

**MINUTE ITEM**

This Calendar Item No. C46 was approved as Minute Item No. 46 by the California State Lands Commission by a vote of 3 to 0 at its 09-17-01 meeting.

**CALENDAR ITEM**

**C46**

A 25, 30

S 12,16

PRC 8161

09/17/01

WP 8161.9

J. Smith

**AMENDMENT OF LEASE**

**LESSEE:**

Friant Water Users Authority  
854 N. Harvard Avenue  
Lindsay, California 93247-1715

**AREA, LAND TYPE, AND LOCATION:**

Sovereign lands in the San Joaquin River between Highway 145 and the Chowchilla Flood Bypass Canal, near the city of Fresno, Fresno and Madera counties.

**AUTHORIZED USE:**

Installation, maintenance and monitoring of piezometers and alluvial wells to gather hydrologic and vegetation information in conjunction with increased river flows.

**LEASE TERM:**

Ten years, beginning July 1, 1999.

**CONSIDERATION:**

The public use and benefit; with the state reserving the right at any time to set a monetary rent if the Commission finds such action to be in the state's best interest.

**PROPOSED AMENDMENT:**

Installation and maintenance of ten additional piezometers; installation, maintenance and monitoring of scour chains and crest gages at existing monitoring transect locations; the lease area is amended to include the bed of the San Joaquin River located between the Mendota Pool to just east of Highway 145. All other terms and conditions of the lease shall remain in effect without amendment.

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**OTHER PERTINENT INFORMATION:**

1. Applicant has a right to use the uplands adjoining the lease premises.
2. On April 20, 2000, the Commission authorized a General Lease - Public Agency Use (Lease No. PRC 8161.9) for the installation, maintenance and monitoring of piezometers and alluvial wells as part of the San Joaquin River Riparian Habitat Restoration Program 1999 and 2000 Pilot Projects. The Lessee is now seeking authorization for the installation and maintenance of ten additional piezometers as part of the 2000 Pilot Project and for the installation, maintenance and monitoring of scour chains and crest gages at existing transect locations as part of the 2001 Pilot Project. The purpose of the pilot projects is to gather vegetation and water monitoring data to guide the development of a long-term riparian habitat restoration plan for the San Joaquin River. The Bureau of Reclamation intends to modify releases from Friant Dam for the purpose of studying the effects of these flows on riparian shrub or tree seedlings in the downstream channel, and on groundwater and surface water conditions and potential flood management issues.

The scour chains are approximately one-inch diameter chain about three feet in length that will be buried vertically in sand to a depth of approximately three feet and marked for retrieval and monitoring purposes. The crest gages will be made of various length sections of two-inch diameter steel galvanized pipe. Holes will be drilled at the base of the pipe to allow for a hydrologic connection with water in the river channel. A section of wood will be installed in the center of the pipe and the pipe will be capped. The pipe will be attached to a six-inch diameter wood post to stabilize the crest gage during a high flow release. The posts will be installed approximately ten feet above ground and four feet underground and will be set in concrete at all transect locations. The holes will be augered by hand. As with the previous Pilot Projects, staff is requesting that the Lessee provide the Commission with copies of the monitoring results and conclusions.

The Natural Resources Defense Council and the San Joaquin River Parkway and Conservation Trust support the project.

Additional components of the 2001 Pilot Project include proposed sediment excavation, levee stabilization, and vegetation control. These

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additional components will require subsequent Commission review and approval.

3. A Mitigated Negative Declaration/Environmental Assessment was prepared and adopted for this project by the Friant Water Users Authority and the U.S. Bureau of Reclamation. The California State Lands Commission's staff has reviewed such document. A Finding of No Significant Impact (FONSI) was prepared and adopted for this project by the U.S. Bureau of Reclamation. A Monitoring and Coordination Plan was adopted by Friant Water Users Authority and the U. S. Bureau of Reclamation.
4. This activity involves lands identified as possessing significant environmental values pursuant to Public Resources Code sections 6370, et seq. Based upon the staff's consultation with the persons nominating such lands and through the CEQA review process, it is the staff's opinion that the project, as proposed, is consistent with its use classification.

**APPROVALS OBTAINED:**

U.S. Bureau of Reclamation; U.S. Fish and Wildlife Service; U.S. Army Corps of Engineers; State Water Resources Control Board; State Reclamation Board.

**FURTHER APPROVALS REQUIRED:**

State Department of Fish and Game; California State Lands Commission.

**EXHIBITS:**

- A. Location Map
- B. Notice of Determination
- C. Monitoring and Coordination Plan

**PERMIT STREAMLINING ACT DEADLINE:**

December 25, 2001

**RECOMMENDED ACTION:**

IT IS RECOMMENDED THAT THE COMMISSION:

**CEQA FINDING:**

FIND THAT A MITIGATED NEGATIVE DECLARATION AND ENVIRONMENTAL ASSESSMENT AND MONITORING AND COORDINATION PLAN WERE PREPARED AND ADOPTED FOR THIS

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PROJECT BY THE FRIANT WATER USERS AUTHORITY AND THE U.S. BUREAU OF RECLAMATION.

FIND THAT THE FINDING OF NO SIGNIFICANT IMPACT, PREPARED AND ADOPTED FOR THIS PROJECT BY THE U.S. BUREAU OF RECLAMATION, MEETS THE REQUIREMENTS OF THE CEQA.

ADOPT THE MONITORING AND COORDINATION PLAN, AS CONTAINED IN EXHIBIT C, ATTACHED HERETO.

**SIGNIFICANT LANDS INVENTORY FINDING:**

FIND THAT THIS ACTIVITY IS CONSISTENT WITH THE USE CLASSIFICATION DESIGNATED BY THE COMMISSION FOR THE LAND PURSUANT TO PUBLIC RESOURCES CODE SECTIONS 6370, ET SEQ.

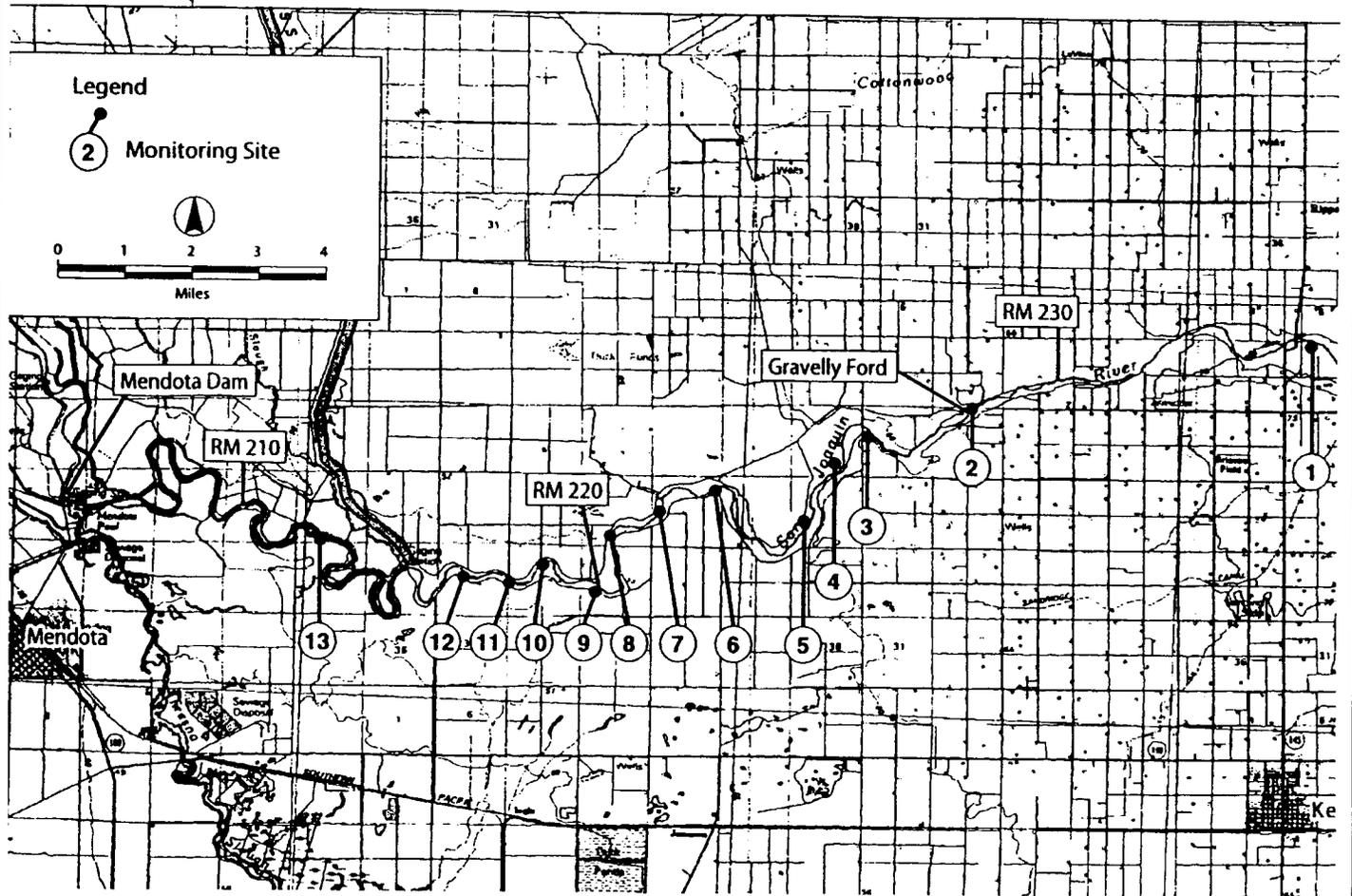
**AUTHORIZATION:**

AUTHORIZE THE AMENDMENT OF LEASE NO. PRC 8161.9, A GENERAL LEASE – PUBLIC AGENCY USE, OF LANDS SHOWN ON EXHIBIT A ATTACHED AND BY THIS REFERENCE MADE A PART HEREOF, EFFECTIVE JULY 1, 2001, FOR THE INSTALLATION, MAINTENANCE AND MONITORING OF TEN ADDITIONAL PIEZOMETERS; INSTALLATION, MAINTENANCE AND MONITORING OF SCOUR CHAINS AND CREST GAGES AT EXISTING MONITORING TRANSECT LOCATIONS IN CONJUNCTION WITH THE SAN JOAQUIN RIVER RIPARIAN HABITAT RESTORATION PROGRAM 2000 AND 2001 PILOT PROJECTS; THE LEASE AREA IS AMENDED TO INCLUDE THE BED OF THE SAN JOAQUIN RIVER LOCATED BETWEEN THE MENDOTA POOL TO JUST EAST OF HIGHWAY 145; ALL OTHER TERMS AND CONDITIONS OF THE LEASE WILL REMAIN IN EFFECT WITHOUT AMENDMENT.

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NO SCALE

# SITE MAP



Monitoring Sites on San Joaquin River

NO SCALE

# LOCATION MAP

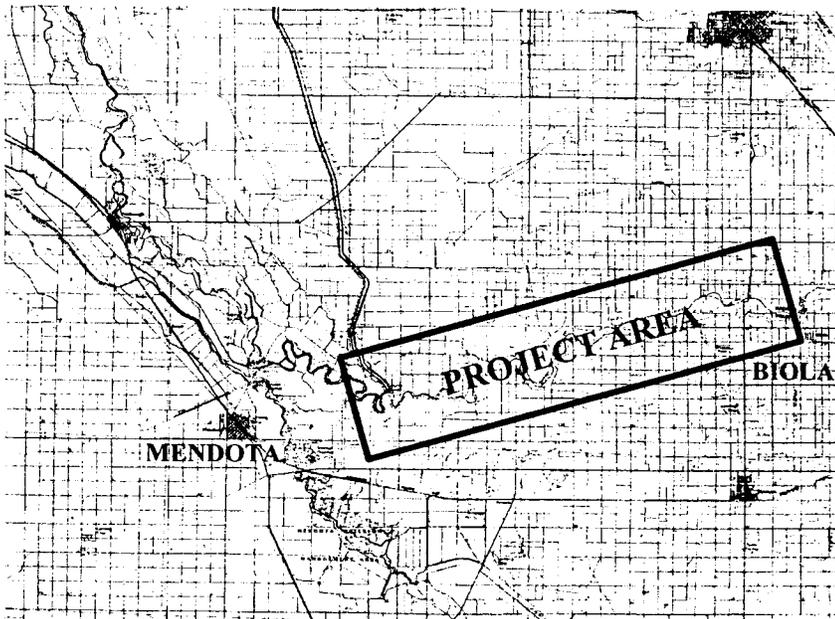


Exhibit A  
 WP8161.9  
 Friant Water Users Authority  
 San Joaquin River  
 FRESNO/MADERA COUNTIES



This Exhibit is solely for purposes of generally defining the lease premises, is based on unverified information provided by the lessee or other parties and is not intended to be, nor shall it be construed as, a waiver or limitation of any state interest in the subject or any other property.

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 MJJ 07/2001

### Notice of Determination

To: \_\_\_\_\_ Office of Planning and Research  
1400 Tenth Street, Room 121  
Sacramento, CA 95814

From: Friant Water Users Authority  
. 854 N. Harvard Ave.  
Lindsay, CA 93247-1715

\_\_\_\_\_ County Clerk  
County of: Madera \_\_\_\_\_  
Fresno \_\_\_\_\_

Subject: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

**Project Title: SAN JOAQUIN RIVER RIPARIAN HABITAT RESTORATION PROGRAM 2001 PILOT PROJECT**

State Clearinghouse Number <i>(If submitted to Clearinghouse)</i>	Lead Agency Contact Person	Area Code/Telephone/Extension
2001051052	Y. Laurence Kimura	(559) 562-6305

**Project Location** *(include county)*  
Madera and Fresno Counties

**Project Description:**

The San Joaquin River Riparian Habitat Restoration Program (SJRRHRP) proposes to conduct a pilot project of water released and/or bypassed from Friant Dam on a 62.5-mile segment of the mainstem of the San Joaquin River between Friant Dam and Mendota Dam. The 2001 Pilot Project's purpose is to support riparian habitat restoration planning and help evaluate flood management implications relative to the development of a restoration plan for the San Joaquin River from Friant Dam to the Mendota Pool. Information is sought to (1) evaluate the need for sustenance of established riparian habitat on the San Joaquin River between Gravelly Ford and Mendota Pool and (2) establish baseline groundwater and surface water hydrologic data in the project area. Water released/bypassed from Friant Dam would occur over the period from approximately June 14 through approximately September 30, 2001. Additional measures, necessary to ensure consensus, are planned.

A range of sources for the alternative releases/bypasses from Friant Dam is under consideration in addition to No Action/No Project: (A) a maintenance flow of approximately 50 cfs requiring up to 12,100 acre-feet with up to 7,500 acre-feet of water provided as a purchase and/or exchange of water available to Arvin Edison Water Storage District under its program of water banking with the Metropolitan Water district of Southern California (MWD), or (B) a maintenance flow of approximately 50 cfs requiring up to 12,100 acre-feet with up to 7,500 acre-feet of water provided as a purchase and/or exchange of water available to CALFED's Environmental Water Account (EWA). Potential sources of water under the EWA are: MWD, San Luis Reservoir, or underground storage in Kern County. Under both alternatives, project proponents would use 4,600 acre-feet banked during the 2000 pilot project. The California Environmental Quality Act (CEQA) lead agency is Friant Water Users Authority, and the National Environmental Policy Act (NEPA) lead agency is the Bureau of Reclamation.

This is to advise that the Friant Water Users Authority  
*Lead Agency*      *Responsible Agency*

has approved the above described project on June 14, 2001 and has made the following determinations regarding the above described project.

1. The project [  will  will not ] have a significant effect on the environment.  
A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
2. An Environmental Impact Report was not prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures [  were  were not ] made a condition of the approval of the project.

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The following measures have been incorporated into the proposed project to mitigate concerns raised by stakeholders. The two action alternatives could have impacts due to potential releases and/or bypasses from Friant Dam and water purchases associated with either of the maintenance flows. These impacts could result from (1) changes in channel capacity and levee stability due to vegetation growth supported by project water, and (2) temporally displaced power generation. To improve the collaborative nature of the SJRRHRP, the SJRRHRP, Reclamation, and the Authority will ensure that the following conditions are met in order to proceed with the 2001 Pilot Project under either Alternatives A or B.

### 3.1 Vegetation Management

To address potential flood flow management issues, a specific plan for vegetation control and/or removal (or other physical measures to resolve the problem) was developed during the 2000 pilot project monitoring, in consultation with the Lower San Joaquin Levee District (LSJLD) and other affected parties (Section 2.2.4). This plan was implemented during the 2000 pilot project. It included conducting low-level aerial photography upon which areas of concern for flood control were outlined relative to the location of vegetation. An herbicide was applied to this vegetation by LSJLD personnel in accordance with their permitted maintenance activities. Continued measures will be implemented as appropriate in conjunction with the LSJLD and other affected parties to mitigate any additional potential problems that may develop as a result of the 2001 Pilot Project.

Of particular importance to levee stability over the long term is prevention of mature tree establishment on the levee slopes. If the 2001 Pilot Project flows support this type of vegetation, then its removal from the levees is to be part of the vegetation control and levee maintenance activities of the LSJLD.

### 3.2 Sediment Excavation

The Project includes excavation of accumulated sediments in the low-flow channel for a distance of about 5 miles from RM 216.1 (Bifurcation Structure) up to about RM 221.1. The restored channel will not exceed the original conveyance capacity. The excavated material will be deposited outside the existing levees to buttress them. Deposition of the excavated sand will avoid potential impacts to any rare, threatened, or endangered species. Additional discussions and avoidance and minimization measures will occur as project design and faunal survey data are completed. Results of the pilot project, and other information, will provide new opportunities for the SJRRHRP to collaborate in this effort to develop and implement scientifically sound floodplain management strategies.

### 3.3 Levee Stabilization

Because the levees are sensitive to any rise in water surface elevation, and such a rise could occur due to vegetation growth over the long term, it is possible that pilot project results may indicate a need to stabilize the levees. Concurrent with the pilot project, the LSJLD is planning to experimentally reinforce about 300 feet of levee with sheetpile to determine how the potential piping problem identified in Section 3.2.2.2 of the Draft EA/IS can be mitigated (White 2001, pers. comm.). This issue will be addressed in additional detail as the experimental design is completed.

### 3.4 Lost Power Reimbursement

No significant net loss to power generation or the power grid is anticipated. Interest foregone or other financial losses, if any, suffered by Friant Power Authority for lost power generation will be fully compensated using funding made available from the State of California for the proposed project.

### Monitoring and Coordination Plan

The Monitoring and Coordination Plan contained in Appendix A of the attached Draft Environmental Assessment/Initial Study provides for data collection of physical and biological variables to understand the relationships between surface and ground water hydrology, channel hydraulics, and vegetation establishment and survival. This data collection and analysis effort by the SJRRHRP will be supplemented with field observations for the potential establishment of vegetation (type and location) that could affect flood flows and levee stability.

Monitoring of the measures above will be conducted by Reclamation and the Authority or other agency such as the Lower San Joaquin Levee District with responsibility for channel maintenance.

4. A Statement of Overriding Considerations [ was  was not] adopted for this project.

This is to certify that the Negative Declaration and supporting Environmental Assessment/Initial Study with comments and record of project approval is available to the General Public at:

Friant Water Users Authority, 854 N. Harvard Ave., Lindsay, CA 93247-1715 (559) 562-6305

	June 14, 2001	Water & Environmental Resources Manager
Signature: Y. Laurence Kimura Friant Water Users Authority	Date	Title

Date received for filing and posting at OPR: \_\_\_\_\_

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2001 Pilot Project: Riparian Restoration Flows for the San Joaquin River between the Friant Dam and Mendota Pool

**Monitoring and Coordination Plan**

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**I. Introduction**

The San Joaquin River Riparian Habitat Restoration Program (SJRRHRP) is a collaborative effort of the Friant Water Users Authority (FWUA), the Natural Resources Defense Council (NRDC), the Pacific Coast Federation of Fishermen's Associations (PCFFA), the U.S. Bureau of Reclamation (USBR), and the U.S. Fish and Wildlife Service (USFWS), with the purpose of improving riverine and riparian conditions along the San Joaquin River. In 1999, a pilot project was initiated to augment flows in the river for promoting dispersal and germination of seed from riparian tree species, and to test the hypothesis that managed flow releases from Friant Dam can be used to restore riparian vegetation that will survive over the long-term. To guide decision making and to quantify the impact of these augmented flows, data were collected on physical and biological variables by different groups including the California Department of Water Resources (DWR), FWUA, Jones & Stokes, Mussetter Engineering Inc. (MEI), and the Natural Heritage Institute. For 2000, another pilot project (2000 Pilot Project) was planned by the SJRRHRP to manage flows from Friant Dam to promote recruitment of riparian tree species and to calibrate and refine hydrologic modeling efforts

In February, 2000, the U.S. Geological Survey (USGS) reviewed the 1999 pilot release program and provided suggestions for designing a monitoring scheme that integrated physical and biological variables (Scott et al. 2000). This integration should increase monitoring efficiency and focus data collection on variables most important for evaluating the degree of success of riparian restoration objectives. The suggested approach and procedures should also assure that monitoring results may guide future adjustments to flow magnitude, timing, and duration. At a pilot project planning workshop held on March 8-9, 2000 at the Fresno office of USBR, the results of the 1999 monitoring and the monitoring scheme proposed by Scott et al. (2000) were discussed by stakeholders, consultants, and government representatives.

Data from the Pilot 2000 were used to make the decision to conduct a third pilot trial during 2001. During 2000, the Pilot Technical Team determined that a long-term monitoring program would be essential to obtain real time data to help develop restoration strategies on the River, regardless of the potential to create experimental flows. Such a monitoring plan would occur year-round, and regardless of flows, as no question exists that riparian vegetation can be enhanced with additional water. However, the critical issue is, how much water is needed during droughty periods, where is the groundwater level relative to the rooting zone of various aged riparian trees and shrubs and what are the survival rates over time, as well as, what species become established under the various possible natural, or created flow regimes.

The monitoring plan for the 2001 Pilot Project is presented in this document. It draws on the suggestions made in the Scott et al. (2000) report and results from the pilot project planning workshop and upon additional information needs being generated. A brief rationale for each monitoring component is presented, followed by a description of the methods to be used and a preliminary recommendation of individuals or groups that might be responsible for completing the work.

Recommended monitoring frequencies for each task are given in Table 1

## 2. Evaluate Timing of Seed Release for Target Riparian Tree Species

### 2.1 Rationale

To determine the best timing of flow releases beneficial for seed dispersal, seed-release periods of target riparian tree species must be better understood. Knowledge of seed-release periods for the target species would provide an understanding of optimal timing of flow releases and the degree of flexibility for initiating augmented flows. Tree species composition may also be manipulated by shifting peak flow releases, if seed-release periods of the species differ.

### 2.2 Methods

Trees to be evaluated for seed release should be representative of trees in the lower San Joaquin River below Friant Dam, yet close to access points to minimize travel time. Given the sampling frequency necessary, all data collection per sampling event should be less than a day.

Locations where trees could be conveniently monitored include :

- Lost Lake,
- Herndon Road, east of Highway 99,
- Dickenson Road,
- Skaggs Bridge,
- Lake
- Napa Road, and
- San Mateo Road.

A total of 10–15 trees of each of two main target species, Fremont cottonwood (*Populus fremontii*), and Goodding's black willow (*Salix gooddingii*) will be chosen at the sampling locations listed above, when possible. Some of the downstream areas may not support the required number of cottonwood trees. (not true *S. exigua* is more abundant than *S. g.*). In addition, where possible and convenient, a few representative trees of three other species present along the river: narrow-leaved or sandbar willow (*Salix exigua*), red willow (*Salix laevigata*), and arroyo willow (*Salix lasiolepis*) will also be chosen. Trees to be sampled will be widely spaced to avoid including genetically related trees. Initial selection of trees should be done at or after the time of flowering to ensure that only female trees are included. If too few female trees

of each species are within easy access at each location, fewer trees will be sampled at more locations. We will attempt to sample trees at sites where access is not an issue. Landowner consent will need to be obtained if data collection requires the use of private roads, access across private lands, or access to private levees.

Tree position will be mapped using a global positioning system (GPS), marked using a numbered metal tag permanently attached to the tree with an aluminum nail, and flagged using highly visible tape. At the time of the first visit, several additional variables will be measured, such as distance of the tree to landmarks and to the active river channel, elevation in relation to the river channel, and size (diameter at 1.5 meters [m] above the ground). These additional data will allow the trees to be relocated in subsequent visits if the permanent markers are vandalized or removed and can be used for analysis of environmental causes of variability in seed-release times.

Amount of ripe seed and pappus ("cotton") present on each tree will be estimated according to the following scale:

- 0 = no cotton present,
- 1 = small proportion of seeds are ripe (1–10%),
- 2 = moderate proportion of seeds are ripe (10–75%), and
- 3 = large proportion of seeds are ripe (75–100%).

In 1999, it was noted that some trees contained large amounts of cotton even late in the summer (Wolfe 1999). This seed was generally not actively dispersed, as it appeared to be trapped by sticky aphid honeydew and spider webs. Branches should be shaken gently to determine whether the seed is easily dislodged and could be dispersed.

For each tree, 5–10 random catkins will also be examined, either with binoculars or with the naked eye, to estimate the number of capsules that have opened. Percentage of open capsules will be scored according to the following scale:

- 0 = no capsules open,
- 1 = 1–10% of capsules open,
- 2 = 11–50% of capsules open,
- 3 = 51–90% of capsules open, and
- 4 = >90% of capsules open.

It is not known what will be most closely related to the amount of seed present in the river system: the overall amount of cotton present or the percent of capsules open on catkins. Evaluating the amount of cotton present should take less than one minute per tree, while estimating the percent of open capsules will likely require less than five minutes per tree. The time required to take both measurements is much less than the driving time necessary to reach each sampling location. In subsequent years, scoring both variables may not be necessary.

At each sampling location the presence of seed cotton in the air and on the water surface (if water is present in the channel) should also be recorded.

Data should be collected every ten days during the main seed-release period from April 1 until the end of July. Data should be collected once in both August and September. Data collection should end when no more seed that can be released remains on the sampled trees.

### 3. Monitor 13 Permanent Transects

#### 3.1 Rationale

Scott et al. (2000) proposed installing a set of permanent transects perpendicular to the channel and extending across the floodway on both sides of the channel. Physical and biological variables would be collected along these transects in an integrated format, to facilitate interpreting the relationships between surface- and groundwater hydrology, channel hydraulics, and vegetation establishment and survival. In addition, repeated measurements of water surface elevation and discharge at these transects will provide valuable data for calibrating existing hydrological models, and synoptic gagings will permit existing loss curves to be better defined. Because of site conditions and access issues, 13 of an originally proposed set of transects (Scott et al. 2000) were installed in Reaches 1 and 2. The monitoring effort is focused on Reach 2, because of the greater historic loss of riparian vegetation in Reach 2 relative to Reach 1 (Jones & Stokes Associates 1998).

#### 3.2 Methods

Transects were located to use existing wells, piezometers, and vegetation transects. Where possible, transects were located on state-owned land or on land owned by cooperative individuals. This preliminary site selection should be based on USBR maps. In addition, transects should be selected to represent a range of sites in proportion to geomorphic environments present in the river channel (e.g., point bars, braided channels and bars).

A schematic illustration of the components of each monitoring transect is presented in Figure 1. Each endpoint of the transects will be monumented with at least three 5-foot long pieces of one-half inch diameter "rebar" to provide redundancy for reestablishment of the monuments should there be losses due to erosion or vandalism. The location of these monuments will be established with survey-grade GPS equipment and will be tied to the NAVD 88 datum (vertical) and to the NAD 83 datum (horizontal). A consistent system of river miles (e.g., modified from the USBR atlas) and a coordinate system (e.g., state plane) should be agreed on prior to the establishment of the transects, and these systems should be used consistently throughout the 2000 Pilot Project and in any subsequent monitoring.

One shallow observation well was installed per transect. Wells consist of a hand-driven sand point on 2-inch galvanized pipe and will be driven to a depth of 3–5 m below the channel thalweg. Wells were located on higher elevation bars within the active river channel and approximately 7 m upstream (or downstream) from the centerline of each transect. At most sites,

the active river channel was defined as the area wetted by an approximately 2,000 cfs flow. Locations and elevations of the well(s) were tied to the transect monuments. Installing wells slightly outside of the transect was preferable, to prevent trampling of seedlings when the wells are measured.

News and-point wells, plus the 13 existing groundwater wells and piezometers should provide information on groundwater elevation that will lead to a better understanding of patterns of subsurface flow at the transects.

#### 4. Monitoring of Physical and Biological Response Variables

##### 4.1 Physical Response Variables

###### 4.1.1 Rationale

The purpose of monitoring physical response variables is to record channel geometry and flow conditions. In addition, these measurements quantify effects of variable flow releases below Friant Dam on physical parameters that may be important to the establishment of riparian vegetation. Because different life stages of riparian vegetation respond to the magnitude of flows at different times of the year, it is imperative that some physical data (e.g., stage, flow, groundwater level) be collected frequently. In this way, responses of riparian vegetation can be correlated to the timing and magnitude of flows or the absence of flow continuity.

###### 4.1.2 Methods

**4.1.2.1 Channel cross-section geometry.** A detailed survey of the channel should be performed between the end point monuments at all transects during the initial transect installation. This baseline survey should be supplemented with a second survey at the same location after high flows have ceased (midsummer, in coordination with the vegetation survey), to determine whether flows have modified channel geometry. The initial survey should be more intensive, including additional cross sections surveyed up to two to three channel widths upstream and downstream in order to create a fine-scale local topographic map of the sampling area. This will permit future extrapolation of vegetation data based on identifiable geomorphic features.

**4.1.2.2 Water surface elevation.** Water surface elevation should be determined relative to the surveyed transect end point monuments using a total station theodolite. These measurements should be made each month at all transect locations and supplemented with measurements provided by automated gages at Friant Dam and Gravelly Ford.

**4.1.2.3 Discharge.** Discharge measurements and water surface elevation measurements are necessary to develop stage-discharge relationships for each transect and loss curves for Reach 1 and Reach 2. Actual river discharge should be measured using standard USGS methods: measurements of water depth and flow velocity (evaluated using a flow meter) at intervals across the river channel. Obtaining these measurements will require a boat at high flow conditions but can be done by wading across the channel in low-flow conditions. All discharge measurements

will be tied to the local and vertical control (monuments) so that the water surface elevations can be used for hydraulic model calibration, and flow depths can be used to evaluate changes in channel geometry.

Discharge will be evaluated at three of the transect locations: between Friant Dam and Gravelly Ford, downstream from Gravelly Ford near RM 224, and at approximately RM 219. USBR gage data could potentially be substituted for discharge measurements at the most upstream location. Measurements will be made under a range of flow conditions: once at the peak pilot flow discharge, once during the receding limb, and once at maintenance flow conditions in late summer. Synoptic discharge measurements will be made at the different locations to provide data for refining loss curves. These measurements might require multiple crews during periods when river flow is changing rapidly, or a single crew over a period of one to two days during periods where releases from Friant Dam are stable. For practicality, the synoptic gaging will have to be conducted when the river is wadeable. Difference in discharge should be computed between each transect where flows are measured and in relation to flows recorded at permanent stream gages (Friant, Gravelly Ford, and below the Chowchilla Bypass).

**4.1.2.4 Shallow groundwater.** Riparian trees are dependent on subsurface moisture; therefore, depth to the groundwater during different seasons is an important component to understanding patterns of and limitations to vegetation establishment and survival. Elevation of the water table should be recorded monthly using the alluvial groundwater wells and the sand-point wells installed adjacent to each transect. Elevation of the water table should be simultaneously recorded at each of the existing wells drilled during 1999. These measurements will be taken monthly at a minimum. As soon as possible, pressure transducers will be installed in the alluvial wells and sand points so that water elevations can ultimately be continuously recorded.

**4.1.2.5 Nonintrusive remote stratigraphic measurements.** This component is optional but could provide potentially informative quantification of the presence and depth of sand and clay layers, as well as insight into patterns of subsurface flow. This information could be gained using shallow-reflection seismic surveys, resistivity surveys, or ground-penetrating radar surveys. Ideally, measurements made using one of these techniques should be taken at each of the transect locations including the transects where the existing wells are located. Existing well logs should be used to provide verification and calibration data for the remote methods. The Department of Geology at Fresno State University has the necessary equipment and expertise, and faculty and students of the department should be involved to make these measurements. Such surveys should optimally be conducted late in the season, when water in the river channel is at its lowest level or not present.

**4.1.2.6 Bed material composition.** Size of sediments within the riverbed should be evaluated one time either prior to augmented flows or after flows have ceased. A sample of bed material should be obtained from mid-channel in the middle of the closest riffle to each transect. Collecting material from within the same geomorphic feature is important so that temporal and spatial changes in bed material can be assessed. Additional bar material samples should also be collected at each of the transects where vegetation becomes established to determine the

gradations of the plant establishment substrates. Material from these samples should be separated into size classes using standard gradation analyses with screens of different sizes.

**4.1.2.7 Bedload mobility studies.** Reach 2 of the San Joaquin River is a mobile bed because of the large amount of loose sandy material. Amounts of scour and deposition need to be quantified to understand how the stage changes relative to discharge. To monitor these parameters, scour chains will be installed at existing transect locations that represent different types of geomorphic locations. These sites will be monitored on a regular basis following high flows.

**4.1.2.8 Maximum stage evaluations.** Maximum stage measurements are needed to calibrate the hydraulic and sediment model and to help determine the discharge relationships. To help obtain this information, crest stage gauges will be installed at existing transect locations. These gauges will be designed to record maximum flows and will be monitored on a regular basis following high flow periods.

## 4.2 Biological Response Variables

### 4.2.1 Rationale

Seedling establishment and seedling and sapling survival are the main biological variables that should be monitored. The purpose of monitoring seedlings and saplings is to quantify vegetation response to flow releases and other conditions affecting germination and survival. Information gained on vegetation establishment patterns in relation to physical and hydrological variables should provide insight into processes that limit riparian tree establishment and growth in this section of the San Joaquin River and should guide the adaptive management of flow releases for best restoring riparian tree species.

### 4.2.2 Methods

Belt transects centered on the transect should be used to sample woody vegetation establishment and survival (Figure 1). A tag line marked in 1 m increments should be placed across the permanent rebar transect endpoints. Using this tag line, a 5-m-wide belt (2.5 m on each side of the tag line) should be evaluated for presence of riparian tree seedlings and saplings. A 1- by 5-m rectangle created by stringing together two 1-m-long pieces of PVC pipe with an appropriate length of rope should be centered on the tag line and moved along this line from one end of the transect to the other at 1-m increments. If tree seedlings and saplings are encountered within the rectangle, their location should be recorded by distance along the transect (Figure 1). Vegetation in each band or patch along the transect should be scored using the following size/age classes:

1. current year germinants,
2. seedlings > 1 year but less than 2 m in height, and
3. saplings > 2 m in height.

Within each size/age class, presence or absence of the different riparian tree species will be noted. Cover of riparian tree species will be roughly estimated using the Daubenmire cover

classification system (1 = 0-5%, 2 = 5-25%, 3 = 25-50%, 4 = 50-75%, 5 = 75-95%, and 6 = 95-100%). The density of live stems of each species will be estimated based on the following scale:

- 0 = none present,
- 1 = <1 stem/m<sup>2</sup>,
- 2 = 1-5 stems/m<sup>2</sup>,
- 3 = 6-20 stems/m<sup>2</sup>,
- 4 = 21-100 stems/m<sup>2</sup>, and
- 5 = >100 stems/ m<sup>2</sup>.

Overall health of the seedlings, occurrence of significant mortality, and apparent cause of mortality (desiccation, herbivory, etc.) will also be noted.

Vegetation composition will be monitored two times in 2001. The first evaluation will occur in April when the permanent transects are installed. This evaluation will provide baseline data on vegetation present prior to the augmented flows. A second evaluation will occur in late July or early August (about 6 weeks after germination of seed at the higher water elevations), and a final evaluation will occur in late October or early November, at the end of the growing season but prior to leaf drop. The first or baseline evaluation is less critical than the second and third. This first evaluation will, however, provide important data on the presence, abundance, and species composition of seedlings already growing within the transect boundaries.

By re-sampling transects, riparian tree mortality would be represented by a loss or reduction in patch area and a reduction in stem density over time. Tree growth would be represented by a change in the size/age class of a patch over time. Mortality corresponding with a drop in the groundwater with no flood-related change in channel cross-sectional geometry would provide evidence for insufficient base flows (*Hypothesis 1, Scott et al. 2000*). The failure to record seedling establishment at or immediately below the stage of a gradually receding peak flow would provide evidence for insufficient seed availability (*Hypothesis 2, Scott et al. 2000*). Mortality following a flood-related change in channel cross-sectional geometry would provide evidence for removal by scouring (*Hypothesis 3, Scott et al. 2000*). The failure to record seedling establishment at or immediately below the stage of a rapidly receding peak flow, occurring within the seed dispersal period, would provide evidence for desiccation mortality resulting from a rapidly declining recession limb (*Hypothesis 4, Scott et al. 2000*).

**4.2.3 Low-level aerial photography.** To gain a broader perspective of vegetation establishment patterns outside of the transect locations, low-level color infrared photographs at a scale of approximately 1:10,000 should be flown annually at the end of summer. Vegetation can be identified on the color infrared aerial photographs. The vegetation data derived from the photographs should facilitate analysis of the hydraulic impact of the vegetation (see Section 5 below). If infrared photographs cannot provide the necessary resolution, the river channel between Gravelly Ford and the backwaters of Mendota Pool should be walked in late October or early November, noting the general area covered by riparian tree seedlings on all sandbars. This information will be drawn on copies of 1999 aerial photographs of the river channel.

## 5. Modeling Effects of Established Vegetation on Future Flood Conveyance

### 5.1 Rationale

Restoring vegetation in the San Joaquin River channel could potentially impact hydraulic roughness and flood conveyance capacity if trees become established over large areas. Under this task, future roughness values that would result from the seedlings established in 1999 and 200 will be estimated. The purpose of including estimates of increased channel roughness in hydrological models is to determine how seedlings established by the pilot flows in 2000 might potentially impact channel flow capacity and levee stability.

### 5.2 Methods

A map of position and abundance of newly germinated riparian tree vegetation relative to measured cross sections will be created in the fall of 2000. Using similar methods as developed for the Mussetter and Jones & Stokes (2000) report on evaluating roughness effects of increased vegetation associated with the 1999 Pilot Project flow releases, roughness projections will be developed for vegetated polygons in Reach 2 between Gravelly Ford and Mendota Pool. Three roughness projections will be based on predicted vegetation size and extent in 2002, 2010, and 2020. Growth projections developed for Goodding's black willow in Mussetter and Jones & Stokes (2000) will be used.

If vegetation is established across a range of channel elevations within a cross section, mortality projections will be developed that include the expectation of increased mortality due to channel scour in future high flows at lower channel elevations. The hydraulic roughness effects of the projected increase in vegetation associated with the 2001 Pilot Project flow releases will then be incorporated into the baseline conditions model by modifying the channel roughness in the new vegetation zones but keeping all other model parameters the same. Differences in model results for each vegetation age-class scenario from the baseline conditions model will represent the effects of the new vegetation.

## 6. Monitoring Coordination and Data Distribution

### 6.1 Rationale

Interests of stakeholders would be best met if all monitoring data and analyses are made available in a timely and efficient manner. Rapid availability of monitoring results will allow informed management decisions, including decisions about flow releases and about monitoring activities. For example, information about seed release could help guide the timing of releases aimed at seed dispersal. If unforeseen circumstances arise that necessitate adjustments of the monitoring procedure, effective communication of those circumstances and monitoring results would making those adjustments easier. To maximize the benefit of the data collection and avoid negative consequences of unforeseen circumstances, a data coordinator should be assigned. In addition, multiple individuals and groups may be collecting data, and coordination of the monitoring activities should ensure that data collection methods are consistent.

## 6.2 Methods

Coordination of data collection and distribution involves two components: coordination of monitoring activities, and data entry and distribution. The data coordinator should be responsible for coordination and distribution of the data. Two recommended tools for the distribution of data and analysis results are e-mail and an internet site where files can be retrieved through file transfer protocol (ftp) using a browser (e.g., Netscape or Internet Explorer) or other software. The internet site could be password protected to ensure the confidentiality of the data. The distribution lists for raw data, summaries and internet passwords should be approved by the SJRRHRP program manager.

### 6.2.1 Coordination of Monitoring Activities

A schedule should be designed prior to the start of monitoring that includes the timing of all monitoring activities. This schedule should be available to all interested parties. It should be the responsibility of the data coordinator to make the schedule available through e-mail and the internet site. As monitoring crews or individuals need to modify the monitoring schedule, they should notify the data coordinator, who will then update the schedule. Availability of the schedule to all interested parties will ensure that all parties are aware when data will be collected and allow adjustment to the schedule or monitoring activities.

### 6.2.2 Data Entry and Distribution

Prior to the onset of monitoring, data sheets should be designed for use in the field. These data sheets should be reviewed by experts involved in the Pilot Program. The data coordinator should make the data sheets (Excel spreadsheets) available in electronic form via email and on the internet site.

As soon as possible after collection, data should be submitted to the data coordinator either in electronic form or by fax. The data coordinator should be responsible for the entry of data that was received by fax and should review all data to ensure completeness and proper formats. The data should then be summarized using simple spreadsheet operations. A brief report summarizing the quantitative results (including summary tables and graphs) should be made available to all appropriate parties via email. If necessary to accommodate software or hardware limitations of the recipient, the data coordinator should fax data summaries to appropriate parties. The raw data and summaries should be posted on the internet site as soon as they are available, and periodic updates on the status of data collection and data entry should be sent to all appropriate parties.

## 7. Data Analysis and Reporting

### 7.1 Rationale

An important purpose of collecting monitoring data for the 2000 Pilot Project is to learn how augmented flows from Friant Dam can most effectively be used to restore riparian vegetation along the San Joaquin River. Careful analysis is required to draw scientifically defensible conclusions from the monitoring data. This analysis should employ rigorous statistical tools and should be informed by a thorough understanding of the current status of the ecology of riparian vegetation.

The monitoring results need to be reported to the agency that provides funding to the project. In addition, the results of the monitoring should be reported to a broader audience of scientists and the public. Publication of scientifically defensible conclusions would greatly benefit the pilot projects. Publication in a respected, peer-reviewed scientific journal will lend scientific credibility to the project and may aid to reduce public controversy. Other riparian vegetation restoration efforts would also benefit from the publication of the monitoring results. Publication of scientifically defensible conclusions from the pilot program to a broad public audience would also greatly benefit the program.

### 7.2 Methods

The specific variables to be compared in the analyses and the statistical test to be used should be determined prior to monitoring. The monitoring data should be periodically reviewed by a riparian ecologist, a hydrologist, and a geomorphologist, to ensure that the data is being collected according to expectations. After the seedling survey in November, all data should be transmitted to a team responsible for analysis and publication of the monitoring results. This team should conduct an analysis of the data as quickly as feasible and report the results to all appropriate parties. Data analysis and interpretation should be coordinated with the technical representatives of the FWUA and NRDC and by the SJRRHRP management team.

Analysis results, interpretation, and conclusions should be incorporated into a report to the funding agency. A manuscript should be prepared and submitted to a peer-reviewed scientific journal. Prior to submission, any manuscripts should be reviewed by the stakeholders and the SJRRHRP management team. Simultaneously, analysis results and their interpretation should be provided to stakeholder representatives for release to the public.

## 8. References

Jones & Stokes Associates, Inc. 1998. Historical riparian habitat conditions of the San Joaquin River—Friant Dam to the Merced River. April. (JSA 97-302.) Sacramento, CA. Prepared for U.S. Bureau of Reclamation, Fresno, CA.

Mussetter Engineering and Jones & Stokes. 2000. Assessment of potential future vegetation conditions on the San Joaquin River resulting from pilot flows in 1999.

- Scott, M.L., G. T. Auble, and P. B. Shafroth. 2000. Evaluating effectiveness of flow releases for restoration of riparian vegetation on the San Joaquin River. Prepared by the United States Geological Survey, Midcontinent Ecological Science Center, Ft. Collins, CO. February. 10 pages.
- Scott, M.L., P.B. Shafroth, and G.T. Auble. 1999. Responses of riparian cottonwoods to alluvial water table declines. *Environmental Management* 23:347-358.
- Shafroth, P.B., J.C. Stromberg, and D. T. Patten. 2000. Woody riparian vegetation response to different alluvial water table regimes. *Western North American Naturalist* 60:66-76.
- Wolfe. MH. 1999. Unpublished report on 1999 seed release monitoring on the San Joaquin River Completed for the Friant Water Users Authority. Lindsay, CA.