DRAFT

2009 Annual Technical Report

DRAFT
February 2010

Table of Contents

Tables

Figures

Appendices

Abbreviations and Acronyms

ATR	Annual Technical Report
cfs	cubic feet per second
CVHM	Central Valley Hydrologic Model
DWR	California Department of Water Resources
RM	river mile
Settlement	Stipulation of Settlement in *NRDC, et al. v. Kirk Rodgers, et al.*
SJRRP	San Joaquin River Restoration Program
SWRCB	State Water Resources Control Board
TIE	toxic identification evaluation
WR	Water Right
WY	water year

This page left blank intentionally.

1.0 Introduction

This Annual Technical Report (ATR) for the San Joaquin River Restoration Program (SJRRP) describes monitoring and analyses conducted during the fall 2009 Interim Flows period between October 1, 2009 and November 20, 2009. ATRs report monitoring, analysis, and management performed to implement the Stipulation of Settlement in *NRDC, et al. v. Kirk Rodgers, et al.* (Settlement). The ATR is a method for the Implementing Agencies to present to stakeholders the process used to address specific SJRRP needs. Physical objectives identified by the Settlement, and related legislation and environmental documentation are identified in Table 1-1.

The Fisheries Management Work Group identified additional objectives for the SJRRP in the Draft Fisheries Management Plan (SJRRP 2009a). The Draft Fisheries Management Plan sets the foundation for an adaptive management approach, and identifies program goals and quantitative objectives. Data needed to properly evaluate the fisheries objectives, and make informed management decisions, are identified in the Draft Fisheries Management Plan (e.g., longitudinal water temperature data, water quality parameters, riparian vegetation distribution and composition, and monitoring flow and velocity vectors to evaluate passage conditions). Fisheries objectives have not been fully integrated into this ATR, but will be presented in future documentation.

Table 1-1.
Components of SJRRP Monitoring and Management

Component	Objectives	Monitoring Parameters	Indicators	Potential Actions	
				Immediate	Long-Term
Flow	Comply with Friant Dam releases, Settlement monitoring location flow requirements, State Water Resources Control Board, Division of Water Rights, Order WR 2009-0058-DWR, and identify recapture quantities	Surface water stage and flow rate	Volumes and rates of Restoration Flows at seven specified monitoring locations	Report to Restoration Administrator (RA), begin negotiations for purchased water from willing sellers	Release purchased water from willing sellers and evaluate enforcement actions in case of increased diversions
Seepage	Reduce or avoid impacts from shallow groundwater due to increased river flow and stage	Groundwater elevation, visual inspection/patrol, landowner contact	Groundwater level relative to thresholds	Change releases/redirect flows through bypasses	Evaluate easements, compensate for damage, pursue engineering solutions
Capacity	Preserve flow conveyance	Aerial vegetation and topographic surveys, surface water stage and flow rate	Stage, roughness, width, and bed elevation	Reduce flows, monitor, and remove obstructions and debris	Evaluate flow, removal of sediment and vegetation, and evaluate channel work

This page left blank intentionally.

1.1 Report Organization

A brief description of the document organization is presented in the bullets below.

- Section 1. Introduction. This section describes the purpose of the ATR, the document structure, and the component and objectives that correspond to physical objectives identified by the Settlement, related legislation, and environmental documentation.

- Section 2. Fall 2009 Summary. This section presents a summary of the fall 2009 Interim Flows period, including a description of the wetting front, flow releases, Millerton Lake temperatures, infiltration losses, groundwater levels, and water quality.

- Section 3. Monitoring Network. This section presents a summary of the monitoring network including the monitoring components, spatial distribution of monitoring locations, and the number of locations monitored per reach.

- Section 4. Modeling and Analyses. This section identifies numerical models that could be used in the future to help understand and manage the system.

- Section 5. Conclusions. This section identifies how monitoring results will be used to update current understanding of physical and biological systems and operational constraints needed to implement Interim and Restoration flows.

- Appendix A. Problem Statements. This appendix presents problem statements identified for the fall 2009 Interim Flows. Problem statements describe specific needs to be addressed in the next year for the SJRRP related to the overall program objectives identified in Table 1-1. Appendix A does not currently present an analysis to address these problem statements.

- Appendix B. Surface Water Stage and Flow. This appendix presents the monitoring methodology used to collect surface water stage and flow and the monitoring data collected during the fall 2009 Interim Flow period.

- Appendix C. Surface Water Quality. This appendix presents the monitoring methodology used to collect surface water quality parameters and the monitoring data collected during the fall 2009 Interim Flow period.

- Appendix D. Sediment. This appendix presents the monitoring methodology used to collect bulk sediment samples, pebble counts, and photogrammetric sediment samples and the presents the monitoring data collected. This appendix identifies other techniques used to collect sediment bed load and sediment mobilization data and data that are described in the California Department of Water Resources (DWR), Draft Fall 2009 Interim Flows Monitoring Data Report for the San Joaquin Restoration Program (Appendix H).

- Appendix E. Groundwater Levels. This appendix presents the monitoring methodology used to collect groundwater levels and the monitoring data collected during the fall 2009 Interim Flow period.

- Appendix F. Bathymetric Surveys. This appendix presents the methodology used to conduct bathymetric surveys and the survey data collected during the fall 2009 Interim Flow period.

- Appendix G. Macrohabitat Surveys. This appendix identifies the methodology used to conduct macrohabitat surveys for the fall 2009 Interim Flows period. Survey data is currently being processed.

- Appendix H. DWR, Draft Fall 2009 Interim Flows Monitoring Data Report for the San Joaquin Restoration Program. This appendix includes a monitoring report including monitoring methodology and data collected for control surveys, water surface profile surveys, discharge measurements, water level recorders, scour chains, monitoring section surveys, Reach 1A bed sampling, Reach 2 bed sampling, and pilot tracer studies.

The main body of the ATR is focused on succinctly describing summary results from monitoring activities during the respective Interim Flows monitoring period. The ATR appendices describe in detail problem statements, monitoring methods, and monitoring data. While some efforts to address areas problem statements may span multiple years of the life of the SJRRP, others may be resolved in one a shorter time period. The modular format of Appendix A allows problems to be addressed as they are identified by monitoring year and removed when they have been resolved.

This page left blank intentionally.

2.0 Fall 2009 Summary

2.1 Wetting Front

Interim Flow releases from Friant Dam to the San Joaquin River began at 350 cubic feet per second (cfs) on October 1, 2009, increased to 700 cfs on November 1, 2009, and decreased to 350 cfs on November 11, 2009. Flows traveled to a little over 3 miles below Sack Dam (River Mile (RM) 182), by the end of the fall Interim Flows period on November 20, 2009 (see Figure 2-1).

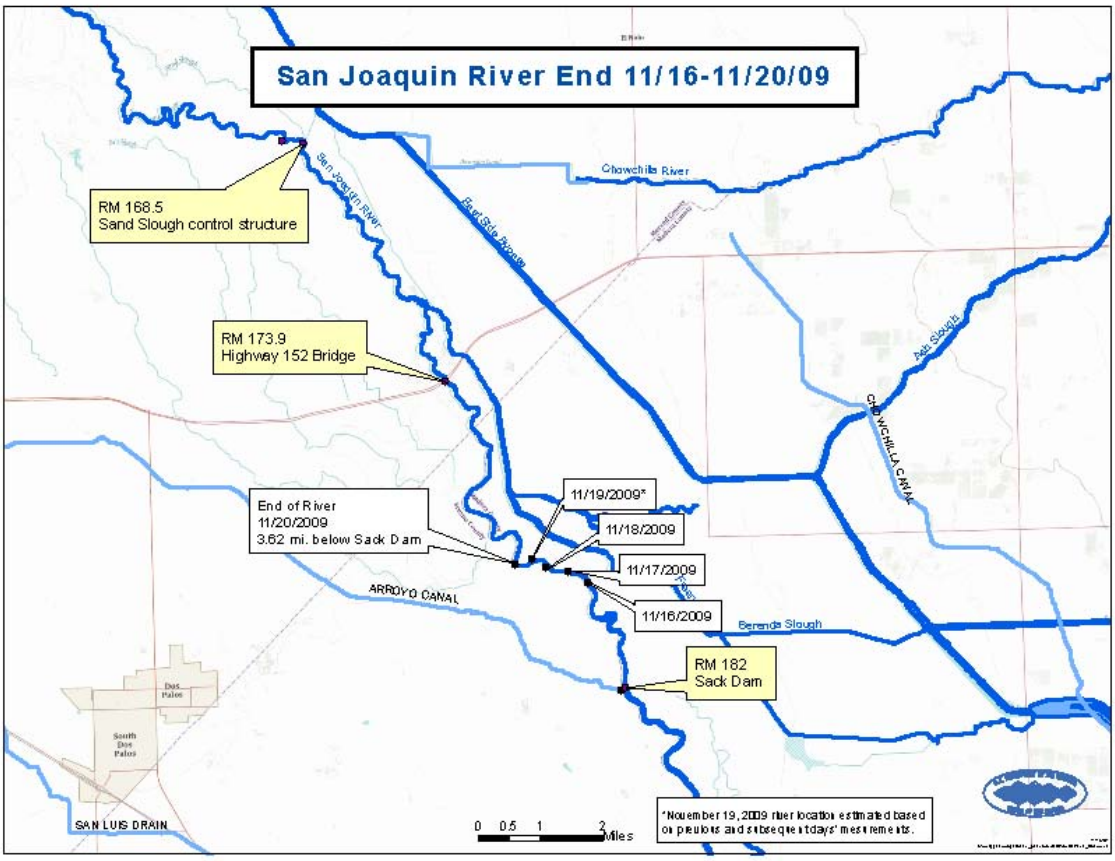

Figure 2-1.
San Joaquin River Wetting Front at End of Fall 2009 Interim Flow Release Period

2.2 Flow Releases

Although October and November of 2009 are part of the 2010 water year, the flow release schedule and accounting consistent with the 2009 water year type for a Normal-Wet year was designated for the fall 2009 Interim Flows (see Table 2-1). Coincidentally, this flow release schedule and accounting are the same for dry, normal-dry, normal-wet, and wet water year types.

Table 2-1.
Friant Dam Release Schedule and Accounting

October 1 to October 31				
Year Type	**Friant Dam Release**	**Riparian Release**	**Flow Passing Gravelly Ford**	**Loss from Friant Dam to Gravelly Ford**
	in, cubic feet per second (cfs)			
Dry to Wet	350	160	195	155
November 1 to November 10				
Year Type	**Friant Dam Release**	**Riparian Release**	**Flow Passing Gravelly Ford**	**Loss from Friant Dam to Gravelly Ford**
	in, cubic feet per second (cfs)			
Dry to Wet	700	130	575	125
November 11 to December 31				
Year Type	**Friant Dam Release**	**Riparian Release**	**Flow Passing Gravelly Ford**	**Loss from Friant Dam to Gravelly Ford**
	in, cubic feet per second (cfs)			
Dry to Wet	350	120	235	115

The 350 cfs release of Interim Flows on October 1, 2009, took approximately 4 days to reach the Gravelly Ford gaging station in Reach 2, and then approximately another 10 to12 days to reach an equilibrium state at the gaging stations operated along Reach 1, including the San Joaquin River at Highway 41 (RM 255.1), San Joaquin River at Donny Bridge (RM 240.7), and San Joaquin River at Skaggs Bridge (RM 232.1).

The increase in releases from Friant Dam to 700 cfs on November 1, 2009, was observed downstream at the Donny Bridge and Skaggs Bridge starting on November 3. The following day, a pulse in flow was measured at Gravelly Ford, approximately 40.0 miles downstream from Friant Dam. Flows measured at gaging stations in Reach 1 did not reach a steady-state during the brief 700 cfs pulse period. Peak daily average flows were observed on November 11 at the Donny Bridge gaging station and November 12 at the Skaggs Bridge and Gravelly Ford gaging stations following the 700 cfs release from Friant Dam.

On November 11, Interim Flow releases were reduced to 350 cfs from Friant Dam. On November 13, flows decreased at each of the gaging stations along Reach 1 in response

to the reduction in water released from Friant Dam. By November 17, the average flow passing through Reach 1 at Gravelly Ford was 210 cfs.

Releases from Friant Dam decreased from 350 cfs back to riparian demand (approximately 120 cfs) on Saturday, November 21, 2009. Flows at Mendota Dam peaked approximately 6 days after the releases were decreased to riparian demand on November 21, 2009. Flow measurements collected during the fall 2009 Interim Flow period at Friant Dam, Gravelly Ford, and just downstream of Mendota Dam are illustrated in Figure 2-2.

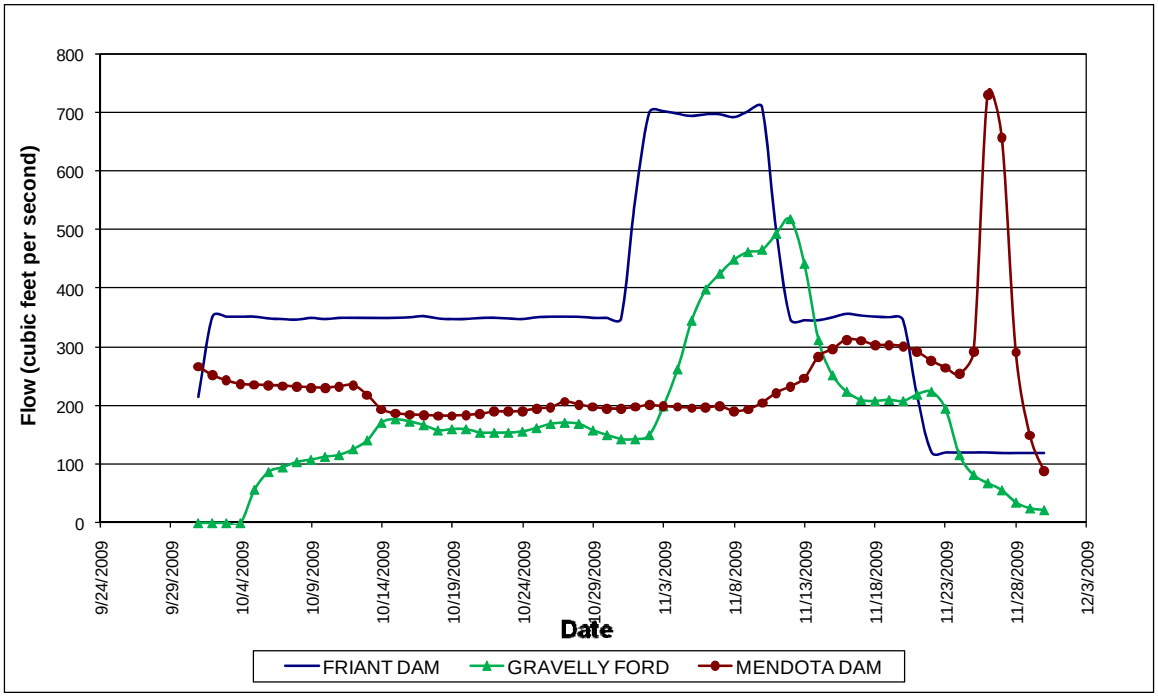

Figure 2-2.
Adjusted Measurements of San Joaquin River Flow at Friant Dam, Gravelly Ford, and Downstream of Mendota Dam During 2009 Fall Interim Flows

2.3 Millerton Lake Temperatures

Field measurements of Millerton Lake water temperature collected during the fall 2009 Interim Flows period indicated fluctuations between when baseline measurements were collected on September 30, 2009, and near the end of the release period, on November 17, 2009. Results from field measurements are presented in Table 2-2.

Table 2-2.
Field Measurements of Millerton Lake Water Temperature

	Specific Analyses	Units	Baseline	Routine Samples			
			9/30/ 2009	10/27/ 2009	11/3/ 2009	11/10/ 2009	11/17/ 2009
Field Measurements	Temperature	°C	23.7	19.8	14.9	16.8	16.2

Key:
°C = degrees Celcius

2.4 Infiltrations Losses

Infiltration losses observed during fall water year (WY) 2010 Interim Flows in Reach 2A were highly variable and ranged from about 460 cfs to less than 50 cfs based on an evaluation of stream gage records and a synoptic flow study. Flow losses in Reach 2A, as infiltration through the channel bottom, did not reach steady state conditions (constant values over a long time period) because of dry antecedent conditions, large variations in depth to the regional water table throughout Reach 2A, variability of the flow release rate from Friant Dam, and the relatively short duration of the flow release from Friant Dam. Therefore, further testing of Settlement assumptions will be required during the spring 2010 Interim Flows period.

2.5 Groundwater Levels

A subset of the final manual measurements of the depth to water collected during the fall 2009 Interim Flows period at groundwater monitoring wells and piezometers in Reaches 2a, 2B, 3, and 4 are presented in Table 2-3. The groundwater monitoring wells, piezometers, and buffer zones presented in Table 2-3 are identified in the Draft SJRRP Seepage Management Plan. Results from the fall 2009 Interim Flow period illustrate that groundwater levels remained below the buffer zones, which are defined in the Draft SJRRP Seepage Management Plan (SJRRP 2009b) as a zone within which waterlogging of crops does not occur, but the threat of waterloging exists. However, it is not clear if the groundwater levels had reached a steady-state condition before flows were reduced to riparian demands.

Table 2-3.
Depth to Water at Groundwater Monitoring Wells in Reaches 2a, 2b, 3, and 4

Reach 2a					
Well ID	**Date**	**DTW_GS (ft)**	**Buffer Zone (ft bgs)**	**River Mile**	**Bank**
FA-9	11/18/2009	12.3	4 – 6	218.2	Left
MW-47	11/18/2009	11.8	6 –8	218.2	Right
MA-4	11/18/2009	15.4	6 –8	217.2	Right
MW-49B	11/18/2009	8.14	4 –6	217.2	Left
Reach 2B					
Well ID	**Date**	**DTW_GS (ft)**	**Buffer Zone (ft bgs)**	**River Mile**	**Bank**
MW-55B	11/17/2009	10.6	6 –8	211.8	Left
R2B-1	11/17/2009	5.71	4 –6	207.1	Right
R2B-2	11/17/2009	10.9	4 –6	205.1	Right
Reach 3					
Well ID	**Date**	**DTW_GS (ft)**	**Buffer Zone (ft bgs)**	**River Mile**	**Bank**
R3-1	11/17/2009	9.7	4 –6	191.6	Right
R3-6	11/17/2009	9.88	4 –6	196.6	Right
R3-7	11/17/2009	8.37	3 –5	199.2	Right
Reach 4					
Well ID	**Date**	**DTW_GS (ft)**	**Buffer Zone (ft bgs)**	**River Mile**	**Bank**
MW-84	11/17/2009	36.9	4 –6	173.9	Right
MW-87B	11/17/2009	> 14 (dry)	4 –6	173.9	Left

Key:
bgs = below ground surface
DTW_GS = depth to water, groundwater surface
ft = feet

2.6 Water Quality

The State Water Resources Control Board (SWRCB) Division of Water Rights, Order Water Right (WR) 2009-0058-DWR, specifies water quality objectives for the WY 2010 Interim Flow period in addition to objectives identified for several of the components shown in Table 1-1. These water quality objectives included collecting baseline information one week prior to the fall 2009 Interim Flow release for bed sediment samples and pore water quality. The results collected from the San Joaquin River just below Friant Dam, San Joaquin River at Gravelly Ford, and the San Joaquin River downstream of Mendota are presented in Table 2-4.

Table 2-4.
Pore Water Quality Results from Bed Sediment at San Joaquin River Below Friant Dam, San Joaquin River at Gravelly Ford, and the San Joaquin River near Mendota Dam

Water Rights Order	Specific Analyses	Units	SJR below Friant Dam	SJR at Gravelly Ford	SJR near Mendota Dam
			9/30/2009	10/1/2009	10/29/2009
Total organic carbon		mg/L	2000	2400	<2600
Metals	copper	mg/L	17	2.3	1.3
	chromium	mg/L	23	2.7	2
	lead	mg/L	2.7	9.3	<1.3
	nickel	mg/L	18	1.6	2.3
	zinc	mg/L	31	16	22
	arsenic	mg/L	1	2.4	<1.3
	mercury	mg/L	<0.0025	<0.0023	<0.024
Organochlorine scan		ug/L	X	X	ND
Pyrethroid scan		ug/L	X	X	ND
Acute toxicity (*Hyalla azteca*)	ten day survival	%	89%	81%	80%
	ten day dry weight	mg	0.06	0.08	0.07
	TIE		N/A	X	N/A
Extras	grain size analysis		N/A	X	X
	percent solids		79.4%	80.8	77%
	percent moisture		N/A	X	N/A

Key:
% = percentage
µg/L = microgram per liter
mg = milligram
mg/L = milligram per liter
N/A = not applicable
TIE = toxic identification evaluation
X = results pending

3.0 Monitoring Network

The monitoring network for the SJRRP was developed to help understand areas of uncertainty identified by the problem statements presented in Appendix A, and to refine or strengthen conceptual models and assumptions. The monitoring network includes sites identified to study the following:

- Stage and Flow
- Surface Water Quality
  - Surface water quality parameters defined by SWRCB Order WR 2009-0058-DWR
  - Surface water temperature for fisheries
- Sediment
  - Bulk sampling
  - Pebble counts
  - Photogrammetric sediment sampling
  - Scour chains
  - Monitoring section surveys
  - Reach 2 bed sampling
  - Pilot tracer study
- Groundwater Levels and Temperature
- Bathymetric Surveys
- Macrohabitat Surveys
- Control Surveys
- Water Surface Profile Surveys

Monitoring data were collected from the sites identified in Figure 3-1 before and during fall 2009 Interim Flows. Table 3-1 identifies the number of stations per reach for each of the monitoring components identified in Figure 3-1.

Appendices B through H describe the monitoring methodology used for each of the components that were monitored during the fall 2009 Interim Flows, and also present data collected before and during the fall 2009 Interim Flows period.

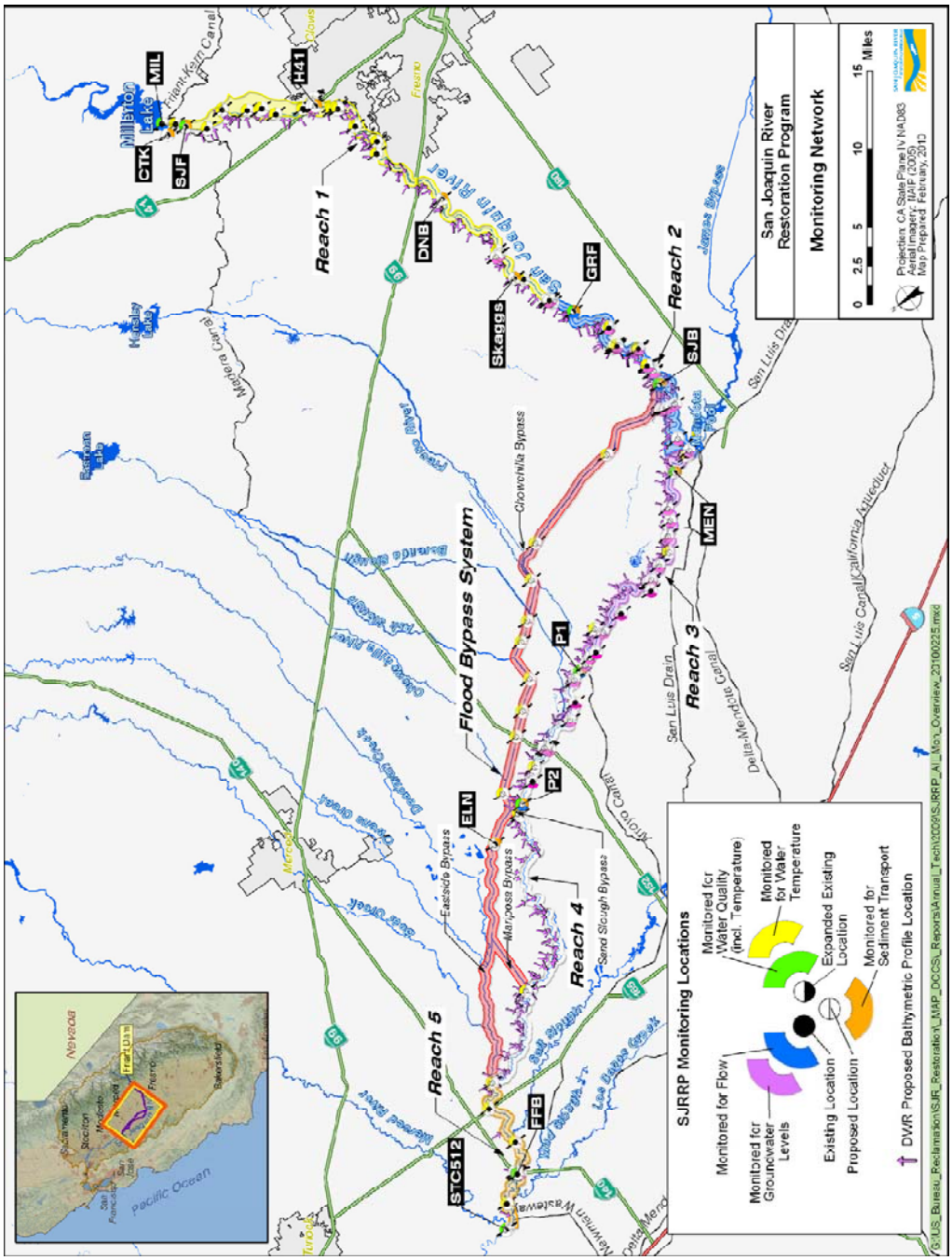

Figure 4-1
Monitoring Locations in Reaches 1 Through 5

Table 3-1.
Number of Monitoring Stations for Components by Reach and Bypass

Reach	Flow and Stage	Groundwater Levels and Temperature	Surface Water Temperature	Surface Water Quality	Sediment	Bathymetric Surveys
1A	1	4	17	2	3	59
1B	0	11	2	0	2	32
2A	6	26	2	1	1	46
2B	1	8	2	1	1	28
3	0	13	3	1	1	51
4A	2	11	4	2	2	30
4B1	0	1	2	0	0	49
4B2	0	0	2	0	0	25
5	1	6	5	2	1	5
Bypasses	1	0	11	0	2	1

This page left blank intentionally.

4.0 Modeling and Analyses

Modeling provides a numerical representation of conceptual models to assist in formulation of operational plans. Monitoring data collected during the fall 2009 Interim Flows period could be used to improve existing models to help manage implementation of the Settlement. The following models are available to represent physical conditions in the San Joaquin River:

- Water temperature relationships using HEC-5Q
- Mobile bed sediment boundary using the one-dimensional SRH-1D transport model
- Water surface using a one-dimensional HEC-RAS model and a two-dimensional SRH-2D
- Vegetation response to flow and sediment transport conditions using SRH-1DV
- Groundwater seepage using the three-dimensional USGS Central Valley Hydrologic Model (CVHM)

No known simulations have been completed this year following the fall 2009 Interim Flows.

This page left blank intentionally.

5.0 Conclusions

Data collected during the fall 2009 Interim Flows period did not provide justification to adjust current assumptions of the physical and biological system. In order to suggest adjustments to the hydrologic assumptions presented in the Exhibit B of the Settlement or the corresponding operation of Friant Dam releases, a better understanding must be developed for the relationships between the river's stage, roughness, geometry, and interaction with the unconfined aquifer. The development of these relationships would be based upon the following:

- Periods of sustained, steady-state flow conditions at various flow rates
- Periods of sustained, steady-state groundwater conditions at various flow rates
- Recorded stage and groundwater elevations at coincident locations along Reaches 1 through 5

The fall 2009 Interim Flow monitoring did not reach a period of sustained steady-state condition for the flow rates released from Friant Dam. In moving forward with the spring 2010 Interim Flows, releases will be consistent with Settlement assumptions used for the fall 2009 Interim Flows period.

This page left blank intentionally.

6.0 References

Central Valley Operations Office (CVOO). 2010. 2009 Reservoir Operations Reports. Available at < http://www.usbr.gov/mp/cvo/rpt_09.html>.

San Joaquin River Restoration Program (SJRRP). 2009a. Draft Fisheries Management Plan: A Framework for Adaptive Management in the San Joaquin River Restoration Program. Available at <http://restoresjr.net/>.

San Joaquin River Restoration Program (SJRRP). 2009b. Draft Seepage Management Plan.

This page left blank intentionally.