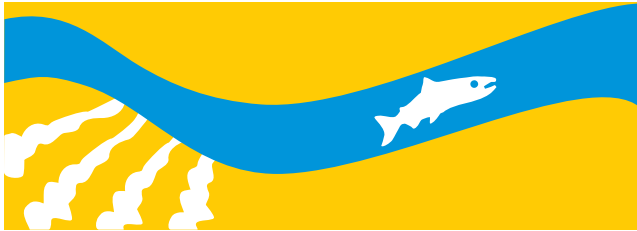


Final

2012 Monitoring and Analysis Plan

SAN JOAQUIN RIVER
RESTORATION PROGRAM



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19 ESA Section 10(a)(1)(A) Permit for Steelhead Monitoring

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2 **Abbreviations and Acronyms**

3	ATR	Annual Technical Report
4	CDEC	California Data Exchange Center
5	DFG	California Department of Fish and Game
6	DWR	California Department of Water Resources
7	EA	Environmental Assessment
8	EDT	Ecosystem Diagnosis and Treatment
9	ESA	Endangered Species Act
10	FMP	Fisheries Management Plan
11	FMWG	Fisheries Management Work Group
12	IS	Initial Study
13	MAP	Monitoring and Analysis Plan
14	MMP	Monitoring and Management Plan
15	NMFS	National Marine Fisheries Service
16	PEIS/R	Program Environmental Impact Statement/ Report
17	RA	Restoration Administrator
18	Reclamation	U.S. Department of the Interior, Bureau of
19		Reclamation
20	Settlement	Stipulation of Settlement in <i>NRDC, et al., v. Kirk</i>
21		<i>Rodgers, et al.</i>
22	SEA	Supplemental Environmental Assessment
23	SJRRP	San Joaquin River Restoration Program
24	State	State of California
25	State Board	State Water Resources Control Board
26	TAC	Technical Advisory Committee
27	USFWS	U.S. Fish and Wildlife Service
28	USGS	U.S. Geological Survey
29	WY	water year
30		
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1 1.0 Introduction

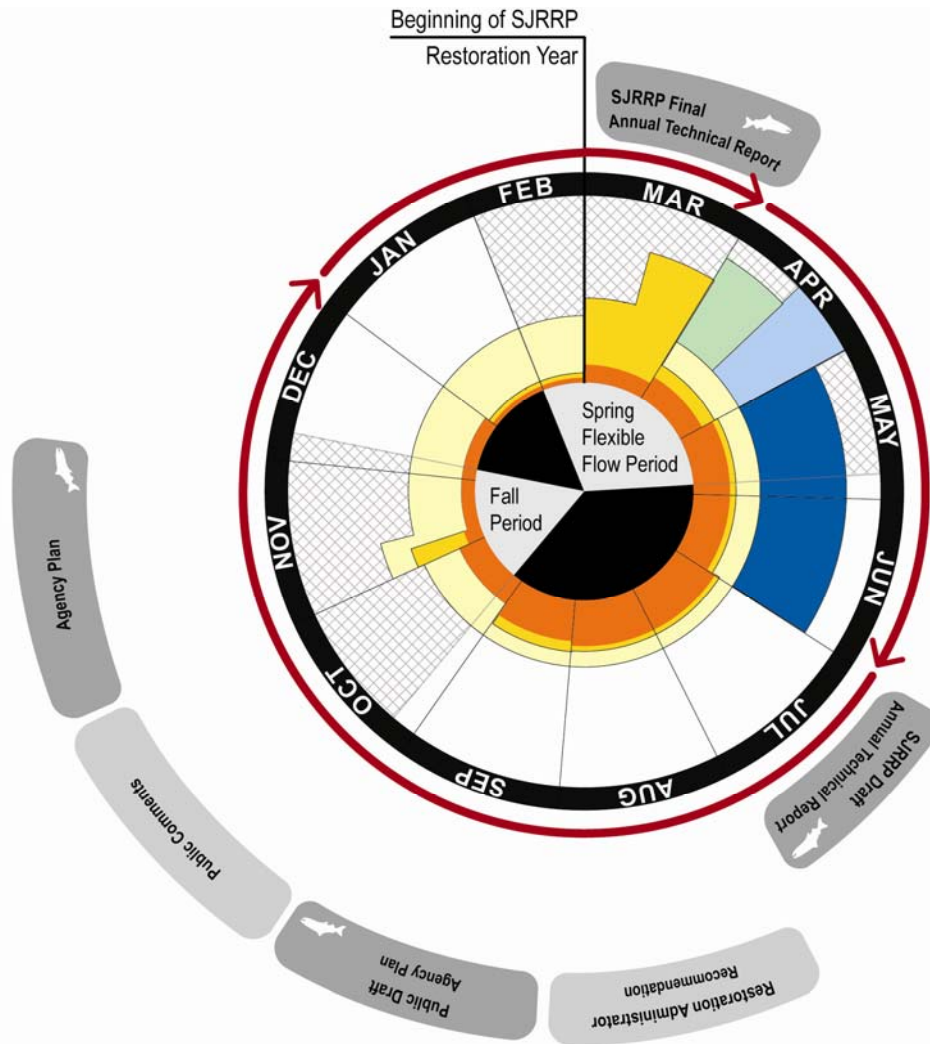
2 This Monitoring and Analysis Plan (MAP) presents studies, monitoring network changes,
3 and the development of analytical tools scheduled for 2012 implementation. The San
4 Joaquin River Restoration Program's (SJRRP) annual planning and reporting process (see
5 Figure 1-1) includes the MAP and an Annual Technical Report (ATR), which reports
6 monitoring and analysis results from the previous calendar year.

7 Agencies responsible for implementing the SJRRP (Implementing Agencies) include the
8 U.S. Department of the Interior, Bureau of Reclamation (Reclamation), U.S. Fish and
9 Wildlife Service (USFWS), the California Natural Resources Agency, the California
10 Department of Water Resources (DWR), the California Department of Fish and Game
11 (DFG), U.S. Department of Commerce, and the National Marine Fisheries Service
12 (NMFS). The MAP provides a framework for the Implementing Agencies to prioritize
13 and consolidate monitoring and analysis proposals (Appendix A) into a coordinated
14 program that best meets SJRRP needs within funding limits and other constraints.

15 The Restoration Administrator (RA), in consultation with the Technical Advisory
16 Committee (TAC), developed recommendations for the monitoring and assessment
17 actions for 2012 (Appendix B). These recommendations should be considered when
18 determining the scope and priority of proposals submitted by the Implementing Agencies.
19 The RA, TAC, and Implementing Agencies met on September 8, 2011, to conduct a
20 workshop focused on consolidation and prioritization of proposals for 2012
21 implementation. The RA provided final 2012 MAP recommendations, which include
22 additional specific comments on proposals reflecting discussions at the September 8,
23 2011, workshop. The Implementing Agencies modified monitoring and analysis activities
24 in response to the RA recommendations to the greatest extent possible within the 2012
25 MAP process and will continue to develop new plans based on the recommendations as
26 part of the next SJRRP planning cycle.

27 The SJRRP is a comprehensive long-term effort to restore flows and a self-sustaining
28 Chinook salmon fishery to the San Joaquin River from Friant Dam to the confluence of
29 the Merced River, while reducing or avoiding adverse water supply impacts. More
30 information on the SJRRP is available at <http://www.restoresjr.net>.

U:\BPR\San Joaquin River Restoration Program\2010 Charts and Figures\November\November SJRRP Flow Schedules_Radius Plot 8.5x11.ai



**Overlay of Exhibit B
Flow Schedules in Center of Graphic**

- Wet Year Riparian Recruitment Flows
- Normal-Wet Year Flushing Flows
- Normal-Dry Spring Period Pulse
- Dry Year Fall Period Pulse and Continuity Flows
- Critical High Spring and Fall Pulses and Continuity Flows
- Critical Low Releases for Riparian Diversions
- Coordination Period
- SJRRP Report or Plan

Revision Date (11/18/10)

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**Figure 1-1.
Monitoring and Reporting Schedule**

1 **1.1 Plan Organization**

2 The main body of the text summarizes future monitoring activities and the current state of
3 analyses. Organization of this plan is briefly described below.

4 **Section 1.0, Introduction** – Purpose and structure of the 2011 Agency Plan.

5 **Section 2.0, Background** – Description of sources for monitoring and analysis planning.

6 **Section 3.0, Monitoring Network Development** – Type, location, and dates of sensors,
7 surveys, or equipment.

8 **Section 4.0, Analytical Toolkit Development** – Type, spatial extent, and scope or model
9 development and implementation.

10 **Section 5.0, Studies Summary** – Proposals that will be implemented in 2012

11 **Section 6.0, Summary** – Summary identifying how the 2012 MAP meets requirements
12 and addresses concerns outlined in the introduction.

13 **Section 7.0, References** – References for sources of information used to compile the
14 2012 MAP.

15 **Appendix A, Proposals** – All proposals received for 2012.

16 **Appendix B, RA Recommendations for 2012 Priority Monitoring and Assessment**
17 **Actions** – Priority monitoring and assessment actions for 2012.

18 **Appendix C, Budget Summary** – Budget summary for 2012 MAP studies.

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2.0 Background

SJRRP monitoring and analysis activities are based on specific requirements within the Stipulation of Settlement in *Natural Resources Defense Council, et al., v. Kirk Rodgers, et al.* (Settlement) and Public Law 111-11, environmental compliance, and general Settlement implementation as recommended by the RA and described in the SJRRP management plans.

2.1 Settlement Requirements

2.1.1 Flow Guidelines

The Settlement requires a flow monitoring program that monitors the daily volume and rate of flow at no less than six stations within the Restoration Area, including the following:

- At or immediately below Friant Dam
- At Gravelly Ford
- Below the Chowchilla Bypass Bifurcation Structure
- Below Sack Dam
- At the head of Reach 4B
- At the San Joaquin River and Merced River confluence

2.2 Environmental Compliance

SJRRP incorporates monitoring and analysis components into actions to meet permit conditions and commitments in environmental documents.

2.2.1 Draft Program Environmental Impact Statement/ Report

The Draft SJRRP Program Environmental Impact Statement/ Report (PEIS/R) (SJRRP, 2011c) contains Conservation Strategies to be incorporated in projects to avoid or minimize adverse effects to listed species. Many of these Conservation Strategies will require monitoring and analysis to establish baseline species presence in the Restoration Area and design more specific protective measures.

2.2.2 2010 Interim Flows Environmental Assessment and 2011–12 Interim Flows Supplemental Environmental Assessments

The water year (WY) 2010 Interim Flows Project includes monitoring and analysis requirements, in the form of monitoring and management plans (MMP) appended to the

1 WY 2010 Interim Flows Project Environmental Assessment/Initial Study (EA/IS)
2 (Reclamation, 2009). WY 2011 and WY 2012 Interim Flows are addressed in Draft
3 Supplemental EAs (SEA). The WY 2011 and WY 2012 Interim Flows Project SEAs
4 include the same requirements in the project descriptions and mitigation measures as for
5 the WY 2010 Interim Flows Project EA/IS.

6 As mentioned, MMPs are appended to the WY 2010 Interim Flows EA/IS (Reclamation,
7 2009), and include seepage, flow, and invasive species MMPs. A fourth monitoring plan
8 requirement, the Water Quality Monitoring and Quality Assurance Plan, is also included
9 in the project description. This requirement states that Reclamation would complete and
10 submit a water quality plan for flows through December 31, 2013. The MMPs and Water
11 Quality Monitoring and Quality Assurance Plan identify the appropriate timing, scope of
12 monitoring, and reporting methodology, and the agency/agencies responsible for
13 implementing the plans.

14 The WY 2011 Interim Flows Project Biological Assessment Errata stated that
15 Reclamation would develop a monitoring plan, in coordination with the SJRRP Fisheries
16 Management Work Group (FMWG), to check for Central Valley steelhead in the
17 Restoration Area during spring Interim Flows, and submit this plan to NMFS before
18 February 1, 2011. The Steelhead Monitoring Plan was developed in coordination with
19 NMFS with continued revisions made through spring 2011. Reclamation's 10(a)(1)(A)
20 permit application for steelhead monitoring is included as Attachment A.

21

22 2.2.3 State Water Resources Control Board Water Rights Orders

23 On October 1, 2009, the State Water Resources Control Board (State Board) issued Order
24 2009-058-DWR for the WY 2010 Interim Flows Project. Order 2009-058-DWR required
25 explicit monitoring during implementation of WY 2010 Interim Flows. These
26 requirements included monitoring of flow, water quality, seepage, and invasive species,
27 consistent with the MMPs and the Water Quality Monitoring and Quality Assurance Plan
28 identified in the WY 2010 Interim Flows Project EA/IS (Reclamation, 2009). Order
29 2009-058-DWR further required monitoring of water quality and sediments at several
30 locations along the river, beginning in fall 2009. Order 2009-058-DWR required
31 Reclamation to develop a monitoring plan, acceptable to the Deputy Director for Water
32 Rights, for releases that began after February 1, 2010.

33 Reclamation developed the 2009–2013 Interim Flow Release Program Water Quality
34 Monitoring Plan in January 2010, in part to meet the water quality and bed sediment
35 monitoring requirements of Order 2009-058-DWR. According to the plan, the core of
36 SJRRP monitoring includes a series of sensors along the river that will make continuous
37 measurements of physical conditions, including flow, depth, temperature, specific
38 conductance (salinity), pH, dissolved oxygen, turbidity, and chlorophyll. Raw data are
39 posted by the California Data Exchange Center (CDEC) (www.cdec.water.ca.gov) and
40 linked to the SJRRP Web site.

1 On September 30, 2010, the State Board issued an order for the WY 2011 Interim Flows
2 Project. Order 2010-029-DWR states that Reclamation is required to continue
3 implementing the 2009–2013 Interim Flow Release Program Water Quality Monitoring
4 Plan and a water quality response plan. Order 2010-029-DWR requires Reclamation to
5 submit requests to modify the Interim Flow Release Program Water Quality Monitoring
6 Plan in writing to the Deputy Director for Water Rights; modifications may only be made
7 upon written approval of the Deputy Director for Water Rights. Order 2010-029-DWR
8 required Reclamation to develop and submit to the Deputy Director for Water Rights, by
9 February 1, 2011, a Water Quality Response Plan completed to address the following: (1)
10 contribution of Interim Flows to high salinity conditions in the Delta-Mendota Canal,
11 Mendota Pool, and Fresno Slough, (2) an identification of the different entities and
12 individuals who may contribute to or play a role in the response to high salinity
13 conditions, (3) the current legal and contractual roles and responsibilities of those entities,
14 and (4) possible mechanisms, including those under the control of Reclamation and those
15 that are the responsibility of other entities and individuals. Order 2010-029-DWR also
16 stated that Reclamation is required to implement monitoring of temperature changes in
17 Millerton Reservoir and to implement a schedule for the ramping of flow releases,
18 consistent with the Settlement.

19 WY 2012 Interim Flows will also be released under a short-term petition until flows may
20 be released under a final PEIS/R.

21 **2.3 General Settlement Implementation**

22 **2.3.1 SJRRP Restoration Administrator Recommendations**

23 In Paragraph 15 the Settlement states, “The Restoration Administrator, in consultation
24 with the Technical Advisory Committee, the Secretary, and other appropriate federal,
25 State, and local agencies, shall develop and recommend to the Secretary implementation
26 of a program of Interim Flows in order to collect relevant data concerning flows,
27 temperatures, fish needs, seepage losses, recirculation, recapture and reuse.” The 2012
28 RA MAP recommendations are included as Appendix B.

29 **2.3.2 Management Plans**

30 The five management plans are as follows:

- 31 • The Fisheries Management Plan (FMP) (SJRRP, 2010) sets the foundation for an
32 adaptive management approach and identifies program goals and quantitative
33 objectives to achieve the Settlement Restoration Goal.
- 34 • The Sediment Management Plan (in progress) documents the current
35 understanding of sediment-related processes as a basis for management within the
36 SJRRP Restoration Area (Friant Dam to the Merced River, including flood
37 control bypasses), proposes a framework to address sediment issues related to the
38 SJRRP, recommends implementation of specific sediment management actions,
39 and outlines monitoring plans. The Sediment Management Plan will address
40 Settlement components for additional improvements, including gravel

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3 • The Vegetation Management Plan (in progress) objectives include invasive
4 vegetation control, meeting existing vegetation-related environmental
5 commitments, flood flow conveyance (Draft PEIS/R), and recruitment of riparian
6 vegetation.

7 • The Seepage Management Plan (SJRRP, 2011b) describes the monitoring and
8 operating guidelines for reducing Interim or Restoration flows to the extent
9 necessary to address any material adverse impacts caused by Interim and
10 Restoration flows in the San Joaquin River identified by the SJRRP groundwater
11 monitoring program.

12 • Channel Capacity Management Plan (in progress).

13

1 **3.0 Monitoring Network Development**

2 SJRRP maintains a network of installed monitoring equipment and permanent survey
3 locations to meet Settlement requirements, environmental commitments, and to collect
4 relevant data during Interim Flows. This section presents changes scheduled for 2012,
5 while existing infrastructure is documented in resource-specific Monitoring Plans and
6 Atlases. The network is continually refined to meet the evolving information needs of the
7 SJRRP. Table 3-1 presents monitoring network installations planned for 2012, and Table
8 3-2 presents monitoring network surveys planned for 2012.

9 Data collected from the monitoring network are presented in the ATR annually. Real-
10 time data available from flow gage stations are available through CDEC and can be
11 accessed through links on the SJRRP Web site (<http://restoresjr.net>). Groundwater levels
12 from select wells and water quality measurements from telemetered stations are also
13 available in real-time and are accessible on the SJRRP Web site. The data collected from
14 the SJRRP monitoring network will be analyzed in studies to support SJRRP
15 implementation and management actions.

**Table 3-1.
Monitoring Equipment Installation**

Equipment	2012 Plans	Relevant Study Name
Temperature	New monitoring locations will be included in temperature atlas updates (available on the SJRRP Web site at http://restoresjr.net).	Temperature Monitoring for Adult Migration
Artificial redds/egg plates/ continuous, dissolved oxygen/ continuous temperature	Install up to 26 artificial redds at 5 locations	Egg Survival, Year 2 (USFWS), Monitor Intragravel Dissolved Oxygen Concentrations (Reclamation)
Water-level recorders	Relocate recorders as needed based on data needs	Study DWR-02H: Water-Level Recorder Data Collection and Relocation Needs
Groundwater monitoring wells	Following installation of wells planned for fall 2011, reevaluate well network, respond to any new stakeholder requests, and complete process to locate and install new wells during 2012	Monitoring Well Network Optimization (Reclamation)

Key:

DWR = California Department of Water Resources

Reclamation = U.S. Department of the Interior, Bureau of Reclamation

USFWS = U.S. Fish and Wildlife Service

**Table 3-2.
Monitoring Network Surveys**

Survey Type	Purpose	2012 Plans	Relevant Study Name
Water Surface Profiles	Hydraulic model calibration	DWR expects to complete final Water Surface Profile Surveys in 2012 to have a complete array of data points in Reaches 1–3. Reclamation does not have any surveys planned for Reaches 4–5 during 2012.	Water Surface Profile Surveys (DWR)
Bathymetric	Hydraulic model calibration	No bathymetric surveys planned for 2012.	
Cross Sections	Hydraulic model calibration	Resurvey 25 cross sections in Reach 2A after spring 2012 flows. Other surveys to be conducted only if flows reach a range expected to significantly change bed topography.	Monitoring Cross-Section Survey and Analysis, Reach 2A Channel Response
Aerial	Inundation mapping, habitat assessments, vegetation mapping	Aerials will be flown if the Friant Dam release exceeds 8,000 cfs.	
Vegetation	Model calibration, detection of invasive species, riparian recruitment info.	Resurvey transects established in 2011 during summer 2012. Establish permanent elderberry photo points.	Vegetation Monitoring, Elderberry Mapping (Reclamation)
Bed Material Sampling	Hydraulic model calibration	Bed material sampling throughout Reach 1.	Bed Material Data Collection (Reclamation), DWR studies.
Invertebrate Studies	Habitat assessment	Continued sampling in 2012.	Benthic Macroinvertebrate Bioassessment

Key:

cfs = cubic feet per second

DWR = California Department of Water Resources

ESB = Eastside Bypass

Reclamation = U.S. Department of the Interior, Bureau of Reclamation

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1 **4.0 Analytical Toolkit Development**

2 Analytical tools provide a numerical representation of conceptual models. Monitoring
3 data collected for the SJRRP can improve calibration and validation of these tools and fill
4 in gaps where physical data were previously unavailable. Table 4-1 presents the
5 analytical tools that have been identified to support operations decisions and analysis for
6 technical studies described in Appendix A. These analytical tools are at different levels of
7 development, as described in the status column in Table 4-1. Data collected from the
8 monitoring network may be used to update the models listed in Table 4-1 to support
9 refinement and calibration. Table 4-2 lists the status of the two-dimensional models by
10 reach.

**Table 4-1.
Analytical Tools for SJRRP**

Model	Type	Purpose	Status	Model Application
HEC-RAS	Hydraulic (1D)	Water surface (inundation mapping)		Terrain updates
SRH-2D	Hydraulic	Depth/velocity/habitat mapping	See Table 4-2: 2D Model Status	Will be used in all reaches to evaluate habitat
SRH-2D	Sediment	Transport/habitat mapping	See Table 4-2: 2D Model Status	
SRH-2D	Temperature	Habitat mapping	See Table 4-2: 2D model status	Will be used in Reach 1A gravel pit temperature study
SRH-1D	1D mobile boundary sediment	Transport		Update based on new terrain data.
HEC-5Q	1D hydraulic routing, temperature	San Joaquin River temperature		Validation using 2010 monitoring data. Modeling for proposed hydrographs to aid flow scheduling.
CE-QUAL-W2	Temperature (vertical 2D)	Millerton cold water pool	Complete	
SRH-1DV	Cross-section vegetation	Vegetation response to flow and sediment conditions	Applied in Reach 2B in 2011	Support for design work on Reach 2B and Reach 4B site-specific projects
CVHM	Groundwater	Groundwater flow	CVHM has 1-mile-square grids for Central Valley	Preliminary simulations related to Reach 2B proposed alignments right now, using current version and input from HEC-RAS model
EDT	Fisheries	Population response to habitat conditions	Under development	

Key:
1D = one-dimensional
2D = two-dimensional

**Table 4-2.
Two-Dimensional (SRH-2D) Model Status by Reach**

Reach	Updated Terrain completed?	Comment on Terrain	Status of 2D Model	Comment on 2D Model	Current Channel Grid Size*	Information Needs
1A	Yes, DWR	2007 photogrammetry combined with 2008/2009 DWR in channel surveys, some areas of 1999 Ayers data	Initial model built by DWR, In use by Reclamation	DWR used to do some initial habitat mapping, Mesh currently being rebuilt by Reclamation for use in 2D temperature model	10–15 feet laterally, 20–25 feet longitudinally	None
1B	Yes	2008 LiDAR combined with DWR 2010 channel surveys	Model built, Reclamation	Highway 99 to downstream most gravel pit, overlaps with Reach 2A	20–30 feet laterally, 35–45 feet longitudinally	Calibration data from DWR
2A	Yes	2008 LiDAR combined with Reclamation and DWR 2009 channel surveys	Model built, Reclamation	Skaggs Bridge to Chowchilla, upstream overlaps with Reach 1B	20–30 feet laterally, 35–45 feet longitudinally	None
2B	Yes	2008 LiDAR combined with Reclamation and DWR 2009 channel surveys	Initial model built by Reclamation, In use by DWR	Existing conditions model ready, extends longitudinally from upstream reach boundary to RM, laterally levee to levee only, does not include Chowchilla Bypass or Mendota Pool, model extended by Tetra Tech for use in Reach 2B site-specific project	25–30 feet lateral, 30–45 feet longitudinal	None
3	Yes	2008 LiDAR combined with Reclamation and DWR 2009 and 2010 channel surveys	No model built		NA	None
4A	Yes, draft	2008 LiDAR combined with Reclamation 2010 and 2011 bathymetry data	No model built		NA	None

Table 4-2. Two-Dimensional (SRH-2D) Model Status by Reach (contd.)

Reach	Updated Terrain completed?	Comment on Terrain	Status of 2D Model	Comment on 2D Model	Current Channel Grid Size*	Information Needs
4B1	Yes	2008 LiDAR combined with in-channel data from 1999 cross sections	Model built, Reclamation	Existing conditions model is available and in use for Reach 4B1 site-specific project	Approximately 20 feet laterally and 50 feet longitudinally	Using cross-section data from 1998/1999, need additional in channel bathymetry if we want to be consistent with other reaches
4B2	No	Collected bathymetry data in 2010 and 2011	No model built		NA	None
5	No	Collected bathymetry data in 2010 and 2011	No model built		NA	None
ESB	Upper eastside complete and in draft format, Lower eastside not yet complete	Collected bathymetry data in 2010 and 2011	No model built		NA	None

Note:

* Grid sizes can be automatically refined for higher resolution model results

Key:

2D = two-dimensional

DWR = California Department of Water Resources

ESB = Eastside Bypass

HW = highway

LiDAR = light detection and ranging

NA = not applicable

Reclamation = U.S. Department of the Interior, Bureau of Reclamation

RM = river mile

1 **5.0 Studies Summary**

2 The Implementing Agencies developed monitoring and analysis proposals (refer to
3 Appendix A) and entered into a process with the RA and TAC (see Appendix B for 2012
4 RA MAP Recommendations) to prioritize and consolidate proposals into a monitoring
5 and analysis program for the following year of the SJRRP. This section presents studies
6 by resource area planned for 2012 implementation. Study numbers below reference
7 Appendix A proposal sections. Many studies include detailed budgets, and a MAP budget
8 summary is provided in Appendix C.

9 **5.1 Settlement Requirements**

10 *Study: 2*

11 Reclamation, DWR, and U.S. Geological Survey (USGS) will continue the flow
12 monitoring program that monitors the daily volume and rate of flow at no less than six
13 stations within the Restoration Area, including the following:

- 14 • At or immediately below Friant Dam
- 15 • At Gravelly Ford
- 16 • Below the Chowchilla Bypass Bifurcation Structure
- 17 • Below Sack Dam
- 18 • At the head of Reach 4B
- 19 • At the San Joaquin River and Merced River confluence

20 **5.2 Environmental Compliance**

21 SJRRP monitoring and analysis activities designed to meet environmental commitments
22 and permit requirements may also address other information needs identified in
23 coordination efforts among the Implementing Agencies, RA, TAC, and stakeholders.

24 **5.2.1 Seepage**

25 *Studies: 3–8*

26 Reclamation's seepage monitoring and analysis are based on requirements of Public Law
27 111-11, Water Rights Orders, commitments in Interim Flows Environmental
28 Assessments, and the Draft PEIS/R (SJRRP, 2011c).

1 **5.2.2 Vegetation**

2 *Studies: 9, 10*

3 The 2009 and 2010 State Board Water Rights Orders require Reclamation to monitor and
4 manage invasive vegetation.

5 Reclamation is mapping elderberry shrubs based on commitments in the Draft PEIS/R
6 (SJRRP, 2011c).

7 **5.2.3 Channel Capacity**

8 *Studies: 9, 28–32, 45–47*

9 Reclamation and DWR’s channel capacity monitoring and analysis are based on
10 requirements of Public Law 111-11, Water Rights Orders, commitments in Interim Flows
11 EAs, and the Draft PEIS/R (SJRRP, 2011c).

12 **5.2.4 Steelhead**

13 *Studies: 42*

14 Steelhead monitoring is an environmental commitment in the WY 2011 Interim Flows
15 SEA.

16 **5.2.5 Hills Ferry Barrier**

17 *Studies: 39*

18 Hills Ferry Barrier monitoring is an environmental commitment in the WY 2011 Interim
19 Flows SEA.

20 **5.2.6 Millerton Temperature Monitoring**

21 *Studies: 23*

22 The State Board Water Rights Order 2010-0029-DWR, Condition 27 states,
23 “Reclamation will implement monitoring of temperature changes in Millerton Reservoir
24 and a schedule for ramping of flow releases consistent with the San Joaquin River
25 Restoration Settlement Agreement in coordination with U.S. Fish and Wildlife Service,
26 National Marine Fisheries Service, Department of Fish and Game, and Department of
27 Water Resources.”

28 **5.3 General Implementation**

29 The Implementing Agencies, in consultation with the RA and TAC, developed and
30 prioritized monitoring and analysis activities to support Settlement implementation that
31 were not explicit environmental compliance requirements.

32 **5.3.1 Egg Survival/ Spawning Gravel**

33 *Studies: 15, 23–25, 33–38*

1 The 2012 MAP includes ongoing studies to evaluate the adequacy of spawning
 2 conditions in Reach 1 through field studies on egg survival, monitoring of habitat
 3 conditions for spawning and egg incubation, and investigations into the physical aspects
 4 of maintaining spawning habitat. Repeated sediment bed material sampling, gravel
 5 mobility measurements, and spot measurements of temperature and water quality both
 6 above and below the streambed surface have led SJRRP to propose an evaluation of the
 7 use of artificial redds during 2012. The redds will contain fish egg plates, so egg survival
 8 can be measured directly in anticipated spawning areas. The redds will also be equipped
 9 with continuous dissolved oxygen and temperature sensors to link the egg survival results
 10 to a continuous data set of parameters known to determine egg survival in other rivers.

11 DWR and USGS continue to investigate sediment mobility and sand storage and
 12 transport in potential spawning areas to address concerns that bed armoring and
 13 infiltration of fine material may be limiting to future spawning.

14 The results of these efforts will help SJRRP understand the need for any actions to
 15 enhance the quantity or quality of spawning habitat in the restoration area.

16 5.3.2 Juvenile Survival

17 *Studies: 11, 13, 17, 18, 40, 41, 43, 48, 44*

18 Studies planned for 2012 will provide direct measures of fish survival, assess the juvenile
 19 salmon habitat supply in the San Joaquin River, and inform the SJRRP on the needs for
 20 juvenile salmon. An ongoing juvenile migration and salmon study led by the USFWS
 21 will be using acoustic tags to track juvenile fish survival as they emigrate down river.
 22 Several activities will help quantify the habitat in the San Joaquin River as well as further
 23 define the habitat needs of fish. Reclamation will lead studies to address the amount of
 24 flood plain habitat needed for juvenile rearing, conduct hydraulic modeling of in-river
 25 habitat, and model the influence of gravel pits on juvenile habitat and water quality.
 26 USGS will continue an effort to summarize and assess water quality data and define the
 27 water quality needs for fish reintroduction. DWR will assess the food resources and river
 28 conditions through an ongoing macroinvertebrate study. Potential limitations to juvenile
 29 survival will be investigated through studies on predator abundance and habitat, and a
 30 review of predation risks at fish screens and water diversions.

31 5.3.3 Reintroduction

32 *Studies: 14, 19, 27*

33 Studies related to the development of methods for the collection, rearing, and
 34 reintroduction of salmon are identified as priorities in the FMP (SJRRP, 2009) and the
 35 Program's *Strategy for Reintroduction for Spring Run Chinook Salmon* (SJRRP, 2011a).
 36 The recommendations of the RA and FMWG also acknowledge the importance of
 37 conducting studies on reintroduction methods. DFG will continue to study captive rearing
 38 techniques for Chinook salmon. The USFWS will conduct research on the collection
 39 from donor stocks that includes collection and transport methods, fish health screening,
 40 and assessing impacts to donor stocks.

1 **5.3.4 Adult Passage**

2 *Studies: 12, 21, 23, 49*

3 Efforts to evaluate the ability of adult salmon to safely migrate to suitable spawning areas
4 will continue in 2012. DWR and USGS will evaluate adult passage at structures and
5 nonstructural passage constraints. DFG will conduct temperature monitoring to
6 determine if temperature levels in the restoration will support adult passage.

7 **5.3.5 Fisheries Models**

8 *Studies: 20–21*

9 Modeling activities planned for 2012 include continued development of an Ecosystem
10 Diagnosis and Treatment (EDT) model. This modeling effort provides a life-cycle-based
11 framework for evaluating the status of the system and planning restoration efforts.
12 Additional modeling at finer scales will support the development of the EDT model by
13 providing reach and life-stage-specific estimates of survival under current and projected
14 conditions.

15 **5.3.6 Other Fish**

16 *Studies: 16*

17 Reclamation and USFWS will collaborate to develop a study design and begin
18 implementation of a long-term monitoring program for assessing the fish community
19 within the study area.

1 **6.0 Conclusions**

2 SJRRP monitoring and analysis to meet environmental compliance and support
3 Settlement implementation is ongoing. Management plans will continue to be developed
4 and revised to describe management strategies and direct monitoring and analysis for
5 specific resources.

6 This MAP contains planned monitoring network installations, analytical toolkit
7 development, and study implementation for 2012. Refinement of the process to
8 coordinate, consolidate, and prioritize monitoring and analysis studies from the
9 Implementing Agencies, with input from the RA/TAC and stakeholders, is ongoing as
10 SJRRP prepares for another year of Interim Flows.

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1 **7.0 References**

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