

Appendix B

Post-Construction Monitoring, Evaluation, and Adaptive Management Plan

Fremont Weir Adult Fish Passage Modification Project Post-Construction Monitoring, Evaluation, and Adaptive Management Plan

Following construction of the Fremont Weir Adult Fish Passage Modification Project, the California Department of Water Resources (DWR) and U.S. Bureau of Reclamation (Reclamation) plan to monitor and evaluate fish passage success at Fremont Weir. DWR and Reclamation anticipate using an annual adaptive management framework for assessing the performance of the fish passage structure and stranding reduction measures. The use of an adaptive management strategy will allow for iterative feedback and accelerate learning regarding what actions are necessary for a successful operational plan. Each activity anticipated as part of the Post-Construction Monitoring, Evaluation, and Adaptive Management Plan will be developed during the spring and summer as a Study Plan, presented to the Yolo Bypass Fisheries and Engineering Technical Team (FETT) for consideration, and then recommended by DWR and Reclamation. For a period of approximately five years, annually, results from these study plans will be generated, presented to the FETT, and summarized in an annual technical memorandum, which will be provided to National Marine Fisheries Service (NMFS) and California Department of Fish and Wildlife (CDFW). The technical memorandum will provide an aggregation of information and provide recommendations for the next water year's adaptively managed operational plan.

The following measures are anticipated to start in water year 2018:

1. **Sonar-Imaging Observation:** An Adaptive Resolution Imaging Sonar (ARIS) camera (manufactured by Sound Metrics, Inc.) will be installed in the fish passage structure at the Fremont Weir. This device uses sound waves to generate a high-resolution image, much like an ultrasound, in turbid, low-light environments. The ARIS camera will provide video that will allow for direct observation of fish behavior at the structure. These videos will be reviewed to qualitatively compare fish passage performance in the structure at various river stages. This review will allow DWR and Reclamation to determine river stages that are critical for the fish passage structure to be operated.
 - a. Footage will be continuously recorded during operation of the fish passage structure, except for periods of routine service to the ARIS components.
 - b. Recorded data will be stored in hourly files. An echogram (a condensed snapshot of fish movement over time) will be generated for each hourly file. These echograms will be reviewed, and sub-samples of footage will be selected for evaluation based on periods of increased fish movement.
 - c. The sub-samples will be evaluated to describe salmonid or acipinserid movement through the survey area. The description would summarize if:
 - i. A fish made little progress moving through the survey area.
 - ii. A fish moved through the survey area on the first attempt.
 - iii. A fish made multiple attempts to move through the survey area.

2. **Telemetry:** As of February 2017, there are two separate ongoing telemetry studies in the Yolo Bypass utilizing a shared receiver array. The array consists of 14 telemetry receivers (69 kHz, Vemco Ltd.) monitored by DWR and University of California, Davis (UCD) staff. The sites from north to south include: Wallace Weir, Knagg's Ranch, Road 22, Above Agricultural Road Crossing 4, Below Agricultural Road Crossing 4, I-80 Bridge, Above Lisbon Weir, Below Lisbon Weir, Rotary Screw Trap, Base of Toe Drain, and an array of 4 receivers at the Cache Slough Confluence (Figure 1).

The first study investigates residence and movement patterns of adult fall-run Chinook salmon in the Yolo Bypass (PI: Jared Frantzich, DWR). The study began in 2015 and will continue through 2017. Thirty adult Chinook salmon were tagged in 2015 and 51 were tagged in 2016. DWR anticipates tagging up to 50 adult Chinook salmon in the fall of 2017. This study stemmed from a previous telemetry study conducted in the Yolo Bypass by UCD (PI: Myfanwy Johnston, UCD) from 2012 through 2014, where both adult Chinook salmon and adult white sturgeon were tagged.

The second telemetry study, occurring in 2017, examines how adult white sturgeon behave in the Yolo Bypass (PI: Zoltan Matica, DWR). Like the salmon study, sturgeon will be tagged and their residency and movement patterns will be monitored. DWR anticipates tagging up to 30 adult white sturgeon in the winter/spring of 2017. An additional receiver has been placed in the deep pond located downstream of Reach 1 because it is believed that sturgeon may hold in the deeper water.

Annual proposals to continue similar telemetry studies through 2021 will be developed and reviewed through the Fisheries Engineering Technical Team (FETT). For 2017, DWR and Reclamation recommend these studies consider adding an additional receiver immediately upstream of the fish passage structure in the Sacramento River at the interface of the upstream channel in an effort to monitor how fish behave at each structure (Figure 1). Combining data from the receiver in the deep pond (downstream of structure) with data from the receiver in the Sacramento River (upstream of structure) would enable researchers to detail the movement of tagged fish as they navigate through the Fremont Weir fish passage structure. These receivers would provide information on residence time in the stretch from the deep pond to the river, and assist crews in determining whether a passage delay or barrier may exist in the structure. Coupling this fish movement data with the Sacramento River stage at Fremont Weir would provide further insight as to how fish behave during overtopping events, particularly by illustrating stages where fish passage begins to be compromised.

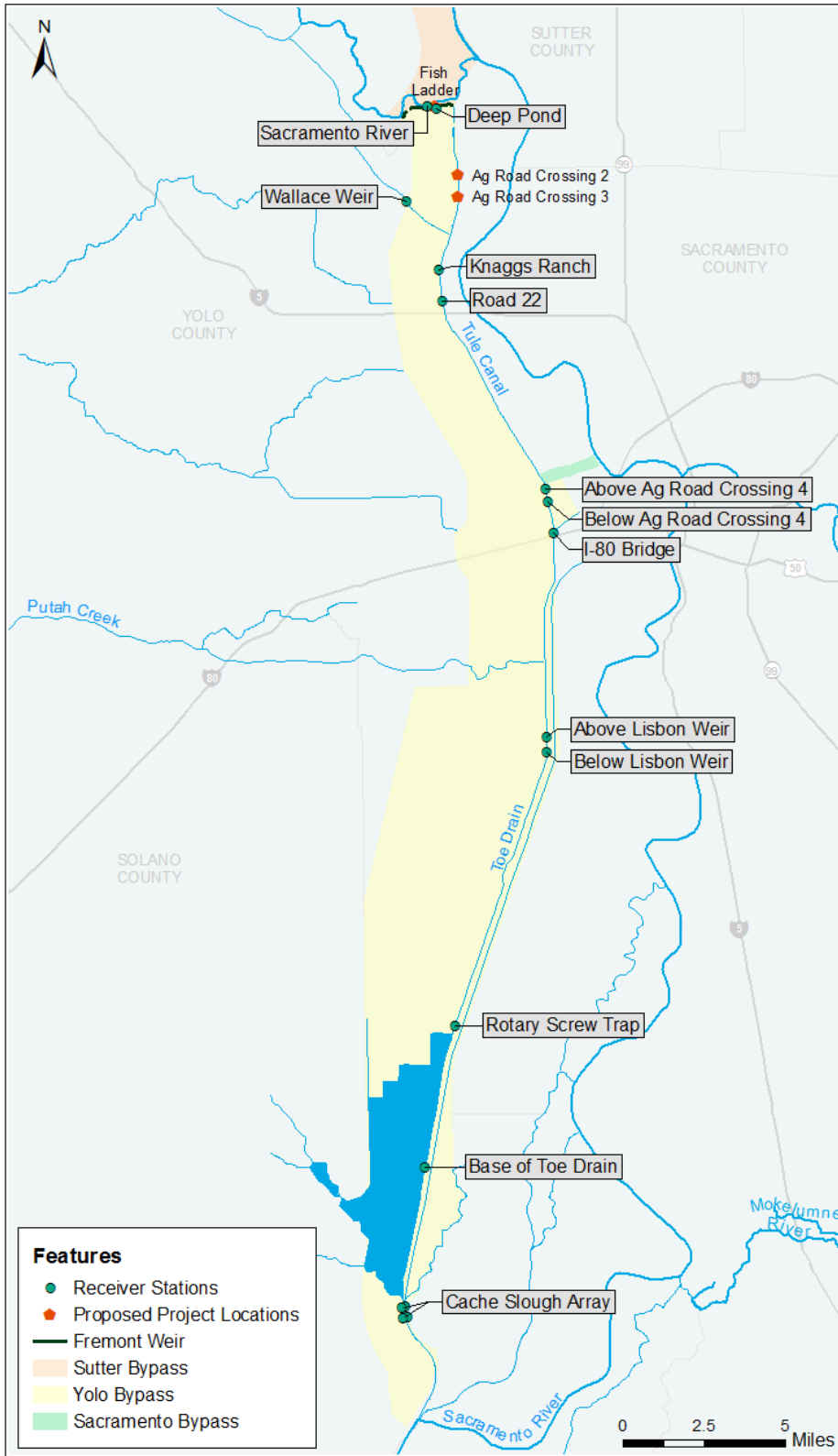


Figure 1. Map of telemetry receiver locations in the Yolo Bypass.

3. **Hydraulic Monitoring:** Following an overtopping event, DWR field crews will access the Fremont Weir fish passage structure and deploy a portable Doppler-type flow meter (PDFM) and measure water stage in the structure. A stage-flow rating curve will be developed with these datasets. This rating curve will be used to estimate average velocity in the structure to verify the predicted values for depth and velocity.
4. **Continued adult fish rescue and stranding reduction:** CDFW conducts fish rescue surveys within the Yolo Bypass. These efforts should continue near Fremont Weir after an overtopping event has occurred and the fish passage structure has been closed again. These surveys should assess where adult fish might be stranded by the operational plan.

The principal adaptive management tool available to this management study would be the ability to change gate operations at the fish passage structure. Initially, the gated structure would be opened following a Fremont Weir overtopping event once the Sacramento River reaches a stage of 32.3 feet at the location of the fish passage structure. This river stage would allow for a flow depth of 0.5 foot over the weir and the resulting flow into the Yolo Bypass would reduce scour velocities through the fish passage structure because of the higher tailwater conditions downstream.

As part of this FWAFP Project, two of the following three operational scenarios would be implemented and evaluated using the monitoring approaches described earlier:

- Scenario 1: The fish passage structure remains open until the upstream channel no longer receives water from the river at a stage of 22 feet.
- Scenario 2: The fish passage structure remains open for three days after Fremont Weir stops overtopping.
- Scenario 3: The fish passage structure remains open for one day after Fremont Weir stops overtopping and reopens when the river stage falls below 27 feet and closes when the river stage reaches 24 feet, for no longer than five days.

Modeling results indicated a slight increase in inundation within the Yolo Bypass for Scenario 1 (refer to Figure 3.10-2 in section 3.10, “Hydrology and Water Quality” of the FWAFP Project Initial Study/Environmental Assessment [IS/EA]). Additionally, there was uncertainty regarding fish passage conditions when the flow through the structure had a depth of less than 3 feet. Modeling results for Scenarios 2 and 3 indicated no significant changes in Yolo Bypass drainage and inundation patterns (refer to Figure 3.10-1 through Figure 3.10-3 in section 3.10, “Hydrology and Water Quality” of the FWAFP Project IS/EA). Because of the inundation increase and fish passage uncertainty inherent in Scenario 1, the FWAFP Project would only implement Scenario 2 or Scenario 3 without further environmental project review.

Initially, Scenario 2 would be operated and evaluated for performance. If annual passage, telemetry, and hydraulic monitoring show performance results in fish stranding in the vicinity of the project area following overtopping events, Scenario 3 would be implemented for future overtopping events and would undergo similar evaluations. If it becomes apparent that one scenario outperforms the other, that scenario will become the default scenario for future operation.

If an overtopping event is brief or minor, fish would be unlikely to access the Fremont Weir fish passage structure. Operating the fish passage structure during smaller events may add risk to migratory fish

because of the lower Sacramento River stages associated with minor overtopping events. CDFW, NMFS, DWR, and Reclamation will work together, potentially via the FETT, to determine the relative risk to migratory fish and annually decide on an operational plan for the fish passage structure. This annual plan will describe which operational scenario will be used and how long the fish passage structure should be opened during different overtopping events.

If stranded fish are regularly observed in the vicinity of the fish passage structure or in project channels (i.e., upstream channel or reach 1), these stranding locations will be remedied to the extent feasible as needed in accordance with Mitigation Measure FISH-3 (refer to Mitigation Measure FISH-3 in section 3.5.3.2, “Biological Resources” of the FWAFP Project IS/EA). If stranded fish are regularly observed outside of the immediate project area (e.g., Reach 2), these sites will be documented and relayed to CDFW to record in their fish stranding database. Adaptive management of stranding in Reach 2 is not initially considered, and DWR and Reclamation do not recommend using earthwork to attempt to remedy stranding outside of Reach 1 at this time. The cause for stranding in these areas would expectantly be addressed by the upcoming Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project (YBSHRFP) through construction or via post-construction adaptive management. The YBSHRFP involves the construction of a gated, deep notch through the Fremont Weir to provide the primary means for adult fish passage and to create additional floodplain habitat in the Yolo Bypass, and modification of the northernmost agricultural road crossing (Agricultural Road Crossing 1) in the Tule Canal to improve hydraulic connectivity. The YBSHRFP is required to comply with NMFS 2009 Biological Opinion and is included in the California EcoRestore Initiative. Construction for the YBSHRFP is scheduled to begin in 2020.

An annual technical memorandum will be prepared for the regulatory agencies that will summarize the operation, monitoring, and maintenance activities performed at the fish passage structure. This report will include:

1. A summary of the hydraulic conditions observed, and the structure’s overall ability to pass fish and convey flow under varied flow settings.
2. An analysis of ARIS footage evaluating how fish behaved upon encountering the structure.
3. A summary of the findings of telemetry studies, along with links to their annual summary reports.
4. A discussion of the past water year’s adaptive management decisions (e.g., selecting an operational scenario) and a recommendation for the next water year’s operations scenario.

Data will be compiled and analyzed at the annual conclusion of each monitoring study’s field component (late-spring to early-summer; dates will vary annually). A technical memorandum will be prepared annually for the duration of five years after the fish passage structure becomes operational. If adaptive management continues as part of the Fremont Weir Adult Fish Passage Modification Project, these memoranda will continue to be generated accordingly. The technical memoranda will be drafted once the data from these studies has been analyzed, likely in the fall. These will be submitted to NMFS, and CDFW.