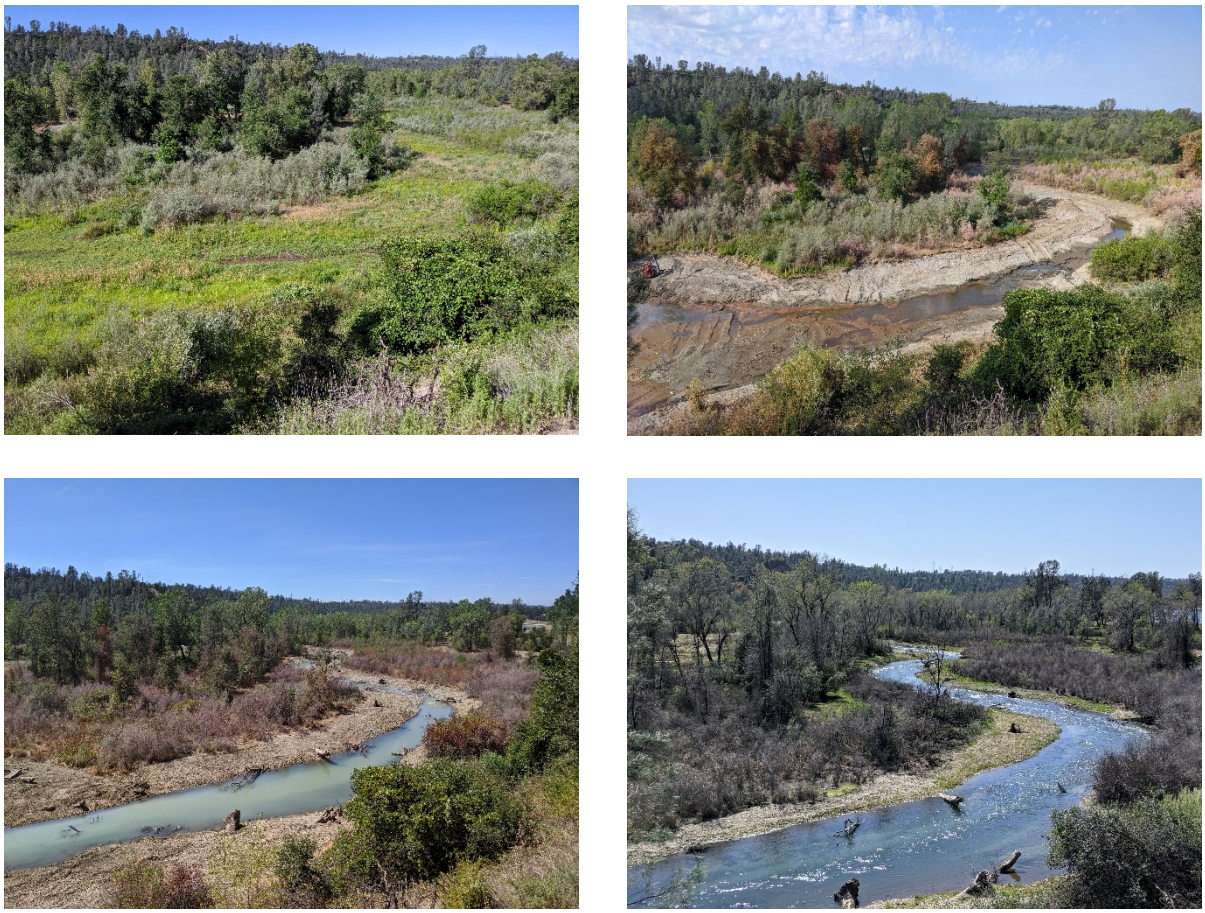


Figure 8. Top Left - A view of the upstream end of the project site showing the where the new channel will be constructed. Top right - A view of the upstream end of the project site showing the new channel being dug and prepared. Bottom left - A view of the upstream end of the project site showing the new channel with wood placement and its final morphology. Bottom right - A view of the upstream end of the project site showing the channel a few months after construction and following revegetation.

Clear Creek - Planned for WY 2022

Lower Clear Creek Floodplain Restoration Project Phase 3B

In WY 2022, in accordance with the Lower Clear Creek mechanical (Non-Flow) Channel Maintenance charter, revegetation is planned to be completed for the Lower Clear Creek Floodplain Restoration Project Phase 3B. This project is permitted through the original permitting associated with the Phase 3B construction, of which some parts were left incomplete has the 2008 construction activities. As such, this project must follow the established protocols for species protection, best management practices and other environmental protection measures outlined in the Phase 3B Environmental Assessment (2007), Biological Opinion (2007/00050), and other compliance documentation.

The revegetation efforts at Phase 3C project site will continue in WY 2022, with irrigation of the newly planted vegetation. These efforts are expected to be complete in the summer of 2023.

Clear Creek Gravel Augmentation
It is anticipated that gravel augmentations will again occur in WY 2022, in accordance with the Lower Clear Creek Anadromous Fish Habitat Restoration and Management Project charter. The implementation of this project is completed in coordination with the Clear Creek Technical Team, who work to determine the locations and amounts of gravel for the annual augmentations.

American River Division

American River – Spawning and Rearing Habitat Restoration

American River – Habitat Restoration Conservation Measures

The Conservation measure for the American River (page 4-52, Section 4.10.4.3) are as follows:

Project activities include primarily side channel and floodplain creation, expansion, and grading, spawning gravel and large cobble additions, and woody material additions. Pursuant to CVPIA 3406(b)(13), Reclamation proposes to implement the following projects: Paradise Beach, Howe Avenue to Watt Avenue rearing habitat, William Pond Outlet, Upper River Bend, Ancil Hoffman, El Manto, Sacramento Bar North, Sacramento Bar South, Lower Sunrise, Sunrise, Upper Sunrise, Lower Sailor Bar, Upper Sailor Bar, Nimbus main channel and side channel, Discovery Park, Cordova Creek Phase II, Carmichael Creek Restoration and Sunrise Stranding Reduction. Reclamation proposes to continue maintenance activities at Nimbus Basin, Upper Sailor Bar, Lower Sailor Bar, Upper Sunrise Lower Sunrise and River Bend restoration sites.

American River - Implemented in WY 2020 and 2021

The October 2019 PA identified habitat restoration activities specific to creation of rearing habitat and expansion and maintenance of spawning habitat. In WY 2020 and 2021, habitat restoration activities on the American River created roughly 7 acres of rearing habitat, with the potential to support roughly 520,000 fry. In addition, habitat restoration activities created 4 acres of spawning habitat, with the potential to support roughly 1,700 Redds, and maintained 3.5 acres of spawning habitat, with the potential to support roughly 1,500 Redds. According to population estimates by DWR's Fisheries Branch Anadromous Resource Assessment Unit, escapement in 2019 in the American River was roughly 27,000 (GrandTab 2021.06.30). Additional details about each habitat restoration project completed in WY 2020 and 2021 on the American River are identified below.

Upper Sailor Bar
In WY 2020, in accordance with the charter for LTO implementation of American River Spawning and Rearing Habitat, the Upper Sailor Bar project was completed in October 2019. This project created spawning and rearing habitat by excavating the floodplain and sorting excavated materials to place the spawning sized material into the main channel to create spawning habitat. The updated estimates of habitat constructed by this project are 1.5 acres of spawning habitat maintained, two acres of spawning habitat added, 1.5 acres of perennial rearing habitat added, and two acres of floodplain rearing habitat created. The larger cobbles were placed downstream of the spawning habitat for higher durability under high flows. The 3.5 acres of rearing habitat created through this project has the potential to support roughly 260,000 fry, the 1.5 acres of spawning habitat maintained has the potential to support roughly 650 Redds, and the two acres of spawning habitat

created has the potential to support roughly 870 Redds. Site specific ESA consultation for this project through USFWS was completed on August 29, 2016 in the Lower American River Anadromous Fish Habitat Restoration Project USFWS concurrence letter (ID #: 08FBDT00-2016-I-0198). The concurrence letter was amended in September 22, 2020 and concluded USFWS ESA Section 7 Consultation (ID #: 08FBDT00-2016-I-0198-R001). Site specific ESA consultation for this project through NMFS was completed on July 2015 in the Lower American River Anadromous Fish Habitat Restoration Project NMFS Biological Opinion.

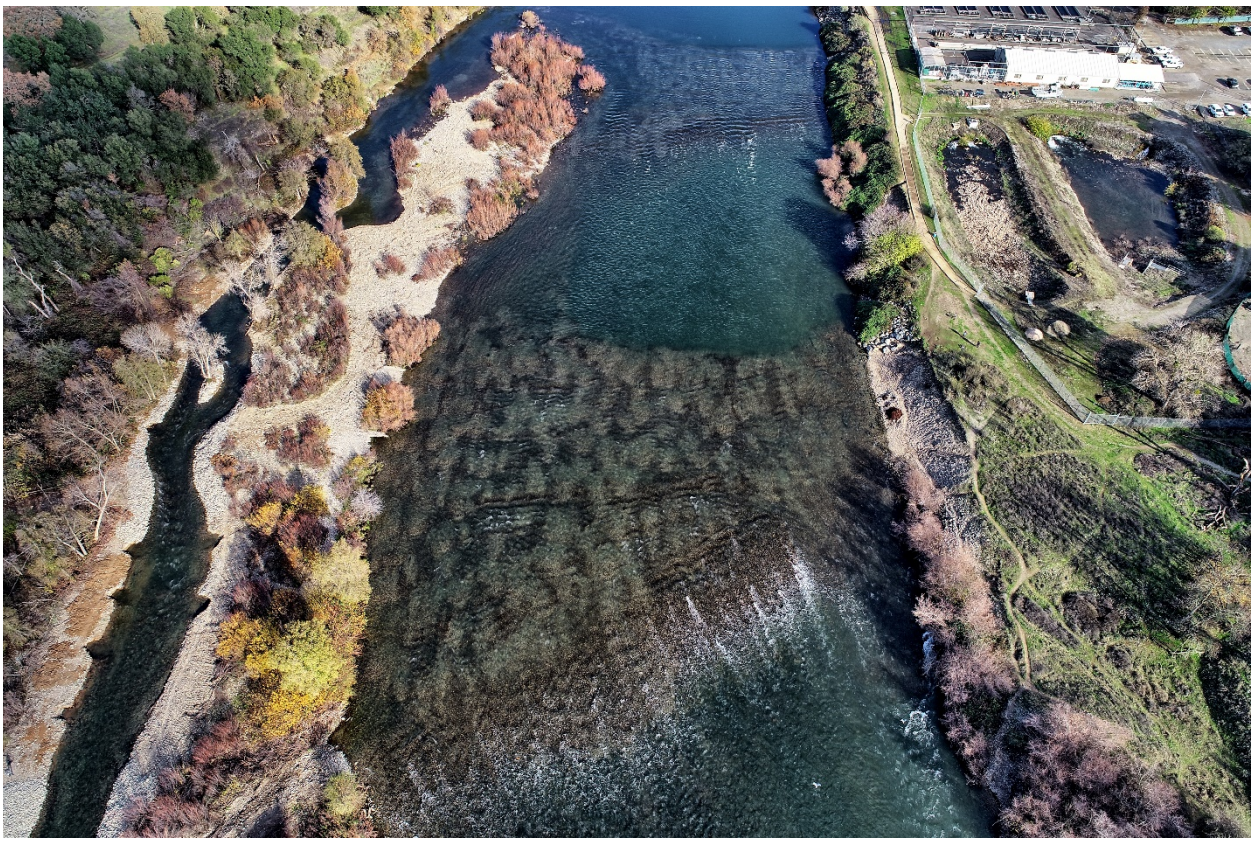


Figure 9. Redds on the new riffles created by the Upper Sailor Bar project.

Ancil Hoffman

In WY 2021, in accordance with the charter for LTO implementation of American River Spawning and Rearing Habitat, the Ancil Hoffman restoration project was completed. The project created spawning habitat through the addition of more than 15,000 cubic yards of clean gravel into the river channel to maintain two acres of spawning habitat; add two acres of spawning habitat, one acre of perennial rearing habitat, and 2.5 acres of floodplain rearing habitat; remove 0.25 acres of stranding area; and create over 20 clusters of large wood for cover. In the coming months, teams will finish their work by planting willow cuttings in a newly created rearing alcove and seeding native grass and wildflower species in the alcove and excess material areas. The 3.5 acres of rearing habitat created through this project has the potential to support 260,000 fry, the 2 acres of spawning habitat created has the potential to support roughly 870 Redds, and the two acres of spawning habitat maintained has the potential to support roughly 870 Redds. Site specific ESA consultation for this project through USFWS was completed on August 29, 2016 in the Lower American River Anadromous Fish Habitat Restoration Project USFWS concurrence letter (ID #: 08FBDT00-2016-I-0198). The

concurrence letter was amended in September 22, 2020 and concluded USFWS ESA Section 7 Consultation (ID #: 08FBDT00-2016-I-0198-R001). Site specific ESA consultation for this project through NMFS was completed on July 2015 in the Lower American River Anadromous Fish Habitat Restoration Project NMFS Biological Opinion.

Figure 10. Looking downstream at completed construction at Ancil Hoffman.

American River - Planned for WY 2022

Lower Sailor Bar

In WY 2022, in accordance with the of the charter for LTO implementation of American River Spawning and Rearing Habitat, spawning and rearing habitat will be created at Lower Sailor Bar. The project is anticipated to maintain three acres of spawning habitat; create five acres of spawning habitat, 1.6 acres of perennial rearing habitat, and one acre of floodplain rearing habitat; and add 70 clusters of large wood for cover. The 2.6 acres of rearing habitat created through this project has the potential to support 190,000 fry, the five acres of spawning habitat created has the potential to support roughly 2,200 Redds, and the three acres of spawning habitat maintained has the potential to support roughly 1,300 Redds. Site specific ESA consultation for this project through USFWS was completed on August 29, 2016 in the Lower American River Anadromous Fish Habitat Restoration Project USFWS concurrence letter (ID #: 08FBDT00-2016-I-0198). The concurrence letter was amended in September 22, 2020 and concluded USFWS ESA Section 7 Consultation (ID #: 08FBDT00-2016-I-0198-R001). Site specific ESA consultation for this project through NMFS was completed on July 2015 in the Lower American River Anadromous Fish Habitat Restoration Project NMFS Biological Opinion.

Cordova Creek Phase II
In addition, Cordova Creek Phase II is anticipated to be completed in WY 2022. The project will build on Phase I which naturalized a channelized drainageway. Phase II will enhance the confluence of Cordova Creek with the American River and provides passage for fish into the channel where there is currently a passage barrier. The water source is Aerojet remediation well water and the flow experiences periodic outages when pumping ceases temporarily. Beaver ponds in the system should maintain water for rearing fish during outages. Site specific ESA consultation for this project through USFWS was completed on August 29, 2016 in the Lower American River Anadromous Fish Habitat Restoration Project USFWS concurrence letter (ID #: 08FBDT00-2016-I-0198). The concurrence letter was amended in September 22, 2020 and concluded USFWS ESA Section 7 Consultation (ID #: 08FBDT00-2016-I-0198-R001). Site specific ESA consultation for this project through NMFS was completed on July 2015 in the Lower American River Anadromous Fish Habitat Restoration Project NMFS Biological Opinion.

Stanislaus River (East Side Division)

Stanislaus River – Spawning and Rearing Habitat Restoration

Stanislaus River – Habitat Restoration Conservation Measures
Conservation measures for the Stanislaus River (PA page 4-83, Section 4.10.6.2) are as follows:

Under the CVPIA (b)(13) program, Reclamation's annual goal of gravel placement is approximately 4,500 tons in the Stanislaus River.

Reclamation proposes to construct an additional 50 acres of rearing habitat adjacent to the Stanislaus River by 2030.

Stanislaus River - Implemented in WY 2020 and 2021

The October 2019 PA identified the addition of 4,500 tons of gravel to the Stanislaus River to create and maintain spawning habitat and the addition of 50 acres of rearing habitat, with the potential to support roughly 3.7 million fry, by 2030. In WY 2020 and 2021, habitat restoration activities on the Stanislaus River included the placement of 22,200 tons of gravel to create and maintain 3.9 acres of spawning habitat, with the potential to support 1,700 Redds. In addition, habitat activities created 0.25 acres of rearing habitat, with the potential to support roughly 19,000 fry. According to population estimates by DWR's Fisheries Branch Anadromous Resource Assessment Unit, escapement in 2019 in the American River was roughly 1,400 (GrandTab 2021.06.30). Additional details about each habitat restoration project completed in WY 2020 and 2021 on the Stanislaus River are identified below.

WY 2020 Goodwin Gravel and Goodwin Canyon Float Tube Pool
In WY 2020, in accordance with the of the charter for LTO implementation of Stanislaus River Habitat Restoration, a total of 15,000 tons of gravel was placed below Goodwin Dam in the Float Tube Pool and at the Cable Crossing area. The updated estimates of habitat constructed by this project is 1.9 acres of spawning habitat added/maintained. In addition, the side channel at Goodwin Canyon Float Tube Pool was excavated and reconnected to the river to create 0.25 acre of perennial rearing habitat located on the south side/downstream end of the Float Tube Pool. The 0.25 acres of

rearing habitat created through this project has the potential to support 19,000 fry and the 1.9 acres of spawning habitat maintained/added has the potential to support 830 redds. Site specific ESA consultation for this project through USFWS was not necessary since Reclamation determined No Effect to ESA-listed USFWS species within the project area. Site specific ESA consultation for this project through NMFS was completed on September 2020 in the NMFS NOAA RC's Central Valley Office Programmatic Approach Biological Opinion.

WY 2021 Goodwin Gravel
In WY 2021, in accordance with the of the charter for LTO implementation of Stanislaus River Habitat Restoration, a total of 7,200 tons of gravel was injected below Goodwin Dam in the Float Tube Pool and at the Cable Crossing area. The updated estimate of habitat constructed by this project is approximately 2 acres of spawning habitat added/maintained. The 2 acres of spawning habitat maintained/added has the potential to support roughly 870 Redds. Site specific ESA consultation for this project through USFWS was not necessary since Reclamation determined No Effect to ESA-listed USFWS species within the project area. Site specific ESA consultation for this project through NMFS was completed on September 2020 in the NMFS NOAA RC's Central Valley Office Programmatic Approach Biological Opinion.

Stanislaus River – Ongoing/Potential Habitat Restoration Projects

Gravel injections to create spawning habitat are ahead of schedule, therefore, no spawning habitat restoration projects are anticipated for WY 2022. Reclamation is coordinating with other agencies to determine priority locations for future gravel injections.

There are funded rearing habitation restoration projects on the Stanislaus River. Several additional projects have been identified. .

San Joaquin River (Friant Division)

Lower San Joaquin River Rearing Habitat

San Joaquin River Habitat Restoration Conservation Measures
The conservation measure for the San Joaquin River (PA page 4-83 and 4-84, Section 4.10.7.1) is as follows:

Reclamation may work with private landowners to create a bottom-up, locally driven regional partnership to define and implement a large-scale floodplain habitat restoration effort in the Lower San Joaquin River. This stretch of the San Joaquin River is cut-off from its floodplain due to an extensive levee system, with two notable exceptions at Dos Rios Ranch (1,600 acres) and the San Joaquin River National Wildlife Refuge (2,200 acres). In recent years, there has been growing interest in multi-benefit floodplain habitat restoration projects in the Central Valley that can provide increased flood protection for urban and agricultural lands, improved riparian corridors for terrestrial plants and wildlife, and enhanced floodplain habitat for fish. The resulting restoration could include thousands of acres of interconnected (or closely spaced) floodplain areas with coordinated and/or collaborative funding and management. Such a large-scale effort along this corridor would require significant support from a variety of stakeholders, which could be facilitated through a regional partnership.

San Joaquin River - Implemented in WY 2020 and 2021

In accordance with the charter for LTO Implementation for Lower San Joaquin River Habitat Restoration, no on-the-ground habitat restoration projects were implemented in WY 2020 and 2021.

The Dos Rios Ranch project, which will impound water on the floodplain temporarily to foster juvenile salmonid outmigrant growth before they enter the Delta, is at a concept level design.

San Joaquin River - Planned for WY 2022

In accordance with the charter for LTO Implementation for Lower San Joaquin River Habitat Restoration, the on-the-ground implementation of habitat restoration projects is not currently planned for WY 2022.

Delta Division

Delta – Tidal Habitat Restoration

Delta Tidal Habitat - Habitat Restoration Conservation Measures

Conservation measures for the Delta tidal habitat restoration (PA page 4-78, Section 4.10.5.12.3) are as follows:

Completing, by 2030, the remaining approximately 6,000 acres of tidal habitat restoration in the Delta of the 8,000 acres DWR has begun. Reclamation and/or DWR would monitor, operate, and maintain the tidal habitat restoration, including obtaining permanent land rights. Consistent with the current regulatory process, future separate consultations would address the effects to listed species from habitat restoration.

All tidal restoration will be subject to Section 7 consultation with the USFWS in accordance with the Suisun Marsh Programmatic Biological Opinion and the 2019 Biological Opinion. Tidal restoration acres will be developed through existing Fish Restoration Program/Fishery Agency Strategy Team (FRP/FAST) process.

Delta Tidal Habitat - Implemented in WY 2020 and 2021 and early WY 2022

DWR has constructed seven projects totaling approximately 3,600 acres of tidal habitat that will contribute toward to PA after final credits are provided by USFWS. DWR plans to formally request credits for all seven projects in 2022.

Tidal Habitat Crediting

The 2011 Memorandum of Agreement titled The Early Implementation of Habitat Projects for the Central Valley Project and State Water Project Coordinated Operations and Bay Delta Conservation Plan established the FAST. The FAST is a review team composed of technical level representatives from each Fishery Agency and Reclamation that works with DWR to review and assist in planning habitat restoration projects and provide guidance to the Water Agency on the expected benefits of

proposed habitat projects in meeting the Restoration Objectives. The FAST is tasked with reviewing the prospectus of proposed habitat projects. The prospectus is information on a proposed habitat project provided to the FAST for the purposes of defining the type and amount of credit the habitat project would yield if implemented as planned. Credits are the acreage and linear mileage contributions of habitat projects toward meeting the 8,000-acre requirement of the 2008 USFWS and 2009 NMFS biological opinions and 2019 PA. One credit is equivalent to one acre in meeting the required acreage.

All the Projects described below are eligible for FAST Crediting, however none have gone through the final crediting process.

Cache Slough Region

Lower Yolo Ranch

Completed in October of 2020, DWR and Reclamation estimate the Lower Yolo Ranch Restoration Project will result in 1,713 creditable acres of Delta Smelt Habitat to count against the 8,000 required by the PA. The goals of this Project were to enhance regional food web productivity in support of Delta Smelt recovery, provide rearing habitats for out-migrating juvenile salmonids, support a broad range of aquatic and wetland dependent species, and provide ecosystem functions associated with the combination of Delta native habitats including freshwater aquatic, tidal marsh, floodplain, and lowland grasslands. The Project offers various habitats and functions.

The restoration features include new tidal channel networks, berm breaches, new tide gates, new diversion structures, a relocated lift pump structure, new drainage ditches, and integration with irrigated agriculture. These features ensure the long-term function of the restored habitats as well as surrounding agricultural lands. Site specific ESA consultation was completed with USFWS (#08FBDT00-2019-F-0276).

Lower Sacramento/ Confluence Region

Winter Island

Completed in November 2019, DWR and Reclamation estimate the Winter Island Tidal Habitat Restoration Project will result in 544 creditable acres of Delta Smelt Habitat to count against the 8,000 required by the PA. The goal of the Project was to restore unrestricted tidal connectivity to the interior of Winter Island to create tidal wetland and associated high marsh on the site to benefit native fish species, including Delta Smelt and salmonids. The restoration of Winter Island reestablished unimpeded tidal connectivity, allowing exchange of water, sediment, nutrients, primary productivity, and aquatic organisms. This Project created tidal wetlands that contribute to, and support, the local aquatic food web and create additional rearing habitat for fish species of concern.

Winter Island is situated in the low salinity zone between Suisun Marsh and the Cache Slough Complex. Prior to construction, Winter Island was managed for duck hunting. Winter Island was predominately made up of muted tidal wetlands with a central island channel, all of which was enclosed by a levee system. Water flow within the Project area was controlled by two water control structures. The Project involved breaching the perimeter levee to restore tidal hydrology to the site. The Project also included the removal of the water control structures and excavation of an eastern channel to reestablish full tidal connections to the existing marsh and surrounding waterways and

enhance aquatic and wetland habitat. Site specific ESA consultation was completed with USFWS (#08FBDT00-2019-F-0079).

Suisun Marsh

Tule Red

Completed in October 2019, DWR and Reclamation estimate the Tule Red Habitat Restoration Project will result in 610 creditable acres of Delta Smelt Habitat to count against the 8,000 required by the PA. The goals of the Project were to provide habitat to Delta smelt, rearing salmonids, and other native fishes; and to reestablish important ecological processes that maximize production of the microscopic plants and animals at the base of the food web that nourish native fish. The restoration of Tule Red reestablished unimpeded tidal connectivity, allowing exchange of water, sediment, nutrients, primary productivity, and aquatic organisms. This Project created tidal wetlands that contribute to, and support, the local aquatic food web and create additional rearing habitat for fish species of concern.

Tule Red, located in Solano County, is on the eastern edge of Grizzly Bay, in the Suisun Marsh. The site was historically managed as the Tule Red Duck Club. In the early 1900's the area was diked off, with the incorporation of a natural berm, to create freshwater habitat favored by game ducks. The Tule Red project involved breaching the natural berm to allow for full daily tidal exchange through the interior of the project site. The Project also included the creation of a network of channels to convey water across the marsh plain. Site specific ESA consultation was completed with USFWS February 28, 2019 (#08FBDT00-2016-F-0071).

Wings Landing

Completed in 2020, DWR and Reclamation estimate the Wings Landing Habitat Restoration Project will result in 244 creditable acres of Delta Smelt Habitat to count against the 8,000 required by the PA. The goal of the Project was to restore unrestricted tidal connectivity to the interior of Wings Landing to restore tidal wetlands on the site to benefit native fish species. Returning the site to natural tidal influence provides increased food production for Delta Smelt, Longfin Smelt, and salmonids onsite and within the northern Suisun Marsh. Furthermore, the project meets objectives by enhancing available food productivity for native fish, enhancing habitat appropriate for rearing salmonids, Delta Smelt, and other native fish species, and it provides connectivity to the marsh plain for migrating salmonids.

Wings Landing is located within the north-central portion of Suisun Marsh, approximately half a mile south of Suisun City in Solano County. Historic topographic maps and aerial photos indicated the presence of historic tidal channels connecting Suisun Slough, Peytonia Slough, and Boynton Slough. The Project design included strategically located channels that mimic these historic conditions, and returned Wings Landing to full-tidal conditions. This was accomplished by strategic channel plugs, seven tidal depressions to increase bathymetric diversity, the removal of five water control structures, and five levee breaches. After restoration, Wings Landing now contributes to over 4,000 acres of contiguous protected habitat, including CDFW's Peytonia Ecological Reserve, CDFW's Hill Slough Wildlife Area, and the Solano Land Trust's Rush Ranch. Site specific ESA consultation was completed with USFWS (#08FBDT00-2020-F-0177).

Arnold Slough

Completed in 2021, DWR and Reclamation estimate the Arnold Slough Restoration Project will result in 141 creditable acres of Delta Smelt Habitat to count against the 8,000 required by the PA. The restoration at Arnold Slough (currently operated as a duck club) restored managed seasonal marsh to benefit native fish species by achieving four goals. The Project's stated goals are to: 1) increase available Delta smelt and Longfin smelt habitat, including to enhance the sites' primary and secondary nutrient productivity; 2) enhance habitat quality to support more special-status species and native wildlife; 3) take advantage of the sites' natural features to promote habitat resiliency for future Suisun Marsh conditions to the greatest extent practicable; and 4) discourage conditions in conflict with project objectives, such as noxious weed infestations.

Arnold Slough is in eastern Suisun Marsh, within Solano County, in the Nurse-Denverton Slough Complex of Suisun Marsh. Restoration at Arnold Slough included of removing a water control structure, creating three exterior levee breaches, grading down sections of the exterior levee, and creating four ditch blocks. Grading down sections of the levee will allow greater connection between the marsh plain and surrounding slough. A ramp for fish monitoring via beach seine, approximately 33 feet wide and 50 feet long, was cut into the slope of the existing interior levee at a 15 percent grade to provide access for monitoring after restoration. Site specific ESA consultation was completed with USFWS (#08FBDT00-2020-F-0211).

Delta Tidal Habitat - Planned for WY 2022

Cache Slough Region

Lookout Slough Tidal Habitat Restoration and Flood Improvement Project

Scheduled for construction in May 2022, DWR and Reclamation estimate the Lookout Slough Tidal Habitat Restoration and Flood Improvement Project will result in 3,000 creditable acres of Delta Smelt Habitat to count against the 8,000 required by the PA. Once completed, Lookout Slough will be the Delta's largest single tidal habitat restoration project to date. Furthermore, Lookout Slough is adjacent to additional tidal habitat restoration efforts, including Yolo Flyway Farms and Lower Yolo Ranch, which when completed will create a contiguous tidal wetland restoration complex spanning 16,000 acres.

The Project is designed to be a multi-benefit project to restore approximately 3,100 acres of tidal marsh, increase flood storage and conveyance in the Yolo Bypass, increase levee resilience, and decrease flood risk. Ecological Project goals include creating and maintain a diverse landscape of intertidal and associated subtidal habitat that supports habitat elements for native species and improved food productivity within the Project Area. Flood conveyance goals include providing additional flood storage and conveyance within the Yolo Bypass to reduce the chance of catastrophic flooding and protect existing nearby infrastructure.

Habitat restoration and flood improvement goals would be attained by excavating a network of tidal channels, constructing a new setback levee along Duck Slough, breaching and degrading the Shag Slough (Yolo Bypass West) Levee, breaching the Vogel Levee, and improving the Cache/Hass Slough Levee. Site specific ESA consultation was completed with USFWS (#08FBDT00-2020-F-0181).

Suisun Marsh Region

Bradmoor Island

Scheduled for WY 2022, the Bradmoor Island Restoration Project will restore or enhance approximately 615 acres of tidal habitat on a 740-acre property. The goal of this effort is to restore tidal wetlands in an area where tidal restoration has a high potential to directly benefit listed fish species by creating rearing habitat and increasing food production and availability in Suisun Marsh.

Bradmoor Island is located within Solano County in the Nurse-Denverton Slough Complex of Suisun Marsh. Bradmoor's restoration will consist of removing water control structures, creating 5 exterior levee breaches and two interior levee breaches, and grading down an interior berm. At each exterior breach, fill will be placed in ditches adjacent to existing levees to marsh plain elevation to create a total of 13 ditch blocks. Remnants of a tidal slough will also be reconnected. Site specific ESA consultation was completed with USFWS (#08FBDT00-2020-F-0211).

Delta – Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project

Yolo Bypass – Habitat Restoration Conservation Measures

Conservation measures for the Yolo Bypass (PA page 4-78, Section 4.10.5.12.3) are as follows:

Reclamation and DWR will provide increased acreage of seasonal floodplain rearing habitat available in the lower Sacramento River basin by 2030.

Yolo Bypass – Salmonid Habitat Restoration and Fish Passage Project Status Update

The Yolo Bypass Salmonid Habitat Restoration and Fish Passage project will allow increased flow from the Sacramento River to enter the Yolo Bypass through a gated notch on the east side of Fremont Weir. The Record of Decision for this project was signed in September 2019. Final design for the project was completed in December 2021 and site preparation construction was completed in October 2021. The remaining construction is anticipated to start on the project in May 2022. The Project is likely to be built over multiple construction seasons (i.e., not in a single season). DWR and Reclamation are considering strategies for accelerating construction. It is anticipated that the project will be completed in 2022 or 2023.

Yolo Bypass – Fremont Weir Adult Fish Passage Structure Status Update

The Fremont Weir Adult Fish Passage Structure was constructed in 2018 and first operated in 2019. Annual Technical Memorandum for the Fremont Weir Adult Fish Passage Structure were prepared by DWR and transmitted to NMFS for water years 2019 and 2020 (submitted in 2020 and 2021, respectively). This facility provides a connection to the Sacramento for migrating adult salmon, steelhead, sturgeon and other migratory species attracted into the Yolo Bypass following a Fremont Weir overtopping event. Monitoring (ARIS sonar imaging) shows the project to be meeting all fish passage objectives, making it the first multi-species fish passage facility of its kind in California to successfully pass salmonids and sturgeon.

Yolo Bypass – Wallace Weir Fish Rescue Facility Status Update

The original Wallace Weir consisted of an earthen berm with a series of culverts to control irrigation and drainage flows from the Colusa Basin Drain. The earthen berm would wash out during high flow events, allowing State- and federally-listed salmonids and sturgeon unimpeded access to the Colusa Basin Drain without the possibility of reentering the Sacramento River. The new facility includes a permanent fish barrier structure and a fish rescue facility where CDFW biologists can safely collect salmonids to be transported back to the Sacramento River. All drainage and irrigation functionality has been retained

through a series of operable gates. To date, thousands of salmon have been captured and safely transported to the river.

Minor efficiency and safety improvements are ongoing at the facility with work expected to be completed by the fall of 2022. Improvements include updating the electrical system, installing a larger water pump and a dedicated air compressor for the livewell aeration system, and installing lights and cameras to improve staff safety and reduce the risk of vandalism.

Yolo Bypass – Agricultural Road Crossing #4 Status Update

The Agricultural Road Crossing #4 Project (ARC4) addresses the final fish passage barrier in the Yolo Bypass that would prevent migrating fish from accessing the Big Notch, the Wallace Weir Fish Rescue Facility, or the Fremont Weir Adult Fish Passage Project. Currently in the 95% design phase, this project replaces an earthen road crossing with a new, open-channel bridge to maximize fish passage. DWR staff have begun submitting environmental permit applications and are finalizing a settlement agreement with the landowner. ARC4 is scheduled to be constructed in the summer of 2023.

Appendix A. Summary Table

See Attachment A.