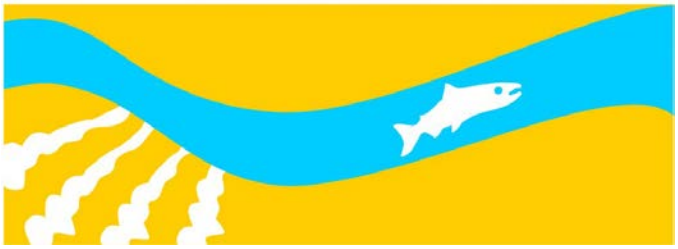
Attachment 2

Ongoing and Completed Studies

Final
2014 Monitoring and Analysis Plan

SAN JOAQUIN RIVER
RESTORATION PROGRAM



November 2013

1 Introduction

In 2013, the small interdisciplinary study groups for Rearing Habitat and Spawning and Incubation developed compilations of the ongoing and completed studies pertaining to their respective themes. This effort was to catalog conclusions produced from each study, any remaining data gaps, and strategy for future study. It is anticipated that compilations of data, gaps, and strategy will be produced for each of the small interdisciplinary groups over time.

1.1 Rearing Habitat

Rearing habitat studies, which are summarized in Table 1-1, have been constrained by an upper limit for Restoration Flow releases of about 1,100 cubic feet per second (cfs), no Restoration Flows below Sack Dam (reaches 3 through 5), and no flow in the natural channels in Reach 4. It is anticipated that about 300 cfs can be released below Sack Dam in 2014 and that Friant Dam releases will increase to 2,000 cfs in 2021. Rearing habitat studies are needed below Sack Dam after flows begin during the juvenile rearing period.

Table 1-1.
Summary of Existing Rearing Habitat Studies, Conclusions, and Data Gaps

Key Characteristic of Rearing Habitat	Study Title	Objective	Conclusions	Data Gap
All	Ecosystems Diagnosis and Treatment Model (2012 MAP)	Development of the EDT model to assess the effectiveness of SJRRP's projects.	How Chinook salmon populations are affected by the alternatives under Paragraphs 11 and 12 of the Settlement (flow and temperature).	Development of the model is underway.
Hydrology and Hydraulics	Floodplain Inundation (2012 MAP)	Quantification of floodplain inundation related to discharge to determine food availability for smolt outmigrants.	Information can be used to identify the amount of discharge necessary to maximize the value of floodplains for outmigrating Chinook salmon.	Study documentation is pending.
Hydrology and Hydraulics	Study DWR-10G: Effects of Altered Flow Regime on Channel Morphology in Reach 1A (2012 MAP)	Ability to determine trends in instream habitat impacts which affect juvenile and adult Chinook salmon that occur as a consequence of altered flow regime.	None to date.	Report is pending.

Table 1-1.
Summary of Existing Rearing Habitat Studies, Conclusions, and Data Gaps
(contd.)

Key Characteristic of Rearing Habitat	Study Title	Objective	Conclusions	Data Gap
All	Minimum Floodplain Requirements	A determination of minimum rearing habitat area necessary to meet the fall-run and spring-run Chinook salmon adult growth population targets identified in the SJRRP Fisheries Management Plan and Technical Advisory Committee Recommendations	Minimum required suitable habitat that meets growth and long-term population goals in Restoration Area - HSI results for each reach - Quantifications of habitat deficit by reach	The analysis assumed that food availability would not differ between floodplain and channel habitats. It also assumed juvenile survival rates based on Stanislaus River data which will likely be different compared to restored conditions in the Restoration Area. The analysis also did not consider the timing, duration, and magnitude of likely Restoration Flow schedules that will determine floodplain inundation. More local information on cover suitability would be useful. (see habitat quality parameter question below)
Hydrology and Hydraulics	2D Hydraulic Habitat Modeling (2012 MAP)	2D Spatial delineation of areas meeting habitat criteria as defined by the hydraulic parameters of depth, velocity, and shear stress. Results to determine areas with high-quality habitat potential.	Study can help inform priorities for Restoration Actions by reach by allowing for comparisons of conditions among multiple disciplines.	Depth and velocity results are completed.
Water Quality	Benthic Macroinvertebrate Bioassessment Study (2012 ATR)	This study is intended to evaluate the impact of the SJRRP actions on ecological integrity and water quality conditions as indicated by changes in the benthic macroinvertebrate community (BMI).	The BMI community will likely signal changes in limiting factors including physical habitat and stream conditions. The study has been providing information associated to physical habitat objectives set forth by the Draft Fisheries Management Plan (SJRRP, 2010) of the SJRRP that, in conjunction with population objectives, will help evaluate overall SJRRP success.	

Table 1-1.
Summary of Existing Rearing Habitat Studies, Conclusions, and Data Gaps (contd.)

Key Characteristic of Rearing Habitat	Study Title	Objective	Conclusions	Data Gap
Predation in Gravel Mine Pits	Assessment of Predator Abundance and Distribution in Mine Pit Habitat in the Restoration Area	To help prioritize the mine pits for restoration from a biological perspective	Report is pending.	
Channel Morphology	Juvenile Salmonid Migration and Survival, Spring 2013	Spring 2013 studies focused on predation in Reach 1 relative to gravel mine pits.	Report is pending.	
Water Quality	Temperature Sensitivity Analyses	Analysis Set 1 evaluated the effects of major flow splits in Reaches 2B and 4B on temperatures under existing conditions. Set 2 evaluated the effect of Friant Dam release temperatures on downstream river temperatures. Set 3 evaluated the effects of the Settlement flow schedules in reaches 1 and 2A. Set 4 evaluated the effect of riparian shading on daily maximum water temperatures. Set 5 evaluated the effect of channel narrowing and deepening on daily maximum water temperatures in reaches 1 and 2.	Daily maximum water temperatures will exceed lethal levels for adult salmon and will be suboptimal for juvenile salmon below Sack Dam under existing conditions. It is unlikely that shading alone can reduce temperatures to suitable levels. Narrowing and deepening the channel by 50 percent may result in substantial reductions in temperature.	Studies are needed to determine the effects of channel narrowing and a wide riparian tree corridor on daily maximum water temperatures below Sack Dam.
Water Quality; Channel Morphology	Thermal Conditions in Riverine Pools	To quantify the number and quality of thermal refugia in 15 San Joaquin River pools in the Eastside Bypass/Reach 4 and Reach 5. By analyzing these refugia, the study will help determine the capacity of the river to meet the temperature needs of a viable salmonid population.	The study determined that even small flows disturb stratification in small pools, suggesting there are no significant thermal refugia to increase suitable downstream juvenile rearing habitat.	

Table 1-1.
Summary of Existing Rearing Habitat Studies, Conclusions, and Data Gaps (contd.)

Key Characteristic of Rearing Habitat	Study Title	Objective	Conclusions	Data Gap
Vegetative Cover	Vegetation Monitoring Results (2011 ATR)	To measure plant cover, composition, overstory height, and stem density in these areas.	Reaches 1A through 3, but particularly Reaches 1A and 1B) exhibited healthier riparian condition than downstream reaches, with greater cover, diversity, and density of woody species and higher habitat variable rankings. Subsequently, downstream reaches – with the exception of the wildlife refuges – are likely to have a greater potential for showing effects from Interim Flows.	Continued monitoring will determine if vegetative conditions and shaded riverine aquatic habitat have improved in transects along all reaches of the San Joaquin River included in this study.
Vegetative Cover; Channel Morphology	Floodplain Quality	This study aims to quantify the amount of cover features present in the existing river system, to inform the levee setback alternatives and revegetation designs.		Results are pending. There is currently little understanding of the amount of cover features present along the San Joaquin River and there is some uncertainty regarding the amount of habitat present in the existing river corridors.

1.2 Spawning and Incubation

Table 1-2.
Summary of Existing Spawning and Incubation Studies, Conclusions, Data Gaps, Strategy for Further Study

Key Characteristic of Spawning Habitat	Study Title	Objective	Conclusion	Data Gaps and Strategy
Hyporheic habitat quality	Hyporheic Water Quality	Evaluate DO, water temperature, and fine sediment accumulation	Survival rates of trout eggs ranged between 27 and 88% at three study sites	Delineate attributes throughout the spawning reach
Hyporheic habitat quality	Egg Survival Studies	Assess spawning habitat quality at five riffles in Reach 1A	Survival rates varied from 13-54% in the five riffles studied over two years	Egg survival in naturally produced redds

Table 1-2.
Summary of Existing Spawning and Incubation Studies, Conclusions, Data Gaps, Strategy for Further Study (contd.)

Key Characteristic of Spawning Habitat	Study Title	Objective	Conclusion	Data Gaps and Strategy
Hyporheic habitat quality	Fine sediment accumulation in Artificial Redds	Quantify the potential for fine sediment to accumulate longitudinally and relationship with egg survival.	Fine sediment transport and accumulation correlate with egg survival. Sand transport appears to be discontinuous with local differences with longitudinal position.	Sand sources, depletion rates, and supply rates. Can supply be controlled? Delineate areas more prone to sand supply than others (temporally and spatially).
Habitat availability	Mesohabitat Characterization	Document distribution of habitat types (e.g., pool, run, glide, riffle) at channel width scale	Mapped polygons of habitat types in the Restoration Area	All of Reach 1 has been mapped, but some lower reaches have not yet been mapped
Habitat Use	Spawning Habitat Use Monitoring / Spawning Ground Surveys	Monitor spawning activity and habitat use of fall-run Chinook transported through the trap-and-haul activities	Eleven potential redds were identified, nine upstream of Highway 41	Habitat conditions at redd sites, survival to emergence
Substrate	Bed material size and mobility, scour and deposition	Quantifiably measure the transport potential of bed material locally.	Critical shear stress measured at two sites is at the lower end of the expected range.	Other sites, especially those with significant differences in the finer mode of the GSD or bed material reinforcing.
Water Temperature	Stream Temperature Monitoring	Monitor hourly stream temperatures at 50+ sites in the Restoration Area (long-term monitoring)	Extent of habitat suitable for egg incubation depending on timing. Data also inform water temperature models and other studies	N/A
Sand Supply	Sand storage studies (Tetra Tech)	Quantify sand storage and monitor. Define sources		
Sediment Transport Rates	Bedload and suspended sediment load monitoring (USGS)	Define sediment contribution from tributaries. Calibration data for predicting the Reach's sediment transport rate.		

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