Summary Information

Turlock Irrigation District

Tuolumne River Restoration Monitoring

Amount sought: $2,430,400

Duration: 36 months

Lead investigator: Mr. Wilton Fryer, Turlock Irrigation District

Short Description

This project proposes monitoring that includes extension and, in some cases, augmentation, of project−specific effectiveness monitoring for four restoration projects on the Tuolumne River. We also propose to extend long−term, river−wide, biological trend monitoring needed to interpret project−specific monitoring results within tributary− and population−level contexts. Monitoring components include channel morphology, sediment transport, riparian vegetation, salmonid distribution and abundance, and salmonid habitat. Projects for which monitoring is proposed are: (1) Gravel Mining Reach Restoration (7/11 reach and M.J. Ruddy reach), (2) Special Run Pool 9 Restoration, (3) Fine Sediment Management, and (4) Coarse Sediment Management (Phases I through III, including coarse sediment augmentation at the Friends of the Tuolumne Bobcat Flat site).

Executive Summary

Considerable restoration has been accomplished on the lower Tuolumne River over the last eight years, largely due to the leadership and support of the Tuolumne River Technical Advisory Committee, the Lower Tuolumne River Corridor Habitat Restoration Plan, and generous funding from CALFED Bay−Delta and AFRP programs. Funding for restoration project has provided for initial monitoring of project effectiveness and some adaptive management experiments; however, as many of these projects have recently been constructed (or will be constructed by 2006), a longer−term monitoring effort is required. This proposal requests funding to expand and extend monitoring on implemented projects that have been funded by CALFED or the AFRP since 1997.

Proposed monitoring includes extension and, in some cases, augmentation, of project−specific effectiveness monitoring for four restoration projects on the Tuolumne River. We also propose to extend long−term, river−wide, biological trend monitoring needed

to interpret project−specific monitoring results within tributary− and population−level contexts. The goal of the proposed monitoring is to ensure that adequate project−specific and river−wide data are gathered to: (1) assess the effectiveness of restoration projects that have been constructed or are near construction in the Tuolumne River across a range of spatial scales (from site−specific to river−wide); (2) evaluate ecosystem cumulative response to numerous restoration projects; (3) evaluate active adaptive management experiments associated with the restoration projects, and (4) provide monitoring data that are comparable to data from similar projects in other watersheds (such as the Merced River and Clear Creek). Monitoring components include channel morphology, sediment transport, riparian vegetation, salmonid distribution and abundance, and salmonid habitat.

Projects for which monitoring is proposed are: (1) Gravel Mining Reach Restoration (7/11 reach and M.J. Ruddy reach), (2) Special Run Pool 9 Restoration, (3) Fine Sediment Management, and (4) Coarse Sediment Management (Phases I through III, including coarse sediment augmentation at the Friends of the Tuolumne Bobcat Flat site). All proposed monitoring is for projects that are implemented or that are scheduled for implementation by 2006. Proposed monitoring would also extend existing river−wide trend monitoring of salmonid abundance, distribution, and life history timing that in the past was funded by the New Don Pedro Project FERC Settlement Agreement (FSA) and the California Department of Fish and Game (CDFG). Monitoring would extend from La Grange Dam (RM 52) to the mouth of the Tuolumne River (RM 0), and also include two seining locations in the San Joaquin River near the mouth of the Tuolumne River.

Monitoring would be implemented by CDFG and contractors to TID, with input from the Tuolumne River Technical Advisory Committee (TRTAC) and TRTAC Monitoring Subcommittee. These parties have worked together for many years on these projects and have implemented most of the past monitoring included in this proposal.

Proposed monitoring would specifically address the following ERP Implementation Plan priorities: (SJ−1) continue habitat restoration actions including channel−floodplain reconstruction projects and habitat restoration studies in collaboration with local groups, (SJ−2) restore geomorphic processes in stream and riparian corridors, (SJ−3) improve rearing and spawning habitat and downstream fish passage on tributary streams and the mainstem San Joaquin River, and (SJ−6) conduct adaptive management experiments in regard to natural and modified flow regimes to promote ecosystem functions or otherwise support restoration actions; CVPIA/AFRP Priorities: (1) improve watershed management and restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel and performing an integrated evaluation of biological and geomorphic processes (priority: high), (2) evaluate and implement actions to reduce predation on juvenile Chinook salmon, including actions to isolate ponded sections of the river (priority: medium); and Multi−Species Conservation Strategy “Big R” species: Central

Valley steelhead ESU, Central Valley fall−/late−fall Chinook salmon SU, Valley Elderberry longhorn beetle (as related to riparian vegetation recruitment).

A. PROJECT DESCRIPTION:

A.1. PROBLEM, GOALS, AND OBJECTIVES

1a. Problem Statement

The Tuolumne River, the largest of the three major tributaries to the San Joaquin River, drains a 1,960-square-mile watershed on the western slope of the Sierra Nevada Range (Figure 1). The lower Tuolumne River corridor, which extends 52.2 miles from La Grange Dam to the San Joaquin River, has been extensively altered by flow regulation and diversion, instream and floodplain gold dredging, instream and floodplain aggregate mining, and agricultural and urban development. These alterations have reduced habitat quantity and quality for native salmonids (Chinook salmon [*Oncorhynchus tschawytscha*] and rainbow trout/steelhead [*O. mykiss*]) and contributed to declines in their populations.

Since 1971, the Turlock and Modesto Irrigation Districts (the Districts), in cooperation with the California Department of Fish and Game (CDFG) and the U.S. Fish and Wildlife Service (USFWS), have conducted extensive studies of Chinook salmon population dynamics and habitat in the lower Tuolumne River. In 1995, through the FERC license amendment process for the Don Pedro Project, the Districts and the City and County of San Francisco (CCSF) entered into a FERC Settlement Agreement (FSA) with the USFWS, CDFG, and several environmental groups. The FSA revised minimum flow requirements for the Tuolumne River downstream of the Don Pedro Project and set forth a strategy for recovery of the lower Tuolumne River Chinook salmon population. Using adaptive management, the FSA goals are to: (1) increase the abundance of wild Chinook salmon in the Tuolumne River, (2) protect remaining genetic characteristics unique to the Tuolumne River Chinook salmon population, and (3) improve salmon habitat in the Tuolumne River.

While Chinook salmon have been the subject of many years of study in the Tuolumne River, rainbow trout/steelhead have received much less attention (though they have been recorded as incidental species in seining and snorkel surveys). With the 1998 listing of the Central Valley steelhead ESU as threatened under the federal Endangered Species Act, fisheries agencies have increased their focus on this species in the Tuolumne River. With input from the TRTAC Monitoring Subcommittee, the TRTAC recently expanded their monitoring of *O. mykiss* distribution in the river. The TRTAC also revised its Coarse Sediment Management Plan (McBain and Trush 2004) to more specifically address *O. mykiss* protection and habitat needs. (Because it is not possible to determine whether a juvenile of this species will mature into a resident rainbow trout or an anadromous steelhead, both life history strategies are collectively referred to as "*O. mykiss*" in this proposal.)

To achieve the FSA and broader restoration goals, the Tuolumne River Technical Advisory Committee (TRTAC) developed a comprehensive, process-based *Habitat Restoration Plan for the Lower Tuolumne River Corridor* (McBain and Trush 2000) that integrates fluvial geomorphic processes as a foundation for overall ecosystem recovery to support salmonid populations. Several high priority projects identified in the Restoration Plan are being implemented with funding from the California Bay-Delta Authority (CBDA), Anadromous Fish Restoration Program (AFRP), the CDWR Delta Fish Protection Agreement, and other sources. These projects span the 25 miles of gravel-bedded river, and are being constructed at a cost of tens of millions of dollars. With their sheer size and cost, these projects require thoughtful design, experimentation, and adaptive management to maximize their benefits both to the river and to restoration science.

The long-term biological research and monitoring data available for this river, combined with the geomorphic studies conducted for the Restoration Plan, provide a solid foundation for hypothesis development, adaptive management, and learning. Effective adaptive management, however, requires long-term monitoring designs that have the capacity to detect change and identify causal linkages in a highly variable environment. The Adaptive Management Forum, in their review of Tuolumne

River restoration projects, emphasized the need for long-term monitoring, as well as for integration of monitoring across spatial scales (i.e., from site-specific to river-wide) (AMF 2001). Tuolumne River project proponents have attempted to develop and implement comprehensive, hypothesis-driven monitoring plans for each restoration project, and initial monitoring has been conducted for several projects for which construction is complete. Short-duration funding cycles for the restoration grants, however, limit the duration of post-construction project monitoring to as little as one year. This short duration of monitoring is usually sufficient to document pre-project conditions and make some initial post-project evaluations. The need to have more experimental elements in the remaining designs will require longer term funding for monitoring to continue well after the projects are constructed. Moreover, interpretation of restoration effects across spatial scales requires monitoring across spatial scales. In the past, site-specific project monitoring has been included in restoration grants (usually funded by CBDA, AFRP, or the CDWR Delta Fish Protection Agreement), while river-wide monitoring was funded by Districts and CCSF (through the FSA) and CDFG. With the expiration of the FSA in 2005, these river-wide monitoring funds have been fully expended and are no longer available. Also, CDFG funding for surveys that they have traditionally conducted (carcass surveys, redd counts, and screw trap monitoring) apparently may not be available in 2005 or thereafter.

This proposal seeks to support adaptive management of the lower Tuolumne River Restoration Program and of these restoration projects by: (1) extending existing site-specific project monitoring for constructed projects and projects near construction; (2) augmenting existing monitoring to include additional metrics; and (3) continuing funding for long-term river-wide monitoring that previously was supported by other sources.

1b. Funded Restoration Projects Included in This Proposal

Projects for which monitoring is included in this proposal are: (1) Gravel Mining Reach Restoration (Phases I and II), (2) Special Run Pool 9 and 10 Restoration, (3) Fine Sediment Management, and (4) Coarse Sediment Management (Phases I through III) (including coarse sediment augmentation at the Friends of the Tuolumne [FOT] Bobcat Flat site). The locations of these projects are shown in Figure 2. Funding and implementation status for each project is provided in Tables 1 through 4. These projects are described in more detail below.

One additional proposal is being submitted to the CBDA ERP program (in this funding round) and another is being prepared for submittal to the CBDA Science Program in January 2005 that complements this proposal. Friends of the Tuolumne is submitting a separate proposal for post-project monitoring at the Bobcat Flat and Grayson River Ranch restoration sites. Monitoring proposed by FOT at these sites will supplement tasks presented in this proposal. FOT and TID will coordinate monitoring implementation and will share data to ensure that monitoring is efficient and that data gathered at all project sites are compatible. Stillwater Sciences and Turlock Irrigation District are preparing a separate proposal for submittal to the CBDA Science Program to study river-wide predator ecology related to the SRPs 9 and 10 projects and potential future channel reconstruction projects. Linkages to these separate proposals are identified in the following sections.

Gravel Mining Reach Restoration Project: The Gravel Mining Reach Restoration Project extends from RM 40.3 (near Roberts Ferry Bridge) to RM 34.4 (the Reed gravel operation) (Figure 2). Due to its length, the project is being implemented in four phases: the 7-11 Reach (RM 37.7 to 40.3), M.J. Ruddy Reach (RM 36.6 to 37.7), Warner-Deardorff Reach (RM 35.2 to 36.6), and Reed Reach (RM 34.3 to 35.2) (Figure 3). The project will reconstruct an appropriately scaled channel and floodplain through a reach that is currently heavily impacted by in-channel and floodplain aggregate mining. Project objectives are to:

- restore floodway width to convey floods of at least 15,000 cfs;
- improve salmonid spawning and rearing habitat by restoring an alternate bar (pool-riffle) morphology within a meandering channel;
- reduce salmon mortality and geomorphic impacts that occur when berms separating floodplain mining pits from the river breach;
- restore native riparian communities on appropriate geomorphic surfaces within the restored floodway; and
- decrease risk of flood damage to aggregate extraction operations, bridges, and other human structures.

Phase I, the 7/11 Reach, was completed in 2003. Phase II, the M.J. Ruddy Reach, will begin construction in 2005. The conceptual design for Phase I is shown in Figure 4. Pre- and post-construction aerial photographs of the 7/11 Reach are shown in Figure 5. Additional detail for the Gravel Mining Reach Project is provided in *Tuolumne River Floodway Restoration: Project Design Approach and Rationale* (McBain and Trush 2004).

Special Run Pools 9 and 10 Restoration Project: Special Run Pools (SRPs) 9 and10 extend from RM 25.9 to RM 25.0 (Figure 2). The SRP 9 and 10 pits, which were created by in-channel aggregate mining in the 1930s through the 1970s, are up to 400 feet wide and 36 feet deep,. Past studies of Chinook salmon population dynamics and outmigrant survival concluded that predation by non-native predatory bass species in these and other SRP reaches is a significant factor limiting Chinook salmon production in this river, particularly during drier years (TID/MID Engineering 1992). Project objectives are to:

- reduce/eliminate habitat favored by predatory bass species and replace it with riverine habitat suitable for Chinook salmon;
- construct a channel and floodplain that is scaled to contemporary and future sediment and flow regimes;
- restore sediment transport continuity through the reach; and
- revegetate reconstructed floodplains with native woody riparian species.

Conceptual designs for both phases are shown in Figure 6. The SRP 9 project was completed in 2002. Pre- and post-construction aerial photographs of the SRP 9 are shown in Figure 7. Immediately prior to construction, budget constraints required substantial modification of the project design. To reduce the volume of fill needed for construction, the elevation of the constructed floodplain at SRP 9 was lowered by 1 to 2 feet, resulting in a design bankfull channel capacity of 1,500 cfs (compared to the initial bankfull design capacity of 5,000 cfs). This modification is expected to increase benefits to juvenile Chinook salmon by increasing the duration of access to productive floodplain rearing areas from January through June from an average of 18 days/year for the 5,000 cfs floodplain to 59 days for the 1,500 cfs floodplain and may shift riparian vegetation species composition toward species that are more tolerant of prolonged inundation. Additional detail for the SRPs 9 and 10 projects, including modifications to the SRP 9 project design, are provided in *Tuolumne River Floodway Restoration: Project Design Approach and Rationale* (McBain and Trush 2004).

Coarse Sediment Augmentation Projects: The Tuolumne River Coarse Sediment Management Plan (CSMP) was completed in July 2004 (McBain and Trush 2004). The CSMP recommends adding more than 500,000 yd^3 of coarse sediment to the river at 29 locations extending from RM 51.5 (near La Grange) to the upstream end of the 7/11 Project (Roberts Ferry Bridge, RM 39.5). Several methods for placing coarse sediment in the river are included in the conceptual designs for augmentation projects,

and the CSMP outlines adaptive management experiments that in should be conducted to compare the costs, effects, and efficacy of each approach in meeting project objectives. Objectives are to:

- restore coarse sediment supply to the gravel-bedded reach downstream of La Grange Dam in a manner that protects existing habitat values for both salmon and *O. mykiss*;
- create immediately usable spawning habitat for both Chinook salmon and *O. mykiss* to supplement existing degraded habitat and/or create new habitat where none currently exists*; and*
- restore coarse sediment routing, reduce bed mobility thresholds, and initiate formation of active alluvial bars and riffles.

Coarse sediment augmentation projects are being implemented by CDFG (at several sites near La Grange), FOT (at Bobcat Flat [RM 43]), and TID (from La Grange Dam to Roberts Ferry Bridge). Augmentation locations are shown in Figure 2. From 1999 through 2003, CDFG added more than 20,000yd^3 of coarse sediment at several sites near La Grange. In 2005, FOT and TID will place up to 15,000 yd^3 of coarse sediment at the Bobcat Flat site (RM 43). In 2006, TID expects to begin implementing the Tuolumne River Sediment Transfusion Project (Phase III of the CSMP), which will add at least 140,000 yd^3 of coarse sediment to the river. The Tuolumne River Sediment Transfusion Project has been funded by the CBDA and is currently under amendment review for a change in scope regarding the source of aggregate for the project.

Fine Sediment Management: The Tuolumne River Fine Sediment Management Plan includes four major components: (1) identifying fine sediment sources to the Tuolumne River, (2) reducing sediment supply to the river from Gasburg Creek, (3) conducting field experiments to evaluate the relationship between Chinook salmon survival-to-emergence and substrate permeability, and (4) experimental riffle cleaning project (planned for summer 2005). Stillwater Sciences has completed the sediment source analysis (Stillwater Sciences 2004). Work on Gasburg Creek will include expansion of an existing wetland to function as an interim sedimentation basin and restoration of the creek channel and floodway where it currently flows through a recently abandoned sand mine. Work is expected to begin in 2005. Riffle cleaning is also expected to be implemented in 2005. Fine sediment management objectives are to:

- Reduce fine sediment and sand yield from Gasburg Creek to the mainstem Tuolumne River;
- Increase salmonid survival-to emergence in the mainstem river.
- Reduce the volume of sand currently stored in the Tuolumne River channel bed and thus increase salmonid survival-to emergence; and
- Quantify the relationship between substrate permeability and Chinook salmon survival-to-emergence.

1c. Goals and Objectives

The overarching goal of the TRTAC restoration program is to re-establish fluvial geomorphic functions, processes, and characteristics within contemporary flow and sediment conditions and, thus, promote the recovery and maintenance of a resilient, wild Chinook salmon population and native plant and animal communities. Because flow regulation will continue into the future, this goal targets a scaled-down version of the former river, but one in which dynamic fluvial processes (sediment transport and scour, floodplain inundation, channel migration) maintain the habitat characteristics favored by salmonids and other native fish and wildlife. Several projects identified in the restoration plan are in various stages of implementation. These projects and the objectives of each are described in Section 1b. Due to short funding cycles, monitoring funds for many of these projects extend only one to two years following construction, which is not adequate to assess project effectiveness. Moreover, river-wide monitoring,

which provides a longer-term and larger spatial context for interpreting site-specific monitoring results, is no longer funded. (In the past, this monitoring has been funded by the FSA and CDFG.)

The goal of this proposal is to ensure that adequate project-specific and river-wide monitoring is in place to: (1) assess the effectiveness of restoration projects that have been constructed or are near construction in the Tuolumne River across a range of spatial scales (from site-specific to river-wide); (2) evaluate ecosystem cumulative response to numerous restoration projects; and (3) provide monitoring data that is comparable to data from similar projects in other watersheds (such as the Merced River and Clear Creek). Proposal objectives are to:

- Extend existing post-project monitoring at constructed sites for three years;
- Augment monitoring for funded projects to collect additional baseline and post-project data needed to evaluate project effectiveness;
- Extend existing river-wide monitoring of Chinook salmon and *O. mykiss* populations.

A.2 JUSTIFICATION

2a. Conceptual Models

The Habitat Restoration Plan for the Lower Tuolumne River (McBain and Trush 2000) identifies 10 "Attributes of Alluvial River Integrity." The *Attributes* are: (1) spatially complex channel morphology; (2) variable yet predictable streamflow patterns; (3) frequently mobilized channel bed surface; (4) periodic channel scour and fill; (5) fine and course sediment supply in balance with long-term transport rates; (6) periodic channel migration and/or avulsion; (7) a functional floodplain; (8) infrequent channel resetting floods; (9) self-sustaining, diverse riparian corridor; and (10) naturally fluctuating groundwater table. Based on the *Attributes* and our current understanding of alluvial rivers, one can describe the linkages between **physical inputs** (e.g., sunlight, streamflow, sediment), **physical processes** (e.g., sediment transport, bank erosion, fine sediment deposition), **habitat structure** (e.g., shallow-gradient riffles, well-sorted and clean spawning gravels) and **biological responses** (e.g., healthy incubation, low density-dependent mortality) (Figure 8). These *Attributes* and the simple conceptual model shon in Figure 8 are the foundation of the conceptual models described below.

In June 2001, the UC Davis Center for the Environment and AFRP sponsored an Adaptive Management Forum to review the science behind the large-scale restoration projects on the Tuolumne River. The TRTAC Monitoring Subcommittee, with assistance and peer review by panel members from the Adaptive Management Forum, developed several interconnected conceptual models depicting our current understanding of (1) the effects of flow regulation and mining on geomorphic processes, habitat structure, and salmonid abundance in the river, (2) the river's Chinook salmon population dynamics, and (3) effects individual restoration actions on geomorphic processes, habitat structure, and salmonid abundance These conceptual models are presented in the report *AFRP / CALFED Adaptive Management Forum: Tuolumne River Restoration Summary Report* (Stillwater Sciences 2001). Models relevant to this proposal are described below.

Model G-1. Effects of dams and mining on geomorphic inputs and processes, habitat structure, and population response (Figure 9). This model illustrates linkages between physical inputs, geomorphic processes, habitat structure, and salmonid abundance and the effects of dams and mining on these linkages. In this model, dams alter seasonal flow patterns in the lower river, reduce peak flow magnitude, reduce fine sediment supply, and eliminate coarse sediment supply. Aggregate mining and gold dredging further reduce coarse sediment supply to the river by removing stored sediment from the channel and floodplain and by trapping coarse sediment that is in transport. These reductions in flow and sediment supply reduce sediment transport, channel migration and avulsion, recruitment of large wood, and floodplain inundation and result in channel incision, bed armoring, channel narrowing

(through riparian vegetation encroachment), and abandonment of pre-dam floodplains. In-channel mining also creates large, lake-like pits in the river channel. These alterations reduce habitat quality for salmonid spawning, incubation, rearing, and outmigration. In addition, reductions in flow magnitude and alteration of seasonal flow patterns potentially affect salmonid run timing and emigration timing, as well as incubation, rearing, and outmigrant survival.

Model G-2. Fine sediment supply and storage in the Tuolumne River and effects in Chinook salmon survival (Figure 10). This model illustrates sources and storage of fine sediment in the Tuolumne River and the effects of fine sediment on Chinook salmon survival. In this model, fine sediment is supplied to the spawning reach primarily by Gasburg Creek and erosion from the New Don Pedro Dam spillway that occurred during the 1997 flood. Average annual yield of fine sediment (< 2mm) from Gasburg Creek to the river is estimated to be 1,440 t/yr (Stillwater Sciences 2004). Gasburg Creek is the first significant tributary to the mainstem Tuolumne River below La Grange Dam, but several smaller tributaries also contribute fine sediment to the river. Based on reconnaissance-level field surveys, Stillwater Sciences (2004) concluded that Mill Gulch, Indian Hill Gulch, Gauging Station Gulch, and Morgan Gulch, combined with failure and erosion of canal embankments, contribute about the same amount of fine sediment to the Tuolumne River as Gasburg Creek. More study of these basins is required to compare their absolute or relative fine sediment yield to the river. Fine sediment yield from Lower Dominici Creek, which in the past was considered to be a potentially significant source of fine sediment to the river, appears to be minor (McBain and Trush 2004). Combined with reduced sediment transport capacity caused by flow regulation, this increase in fine sediment supply has resulted in increased storage of fine sediment in riffles and possibly in pools. The sand stored in pools can be mobilized during high flows, thus increasing supply. The increase in the volume of sand stored in riffles results in reduced permeability in spawning substrates and a concomitant reduction in salmon survival-to-emergence.

Model S-1. Factors affecting Chinook salmon population abundance in the Tuolumne River (Figure 11). This conceptual model depicts the factors affecting each Chinook salmon life history stage, within and outside of the Tuolumne River basin. Within the basin, research and monitoring have identified three primary factors that limit Chinook salmon population abundance: (1) redd superimposition; (2) low survival-to-emergence resulting from low substrate permeability; and (3) low outmigrant survival resulting from spring flow conditions, predation by largemouth bass, and water temperature. Other factors could also affect Chinook salmon population abundance, but these are not considered to be limiting. Of the limiting factors identified, redd superimposition is the only density-dependent mortality factor. The superimposition model developed by Stillwater Sciences from field studies on the Tuolumne River supports the hypothesis that superimposition and delayed fry emergence is a key factor driving the stock-recruitment curves developed from empirical observations in the Tuolumne River (TID/MID 1997, Report 96-6). Numerous factors outside the Tuolumne River watershed also affect the numbers of Chinook salmon returning to the Tuolumne to spawn. Such factors include (but are not limited to) Delta exports, ocean harvest, ocean conditions, and predation and water quality in the Delta.

Model P-1. Effects of the Special Run-Pools (SRPs) 9 and 10 Projects on geomorphic process, riparian vegetation, and Chinook salmon survival (Figure 12). Past studies of Tuolumne River Chinook salmon population dynamics identified predation by largemouth bass as a major factor limiting outmigrant survival (and thus recruitment) in the Tuolumne River, particularly during drier years (TID/MID 1992). Largemouth bass prefer deep, low velocity, warm-water habitats with abundant cover. In this model, replacing the large, deep SRP pit with a shallower, narrower channel reduces habitat suitability for adult largemouth bass and, thus, reduces adult bass carrying capacity (and adult bass abundance) and predation pressure on outmigrating salmon at the site. During high flows (>1,400 cfs), reconstructed

floodplains provide rearing areas and outmigration routes that are reduce juvenile salmon interactions with adult largemouth bass. The reconstructed floodplain also provides a surface for colonization by riparian vegetation. (Note that the project also includes initial planting and maintenance of riparian vegetation.)

Model P-2. Effects of the Gravel Mining Reach Project on geomorphic processes, riparian vegetation, and Chinook salmon survival (Figure 13). In this model, reconstructing a channel and floodplain that are scaled to contemporary flow conditions, combined with planting native riparian vegetation on the reconstructed floodplain and maintaining coarse sediment supply, improves in-channel and floodplain geomorphic and riparian processes and improves Chinook salmon spawning and rearing habitat. Constructing an appropriately scaled channel and maintaining coarse sediment supply balances sediment transport capacity with sediment supply, thus providing a channel and floodplain that functions under contemporary, regulated flow conditions. By providing conditions that allow the channel to construct bars and riffles, the project improves salmon spawning, incubation, and rearing habitats. In addition, by reducing floodplain elevation, increasing floodplain width, and creating high flow channels on the floodplain, the project reduces flow velocities during floods and provides refugia for rearing salmon.

Model P-3. Effects of flow and coarse sediment management on aquatic and riparian habitat (Figure 14). This model depicts the anticipated effects of flow management and gravel augmentation on in-channel, floodplain, and riparian habitats and on Chinook salmon survival. In this model, increased spring high flows recharge shallow groundwater tables, deposit sand and fine sediment on floodplains, and scour and deposit coarse sediment in the channel. At the same time, adding gravel to the spawning reach increases coarse sediment supply. The combined effects of increased flow and increased sediment supply include prevention of riparian vegetation encroachment into the active channel, reconnection of floodplains to the channel, reinitiation of riparian vegetation recruitment and successional processes, and creation of active alluvial bars and riffles. In addition, increased spring flows reduce water temperature and, under some conditions, could increase salmon outmigrant survival. Increased spawning habitat area reduces redd superimposition, and reduced storage of sand and fine sediment in the channel bed improves incubation conditions. Both of these factors increase salmon survival-to-emergence.

Model P-4. Effects of fine sediment management on substrate conditions and Chinook salmon survival (Figure 15). This model depicts the anticipated effects of the fine sediment management project on spawning substrate conditions and salmon survival-to-emergence. The Gasburg Creek restoration project reduces fine sediment supply to the Tuolumne River by: (1) enlarging an existing wetland to function as an interim sedimentation basin to capture sediment delivered from the upper Gasburg Creek watershed, and (2) implementing watershed management actions to reduce fine sediment supply. Downstream of the At the same time, riffle cleaning reduces sand and fine sediment storage in riffles. Potential methods of riffle cleaning were evaluated from existing data and literature and are reported in McBain and Trush (2004). By reducing sand and fine sediment storage in riffles, riffle cleaning increases spawning substrate permeability, thus increasing salmon survival-to-emergence. Increased permeability is maintained by reducing sand supply to the spawning reach from Gasburg Creek and other tributary sources.

A.3 PREVIOUSLY FUNDED MONITORING

The Habitat Restoration Plan for the Tuolumne River Corridor (McBain and Trush 2000) recommends a two-tiered monitoring strategy for the river: (1) project-specific monitoring to assess the effectiveness of individual restoration projects in meeting specific objectives, and (2) river-wide monitoring that addresses overall goals of the Restoration Plan, as well as the cumulative effects of the individual restoration projects.

Project-specific Monitoring

Project-specific monitoring has been developed and partially implemented for the Gravel Mining Reach, SRPs 9 and 10, Coarse Sediment Augmentation (including augmentation at Bobcat Flat and CDFG projects at La Grange), and Fine Sediment Management. Monitoring hypotheses, metrics, and methods are described in Table 5. Monitoring funding and implementation status for each project is shown in Tables 1 through 4.

River-wide Monitoring

In the past, long-term river-wide monitoring of Chinook salmon population trends in the Tuolumne River was funded by the FSA and CDFG. The FSA allocated and expended $1,335,000 for salmonid monitoring in the Tuolumne River. The FSA program included trend monitoring of adult Chinook salmon escapement, distribution, and timing; spawning and incubation habitat quality (with regard to substrate composition); fry and juvenile abundance, distribution, and stranding; outmigrant survival, abundance, and timing, and water temperature and quality. The FSA will expire in 2005, and its funds are now fully expended. No additional monitoring funds are available through this program.

Funds for these river-wide monitoring programs are no longer available through the FSA. Over the past several years (or decades in some cases), CDFG has conducted Chinook salmon escapement surveys and redd counts and has operated rotary screw traps deployed at the mouth of the river. CDFG funding to continue these efforts in 2005 and beyond is not secure, and CDFG cannot commit to continuation of these monitoring efforts. With the potential loss of CDFG funds and the expiration of the FSA, no funds have been identified to continue this river-wide trend monitoring. Streamflow is monitored at La Grange and Modesto by the U.S. Geological Survey.

A.4 APPROACH AND SCOPE OF WORK

Tasks included in the Scope of Work are listed below and are described in more detail in Table 5. The majority of the monitoring included in this proposal has been implemented by the TRTAC, their consultants, and CDFG over the past several years. In these cases, this proposal would simply extend the duration of ongoing monitoring. This proposal includes continuing existing, long-term river-wide trend monitoring that previously was funded by CBDA or AFRP. No new trend monitoring is proposed. Tasks not included in previous CBDA- or AFRP-funded monitoring are indicated by an asterisk (*). Contractors or agencies expected to conduct each task are indicated in [brackets] following each task description.

Task 1. Project Management

TID, with support from their contractors, will provide all technical and administrative services associated with performing and completing the work for this project and will provide quarterly progress reports, invoices, and scheduled deliverables as indicated.

Task Deliverables: Quarterly progress reports, invoices, and subcontract documentation.

Task 2. Public Participation

2A. Coordinate with TRTAC, TRTAC Monitoring Subcommitee, and Lower Tuolumne River Coalition:

Public outreach and involvement for the Tuolumne River monitoring will occur through three venues: (1) coordination and updates through existing forums, (2) development and distribution of user-friendly, graphically rich “brochures”, and (3) presentation of findings at least one CBDA Science Conference. TID and their consultants will continue to participate in the TRTAC, the TRTAC Monitoring Subcommittee, and the Tuolumne River Coalition. TID currently participates in and coordinates activities of TRTAC, which has overseen monitoring design and implementation in the lower Tuolumne River for nearly ten years and provides a forum for input from agencies

(NOAA, CDFG, USFWS), environmental groups (California Rivers Restoration Fund, Friends of the Tuolumne, Tuolumne River Preservation Trust), and the Districts (CCSF, TID, and MID). TID will continue to collaborate with TRTAC and TRTAC Monitoring Subcommittee on all project-specific and river-wide monitoring included in this proposal. TID also participates in the Tuolumne River Coalition (www.tuolumnerivercoalition.org), which brings together 25 agencies and organizations to integrate existing plans, increase public awareness, and obtain financial support for projects that benefit the Tuolumne River. The Coalition includes city and county agencies, water districts, local non–governmental organizations, as well as state and federal agencies. TID is a member of the Coalition and will use Coalition meetings and publications as opportunities to provide updates on Tuolumne River monitoring. [TID, McBain and Trush, Stillwater Sciences]

2B. Produce and Distribute Interpretive Brochures for the Restoration Projects and Monitoring: To provide user-friendly information about the restoration projects, ongoing monitoring, and adaptive management on the Tuolumne River, TID or their consultant will develop an 11"x17" 4-page brochure for each restoration project that explains the project, project monitoring activities, and the river-wide context for each project and summarizes monitoring results. The brochures will be concise, easily reproducible, graphically rich, and directed to a general public audience. Brochures will be provided to CALFED (hard copies and web-ready electronic versions) and distributed through existing forums. Electronic versions will be posted on the TID website and will be made available for posting on other stakeholder websites. [McBain and Trush]

2C. Present findings at CALFED Science Conference and Prepare Manuscript(s) for Publication: TID and the investigators included in the proposed monitoring will make at least one presentation at at least one CBDA Science Conference. In addition to methods and findings, the presentation(s) will include lessons learned and recommendations for future similar restoration projects and monitoring programs. To support broad dissemination of scientific information and collaboration among restoration scientists, TID and their consultants will also endeavor to publish monitoring results for each restoration project listed in Section 1b of this proposal in an appropriate peer-reviewed journal. Tentative publication topics include: efficacy of constructing "scaled down" rivers as restoration, effects of channel reconstruction on predator populations and Chinook salmon predation mortality, and effects of coarse sediment augmentation of geomorphic processes, channel form, and salmonid habitat. [McBain and Trush, Stillwater Sciences]

Task Deliverables: Quarterly progress reports, meeting summaries and minutes of the TRTAC, TRTAC Monitoring Subcommittee, and Tuolumne River Coalition meetings; one hard copy and one electronic copy of an interpretive brochure for each restoration project and related monitoring; presentation(s) at least one CBDA Science Conference; up to three manuscripts submitted to peer-reviewed journals.

Task 3 . 7/11, M.J. Ruddy, and SRP 9 Project Monitoring

Monitoring would include the following tasks:

3A. Resurvey cross sections and a longitudinal profiles: Resurvey 7 to 9 cross sections and a longitudinal profile through each project site after each of two high flow events exceeding 4,500 cfs. [McBain and Trush]

3B. Deploy and maintain tracer rocks: Deploy and maintain tracer rocks on approximately six cross sections at each of the 7/11 and M.J. Ruddy sites. (No tracer rocks would be deployed at SRP 9 because the channel slope at that site is too low to support coarse sediment transport.) Rocks would be checked and replaced after each flow exceeding 4,500 cfs. Budget allows at least three tracer rock deployments at each site. [McBain and Trush]

3C. *Map channel migration and other planform changes: Obtain and orthorectify aerial photographs after one flow exceeding 9,000 cfs or if noticeable changes in channel location occur. Aerial photographs will be true color, stereo pairs, and at suitable resolution for printing and interpretation at a scale of 1:6,000 or larger. [McBain and Trush]

3D. *Monitor peak flow water surface elevations (crest gauges): Establish and maintain crest gauges at a subset of channel cross sections to monitor peak flow water surface elevation. Maintain each gauge after each flow exceeding 4,500 cfs. These data will be used to test actual channel capacity relative to design capacity and calibrate the hydraulic model developed for the project. [McBain and Trush]

3E. *Continuous water surface elevation recording gauge: Establish and maintain one continuously recording stage gauge at one cross section within the each project site. [McBain and Trush]

3F. Monitor survival, percent cover, and growth of planted riparian vegetation: Continue monitoring survival, percent cover, and growth of planted riparian vegetation through post-project year 5 (i.e., 2008). [McBain and Trush]

3G. *Monitor natural riparian vegetation recruitment and establishment on reconstructed floodplain surfaces*:* Conduct annual plot-based monitoring of natural riparian vegetation recruitment and establishment on the reconstructed floodplains for three years. [McBain and Trush]

3H. *Map Chinook salmon spawning location and habitat characteristics at spawning sites: Conduct biweekly surveys to document Chinook salmon spawning and habitat characteristics of spawning sites in the reconstructed reach from approximately November 1 through December 31 each year. Redds would be mapped onto orthorectified aerial photographs and given unique identifying codes. At each redd, habitat characteristics, including flow depth and velocity, would be recorded at the head of each redd. [Stillwater Sciences]

3I. *Conduct seine surveys to assess juvenile distribution, abundance, and size: Add one location within the each reconstructed site in conjunction with the river-wide seining surveys (budget for this task is included in Task 6). [Stillwater Sciences]

3J. * Monitor groundwater wells on reconstructed floodplains: Install and monitor five groundwater wells on reconstructed floodplains within each site. [McBain and Trush]

3K. *Monitor riparian nesting species composition, abundance of selected species, and associations with vegetation structure: Conduct repeat point count bird surveys and associated riparian vegetation relevée surveys during the breeding season (May and June) on at least one restored floodplain location at each project site and at least two control sites (i.e., one "natural" riparian forest and one unrestored site) for three years. Methods will be consistent with similar monitoring being conducted by Pt. Reyes Bird Observatory Conservation Science on several Central Valley rivers and streams, including the San Joaquin River, Tuolumne River (Grayson River Ranch), Sacramento River, and Clear Creek. [McBain and Trush]

3L. Report Preparation and distribution: At the end of the funded monitoring period, prepare and distribute a draft and final report presenting monitoring methods and results for each site, including synthesis of previous project monitoring methods and results (if available), as well as past and on-going reach-scale and river-wide monitoring results. [McBain and Trush]

Task Deliverables: Quarterly progress reports, orthorectified aerial photographs, one draft and one final monitoring report that describes each project, monitoring methods, and monitoring results; synthesizes data from previous monitoring (if applicable); synthesizes results across spatial scales (i.e., project site to river-wide); updates conceptual models based on monitoring results, and provides recommendations for adaptive management of these projects and design and monitoring of future similar projects. Technical data collected as part of the monitoring (e.g., cross section surveys, flow stage) will be included in appendices to the monitoring report.

Task 4. Fine Sediment Management Monitoring

4A. Quantify annual sediment accumulation in the interim sedimentation basin: Extend interim sedimentation basin monitoring to include two additional total station surveys of sediment accumulation. [McBain and Trush]

4B. Monitor channel stability and riparian vegetation establishment in the Gasburg Creek restoration site: Extend monitoring of the reconstructed Gasburg Creek channel (repeat cross section and profile surveys) and planted riparian vegetation (survival and percent cover by species) for three years. One year of this survey is funded under the existing Fine Sediment Management Plan, and this task will extend surveys to 2007 and 2008. [McBain and Trush]

4C. *Quantify fine sediment contribution to the river from tributaries and prioritize future fine sediment management actions: Measure suspended sediment transport rates during consistent storm event (synoptic) in tributaries identified through field surveys (McBain and Trush 2004) as the largest potential contributors of fine sediment to the river. Based on fine sediment loading, identify and prioritize future fine sediment management needs and locations. [McBain and Trush]

4D. *Monitor benthic macroinvertebrate composition, abundance, biomass and diversity in the gravel-bedded reach: Monitor benthic macroinvertebrate composition, abundance, biomass and diversity indices using the California Stream Bioassessment Procedure (CDFG 1999) at five sites (three Hess samples each) in the gravel-bedded reach. Sample locations will be selected from cleaned riffles and untreated sites using staircase design (Walter et al. 1998). [Stillwater Sciences]

4E. Quantify Chinook salmon spawning habitat selection and redd superimposition. Conduct biweekly, detailed Chinook salmon redd mapping at riffle treatment sites (riffle cleaning sites and augmentation sites including CDFG sites, Bobcat Flat RM 43, and Phase III Sediment Transfusion sites) and control sites throughout the spawning reach to compare spawner utilization of treatment sites to similar "natural" riffles, utilization of different cleaning and augmentation methods/ designs, and redd superimposition rates between riffles and years (i.e., within increasing numbers of augmentation projects constructed). Mark each redd and measure mound length, mound width, pit depth, pit length, pit depth and length of tail spill using previously established methods (TID/ MID 1992), and measure flow depth and velocity at a subset of redds during each survey. This task uses a staircase design (Walters et al. 1988) modification to the "before-after-control-impact" (BACI) approach (Stewart-Oaten et al. 1986) at six riffle habitat sites in the lower Tuolumne River. [Stillwater Sciences]

4F. Report Preparation and distribution: At the end of the funded monitoring period, prepare and distribute the following draft and final reports: (1) Gasburg Creek Monitoring Report (Tasks 4A and 4B), (2) Tributary Suspended Sediment Monitoring and Management Recommendations (Task 4C), and (3) Riffle Cleaning Report (Tasks 4D, 4E, 5E, 6D, and 6E). All reports will include synthesis of previous project monitoring methods and results (if available), as well as past and on-going reach-scale and river-wide monitoring results. [McBain and Trush, Stillwater Sciences]

Task Deliverables: Quarterly progress reports; one draft and one final report describing the Gasburg Creek project, monitoring methods, conclusions, and recommendations for future actions in the Gasburg Creek watershed (if needed); one draft and one final report describing locations, methods, and results of suspended sediment monitoring and providing recommendations for locations, methods, and priority of future tributary fine sediment reduction actions; one draft and one final report describing locations, methods, and results of benthic macroinvertebrate monitoring, comparing the results of this monitoring with previous macroinvertebrate monitoring on the Tuolumne River, and providing recommendations for future riffle cleaning and coarse sediment augmentation implementation.

Task 5. Coarse Sediment Augmentation Project Monitoring: Tuolumne River Sediment Transfusion Project, CDFG Sediment Augmentation Projects at La Grange, and Bobcat Flat (RM 43) Sediment Transfusion Project

[NOTE: The Tuolumne River Sediment Transfusion Project (ERP-02-P29) was submitted to CBDA for a Level III Amendment on November 8, 2004 to address a change in sediment source for the project. The revised project, if approved, would fund Task 5. Task 5 is included in this proposal as a contingency in the event that the amendment is not approved.]

5A. Document channel bed texture and monitor bed mobility thresholds: Map channelbed sediment facies at sediment transfusion sites, collect pebble counts and bulk samples to document surface and subsurface sediment composition, install and monitor tracer rocks to document surface particle mobility thresholds, install scour cores to document depth of scour during flood events. Recover tracer rocks and scour cores after flows exceeding 4,500 cfs. A total of three redeployments is budgeted over a three-year period. [McBain and Trush]

5B. Survey reach-scale channel cross sections and profile and quantify net sediment removal from augmentation sites: After flow exceeding 4,500 cfs, resurvey 20 cross sections to document changes in sediment storage and channel geometry, resurvey longitudinal profile in 3 mile reach from La Grange Bridge to Basso Bridge, and survey topography at 2 transfusion sites to document change in sediment storage volume. [McBain and Trush]

5C. Develop and test a predictive sediment transport model: Measure suspended sediment and bedload transport rates using a 6-inch Helley-Smith sampler deployed from a cataraft at Riffle 4B (repeating sediment transport measurements conducted in 2000) at flows ranging from 5,500 cfs to 10,000 cfs. Budget allows for sampling three discrete flow events over a three-year period. The Sediment Transfusion Project includes funds to develop HEC-RAS and sediment transport models for the reach from La Grange Dam to Roberts Ferry Bridge (i.e., the upstream end of the Gravel Mining Reach). The sediment transport model will be similar to those developed for the Sandy River and Merced River (Stillwater Sciences 2000, 2004) and will be a powerful tool for predicting the effects of coarse sediment augmentation on transport rates and channel morphology, as well as predicting the volume of sediment needed for long-term supply maintenance. [McBain and Trush, Stillwater Sciences]

5D. Map planform geomorphic and habitat features: Using laminated aerial photographs as base maps, map and quantify geomorphic features (bed and banks, alternate bars, active floodplains, sediment deposits) for pre- and post-augmentation in the augmentation reach. Map and quantify mesohabitat features (pool, riffle, run) and salmonid spawning habitat. Mapping will be conducted for one pre- and post-augmentation year and will build on data collected by the Districts in 1988 and data collected under the Coarse Sediment Management Plan (McBain and Trush 2004). [McBain and Trush]

5E. Monitor spawning substrate permeability: Measure permeability, intra-gravel dissolved oxygen and temperature, and collect and analyze bulk samples at 14 riffle sites in the primary spawning reach (between La Grange Dam and Basso Bridge). Methods will be consistent with prior permeability monitoring and will include riffle treatment sites cleaned of fine sediment under the Fine Sediment Management Plan. Gravel quality analyses will be conduced in 2006 and in 2008. [Stillwater Sciences]

5F. Report preparation and distribution. Write and distribute a summary report for each monitoring year, presenting all data collected and analyzed, including interpretations of data for each project and within a broader river-wide context. [McBain and Trush, Stillwater Sciences]

Task Deliverables: Annual Monitoring Report containing all field data and analyses in raw and/or summary format, graphics presenting data results, and written descriptions and interpretations of monitoring results.

Task 6. Monitoring of Cumulative Effects on Target Populations [Chinook salmon and *O. mykiss*]
This task would extend river-wide trend monitoring that, in the past, was funded by the FSA and CDFG. FSA funds are fully expended, and no additional funds are available. CDFG funds are not certain. Without additional, secure funding, these long-term monitoring efforts may be halted. Methods and reporting for all Chinook salmon, *O. mykiss*, and macroinvertebrate monitoring under Task 6 be consistent with the protocols and participants employed in 2004 monitoring activities.

6A. Juvenile Chinook salmon production and outmigration timing: Install and monitor two rotary screw traps near RM 5.5 from approximately January 1 through June 15 for three years. The trap would generally be operated 7 days/week and will be checked at least daily. Conduct up to six trap efficiency test releases each year. Test releases will use captured, wild juvenile salmon when available. When sufficient numbers of wild juvenile salmon are not available, hatchery-reared juvenile salmon will be used for the tests. [CDFG, S.P. Cramer]

6B. Juvenile Chinook salmon and *O. mykiss* distribution, abundance, and size (winter and spring): Conduct biweekly seining surveys from January through May at up to 18 locations from approximately RM 51.5 (near La Grange) through RM 0 (including two sites in the San Joaquin River) for three years. Sample locations would include approximately ten sites used during prior years, as well as additional sites within the Gravel Mining Reach, SRPs 9 and 10, Bobcat Flat, and coarse sediment augmentation projects. Data for Bobcat Flat will be extracted and provided to FOT. [Stillwater Sciences, S.P. Cramer]

6C. Juvenile Chinook salmon and *O. mykiss* distribution (summer): Conduct two snorkel surveys during June through September at up to 16 locations from RM 51.5 (La Grange Bridge) through RM 31.5 (near Hickman Bridge), including restoration project sites, to document summer distribution of juvenile Chinook salmon and *O. mykiss*. Data for Bobcat Flat will be extracted and provided to FOT. [Stillwater Sciences, S.P. Cramer]

6D. Chinook salmon adult escapement: Conduct weekly Chinook salmon carcass surveys and redd counts from upstream of La Grange (RM 51.6) to Geer Road (RM 26) from approximately October 15 through January 15 for three years to quantify adult escapement and document spawning distribution. [CDFG, S.P. Cramer]

6E. *O. mykiss* adult distribution: Conduct hook-and-line surveys from approximately RM 52 through RM 36.5 (within the M.J. Ruddy Reach) for three years to document distribution of adult *O. mykiss*. Surveys would be conducted approximately biweekly from November 1 through December 31 and weekly from January through June. [Stillwater Sciences, S.P. Cramer with local guide subcontractor (California Rivers Restoration Fund)]

6F. Benthic macroinvertebrate composition, abundance, and diversity indices: Conduct annual summer benthic macroinvertebrate monitoring (composition, abundance, and diversity indices) using the California Stream Bioassessment Procedure (CDFG 1999) over a three-year period. Three separate kicknet samples will be taken at six sites in the gravel-bedded reach; three Hess samples will also be collected at two of those sites. [Stillwater Sciences]

Task Deliverables: Quarterly progress reports; one draft and one final report for each task describing monitoring methods, results, and conclusions. Reports will be in a format consistent with reports included in the Districts 2003 FERC report (TID 2004).

Task 7. Aerial Photography and Bathymetry

Aerial photography, topography, and bathymetry available for channel design and monitoring have been collected in a piecemeal fashion for specific reaches of the Tuolumne River. However, low altitude orthorectified photographs with channel and floodplain topography are extremely useful tools for preparing conceptual designs, documenting pre-construction conditions, and documenting future conditions as the channel evolves, and for developing hydraulic and sediment transport models. This task will provide a high-quality, river-wide aerial photograph set for the lower Tuolumne River from La Grange Dam to the San Joaquin River, with complete topography and bathymetry developed for the upper 18 miles below La Grange Dam:

7A. Aerial photo flight: Take low altitude color aerial photographs from La Grange Dam (RM 53) to the San Joaquin River (RM 0). [McBain and Trush]

7B. Ground control: Install surveyed ground control points. [McBain and Trush]

7C. Orthorectification: Orthorectify aerial photographs based on ground control points from La Grange Dam (RM 52) to RM 25. Orthorectification could be extended downstream to include the entire river at a later date, if needed and as funding permits. [McBain and Trush]

7D. Develop topography : Using standard photogrammetric analyses, generate topographic data and maps from La Grange Dam to RM 34.2 at a 2 ft contour interval accuracy. Photogrammetry could be completed for the entire river at a later date, if needed and as funding allows. [McBain and Trush]

7E. Channel bathymetry: Use boat-mounted bathymetric surveys or other appropriate technology (such as water penetrating LIDAR) to generate channel bathymetry data and maps from La Grange Dam to at least the downstream end of the Gravel Mining Reach Project (RM 34.2) and extending further downstream if funding permits. [McBain and Trush]

Task Deliverables: The photogrammetry and bathymetry topographic data will be integrated to produce a single digital terrain model for the upper 18 miles below La Grange Dam. This topography will provide baseline channel and floodplain conditions for evaluating the topographic evolution of the channel in the Sediment Transfusion reaches and in the Gravel Mining reaches. The digital terrain model will also provide the topographic data needed to construct a HEC-RAS model and a sediment routing modeling that is proposed under the revised Sediment Transfusion Project.

5. FEASIBILITY

The proposed monitoring is feasible within the project timeline and with available staff and contractor resources, permits required for the proposed monitoring are either in-hand or in process, and access to private property has been arranged. The greatest uncertainty that could affect the proposed monitoring is the occurrence of flows large enough to do geomorphic work. Many of the geomorphic monitoring events are triggered by flows exceeding 5,000 cfs. If flows sufficient to trigger monitoring do not occur during the funding period, funds for uncompleted tasks would be remain with CBDA because CBDA only reimburses contractors for actual expenditures. At the close of the contract any unexpended funds revert to CBDA for reallocation to other projects.

All proposed monitoring is for projects that are implemented or that are scheduled for implementation by 2006. The 7/11 and SRP 9 projects are constructed. Construction for the M.J. Ruddy and Gasburg Creek projects is expected to begin in 2005. Riffle cleaning is also expected to begin in 2005. The Tuolumne River Sediment Transfusion Project is expected to begin in 2006. Implementation of this project will likely require two construction seasons. These implementation schedules allow for continuation of ongoing post-construction monitoring (7/11, SRP 9, M.J. Ruddy, Gasburg Creek, Bobcat Flat, CDFG sediment augmentation, and riffle cleaning) or collection of baseline data with limited (1-2 years) post-project monitoring (Tuolumne River Sediment Transfusion).

Monitoring would be implemented by contractors to TID and CDFG, with input from the TRTAC and TRTAC Monitoring Subcommittee. These parties have worked together for many years on these projects. Most of the monitoring included in this proposal has been implemented by the TRTAC, their consultants, and CDFG over the past several years. In these cases, this proposal would simply extend the duration of ongoing monitoring. New monitoring tasks would use standard methods applied by the investigators on the Tuolumne, Merced, and other river. Invertebrate analysis and sediment transport modeling will use methods developed by Stillwater Sciences and applied on the Merced River and other rivers.

Depending on the task, contractors and staff participating in monitoring may be required to have collection permits from CDFG and scientific research permits from NOAA (pursuant to Section 10 of the Endangered Species Act). All investigators participating in collection and sampling of Chinook salmon and *O. mykiss* (S.P. Cramer and Stillwater Sciences) have current CDFG collection permits. Permit numbers are provided in Attachment A. TID applied to NOAA for a scientific research permit for their staff and contractors on October 9, 2000. NOAA is currently processing this permit application. Since submitting the application, TID and their contractors have worked with NOAA staff to obtain short-term authorizations consistent with the pending application. TID will continue to work with CDFG and NOAA to ensure that all collection permits are obtained and kept current.

Access to the majority of the Tuolumne River and Gasburg Creek monitoring sites is through public properties (owned by Stanislaus County, Modesto ID, TID, and CDFG). Access through private property would be required at the 7/11 and Bobcat Flat project sites. A letter from Friends of the Tuolumne (who owns the Bobcat Flat site) authorizing access for monitoring purposes is provided in Attachment B. TID owns an easement on the 7/11 site that allows access for monitoring and maintenance. Several seining survey locations for river-wide monitoring (Task 6) require access through private lands. Landowners have provided access to TID to conduct these surveys since 1986. If funding is approved, TID obtain letters providing permission to access these properties from the landowners. If permission is withheld, the affected seine location could be shifted to a similar site nearby.

6. EXPECTED OUTCOMES AND PRODUCTS

The CBDA and AFRP have invested nearly $30 million in restoration projects on the Tuolumne River, managed by TID and implemented by the TRTAC and its consultants. An additional $4.4 million is being considered by the CDBA Amendment Committee. The CBDA and AFRP have acknowledged that more research needs to be done to better understand how to do large-scale river habitat restoration. But if these river restoration projects are to effectively generate knowledge that is transferable to future projects, investigations of process need to be instituted, and investment in monitoring is essential. The proposed monitoring will provide monitoring funding during a critical period of restoration program implementation, and will provide data and reports needed to support adaptive management at project design, reach-wide, and river-wide scales. Data and reports to be delivered are described in Section A.4 and the Task and Deliverables form.

The Adaptive Management Forum panel stated that “The implementation of an ecosystem-based adaptive management approach to these projects will have to be implemented gradually. However, the monitoring of long-term project effectiveness and the implementation of comparative studies needs to be given a higher status, adequately supported, and made more effective. The Panel recommends that this issue be addressed directly and urgently because it will affect the degree to which investments already made in projects sponsored by AFRP and CBDA can be leveraged into useful knowledge for future projects.”

The Tuolumne River is a focal point for implementation of the CBDA and AFRP program goals, testing a fundamental hypotheses of scaled-down river channel reconstruction, river-wide restoration, and ecosystem management under regulated flow and sediment conditions. Investment in continued monitoring of these projects is essential to:

- sustain salmonid populations and other ecosystem components on the Tuolumne River through improved restoration project design and implementation;
- provide information that will improve our understanding of the performance of projects recently implemented or scheduled to be implemented in the next several years;
- yield knowledge and information applicable to other systems or restoration programs, generated through passive and active adaptive management experiments;

7. DATA HANDLING, STORAGE, AND DISSEMINATION

TID will function as contract manager for this project, similar to other Tuolumne River projects funded by CBDA. TID typically develops service contracts with consultants to conduct monitoring. If specific monitoring tasks are to be performed by agencies, such as CDFG, then the TID anticipates entering into agreements for that work. Reports and analysis prepared by the contractor are submitted to the TRTAC for review. These monitoring reports are also included with the annual Status Report submitted to FERC along with the associated river-wide monitoring conducted by the Districts and TRTAC. All reports, maps, GIS data, draft and final project design documents, regulatory compliance documents, bid specification packages, and monitoring data are compiled by TID as project records. Information is generally stored in MS Excel and Word, AutoCAD, and ArcInfo. All final reports prepared as task deliverables during this project will be provided to CBDA and AFRP, and additional reports and data will be made available to CBDA/AFRP upon request.

Contractors will be responsible for quality assurance/quality control of their data collection and data entry. All data recorded in field books will be photocopied upon returning from the field and archived. Originals or copies of all other field data (such as maps, photographs, etc.) will be maintained by the Contractor and archived pending completion of the project. Electronic data files will be made available to CBDA upon request.

8. PUBLIC INVOLVEMENT AND OUTREACH

Public involvement and outreach is described in Task 2. In addition to outreach described in Task 2, several opportunities for public involvement were provided during the design and environmental review phases of the SRPs 9 and 10 and Gravel Mining Reach projects. TID (the state lead agency) and the U.S. Fish and Wildlife Service (the federal lead agency, completed and circulated an Environmental Assessment/Initial Study (EA/IS) for these restoration projects. The EA/IS comment period included a public hearing held in June 1998. The EA/IS outlines mitigation and monitoring for these restoration projects.

With the completion of the Habitat Restoration Plan for the Lower Tuolumne River Corridor (McBain and Trush 2000), the TRTAC hosted an additional public workshop in June 1999 to present the plan and provide an opportunity to address the public's questions about future restoration. This workshop included presentations by TRTAC member groups and agencies, and TRTAC participants and their consultants were available at topic-specific information stations to discuss the projects and answer questions. To make the Restoration Plan more available to the public and other interested parties, the TRTAC (with funding from AFRP) developed a 16-page summary. Since 1999, more than 5,000 copies of this brochure have been distributed. The brochure is also available at the TID web page at www.tid.org.

9. WORK SCHEDULE

See Table 6 for the work schedule.

B. APPLICABILITY TO PROGRAM GOALS

1. ERP AND CVPIA PRIORITIES

ERP Priorities: Components of the ERP Vision for the Tuolumne River Ecological Management Unit addressed by the proposed monitoring include: spatially complex channel morphology, frequently mobilized channel bed surface, periodic channel bed scour and fill, balanced coarse and fine sediment budgets, periodic channel migration or avulsion, functional floodplain, self-sustaining riparian plant communities, naturally-fluctuating groundwater table (ERP Plan vol. II, pp. 387-388). Measures to achieve this vision are addressed in more detail in the ERP Stage 1 Implementation Plan (CBDA 2001). Proposed monitoring would specifically address the following Implementation Plan priorities and specific action and information needs (pp. 69-74):

- SJ-1: Continue habitat restoration actions including channel-floodplain reconstruction projects and habitat restoration studies in collaboration with local groups (specific actions/information: channel-floodplain reconstruction projects, gravel augmentation projects);
- SJ-2. Restore geomorphic processes in stream and riparian corridors (specific actions/information: hydrologic, hydraulic, and sediment transport models);
- SJ-3. Improve rearing and spawning habitat and downstream fish passage on tributary streams and the mainstem San Joaquin River, particularly for Chinook salmon, steelhead trout and splittail (specific actions/information: studies that (1) build knowledge on status and needs of steelhead in the San Joaquin River tributaries, and (2) assess life history and habitat associations in relation to existing and restored habitats); and
- SJ-6. Conduct adaptive management experiments in regard to natural and modified flow regimes to promote ecosystem functions or otherwise support restoration actions (specific actions/information: mechanistic models as restoration tools).

Conservation Species: Proposed monitoring would gather and synthesize data relevant to the following "Big R" species identified in the Multi-Species Conservation Strategy (CBDA 2000): Central Valley steelhead ESU, Central Valley fall-/late-fall Chinook salmon SU, Valley Elderberry longhorn beetle (as related to riparian vegetation recruitment).

CVPIA/AFRP Priorities: The AFRP has made a large investment in Tuolumne River restoration. The proposed monitoring addresses the following restoration actions identified in the Final Restoration Plan for the AFRP (AFRP 2001):

- Improve watershed management and restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel and performing an integrated evaluation of biological and geomorphic processes (priority: high); and
- Evaluate and implement actions to reduce predation on juvenile Chinook salmon, including actions to isolate ponded sections of the river (priority: medium).

2. RELATIONSHIP TO OTHER ECOSYSTEM RESTORATION ACTIONS, MONITORING PROGRAMS, OR SYSTEM-WIDE ECOSYSTEM BENEFITS

This proposal extends, augments, and integrates monitoring of channel reconstruction, coarse sediment augmentation, and fine sediment management projects funded by ERP and AFRP and also is linked to

restoration projects funded by the CDWR Four Pumps Mitigation Fund. Proposed monitoring would assess geomorphic processes at the site-specific and reach-scales and would assess Chinook salmon and to some extent *O. mykiss* response to restoration at the site-specific, reach, and river-wide scales. Information gathered through this monitoring would inform design and implementation of future restoration projects, including SRP 10, future Gravel Mining Reach phases, and future coarse sediment augmentation.

3. ADDITIONAL INFORMATION FOR PROPOSALS CONTAINING LAND ACQUISITION

No land acquisition is included in this proposal.

C. QUALIFICATIONS

The project team described below has been conducting monitoring on the Tuolumne River for over 15 years, and is uniquely qualified to implement this project. In addition to TID and the consultants listed below, the California Department of Fish and Game will also be participating in the monitoring efforts.

Turlock Irrigation District (TID) is the grant applicant and would manage the project. TID has decades of experience in overseeing monitoring programs conducted through contractors and partner agencies. Beginning in 1971, TID and its partners managed a comprehensive research program that ultimately resulted in the flow schedule and restoration measures included in the FSA. TID and its partners also managed more than $1.3 million in FSA monitoring funds, which will culminate in a report to FERC in 2005 that provides monitoring conclusions and recommendations for future river management. TID has received and managed several CBDA and AFRP grants for restoration projects on the Tuolumne River, totaling nearly $30 million (see Tables 1 through 4). *Primary Technical Staff for the Project:* Wilton Fryer, P.E., has been program manager for the Turlock and Modesto Irrigation District Restoration Program since 1997. Mr. Fryer graduated from the University of California at Davis with a BS in Soil & Water Science, an MS in Irrigation Science, and an ME in Civil Engineering with an emphasis in water resources. He is currently registered as both a Civil Engineer and an Agricultural Engineer. Tim Ford has been the staff aquatic biologist for TID and MID since 1981. Mr. Ford graduated from the University of California at Davis with a BS in Wildlife and Fisheries Biology in 1977. He worked as a Biological Technician for the Modoc, Tahoe, and Stanislaus National Forests prior to working for the Districts. Mr. Ford oversees the aquatic resources program for the Districts.
McBain and Trush, Inc. is a professional consulting firm applying fluvial geomorphic and ecological research to river preservation, management, and restoration. McBain and Trush authored Habitat Restoration Plan for the Tuolumne River and the Tuolumne River Coarse Sediment Management Plan. For this project, McBain and Trush would develop and implement geomorphic, hydraulic, hydrologic and riparian vegetation monitoring; manage the subcontract for riparian bird surveys; coordinate and oversee aerial photography; and prepare public outreach brochures. *Technical Staff for the Project:* Dr. William Trush (PhD, Forestry) was a principal scientist in developing the Habitat Restoration Plan for the Tuolumne River, and has been designing restoration projects and conducting monitoring on the Tuolumne River since 1989. Scott McBain (MS. Civil Engineering) was also a principal scientist in developing the Restoration Plan and created the conceptual designs for the Gravel Mining Reach, SRPs 9 and 10, Gasburg Creek, Bobcat Flat, and Tuolumne River Sediment Transfusion Projects. Mr. McBain has also been a lead scientist for restoration planning and investigations on Clear Creek and the Trinity River. Darren Mierau (MA, aquatic biologist) has been involved with the Tuolumne River restoration program since 1997, assisted in completion of the Restoration Plan, developed and implemented

monitoring plans in the Gravel Mining Reach and SRP projects, was project manager and co-author of the Tuolumne River Coarse Sediment Management Plan. Jennifer Vick (MLA, Environmental Planning/ Landscape Architecture) has been involved with restoration planning, implementation, and monitoring on the Tuolumne and Merced Rivers since 1997. She was lead author on the Merced River Corridor Restoration Plan and has designed, managed, and implemented baseline evaluations and restoration project monitoring on the Tuolumne River since 1998. She also co-authored of the Tuolumne River Coarse Sediment Management Plan. John Bair (MA, riparian botanist) has developed riparian and wetland restoration designs in Clear Creek and the Tuolumne River.

Stillwater Sciences is a firm of biological and geological scientists that specializes in developing new scientific approaches and technologies for environmental problem solving in aquatic and terrestrial systems. Its founding members are experienced in freshwater ecology, fisheries and wildlife biology, riparian and wetland ecology, entomology, botany, and hillslope and fluvial geomorphology and have led ecological studies on the Tuolumne River since 1987. Stillwater Sciences is currently developing restoration designs and has conducted detailed hydraulic and sediment transport modeling for the Merced River Dredger Tailings Reach and will provide important connectivity between similar restoration and monitoring projects be implemented the Merced and Tuolumne rivers. For this project, Stillwater will oversee fisheries and ecological monitoring, including *O. mykiss* surveys, macro-invertebrate studies, redd superimposition studies, and riffle cleaning analyses. Stillwater, with S.P. Cramer and Associates, will also conduct seine and snorkel surveys. *Primary Technical Staff for the Project:* Frank Ligon is an aquatic ecologist and geomorphologist specializing in investigations of the role of fluvial processes in the ecology of stream fish, invertebrates, and plant communities. On the Tuolumne River, Mr. Ligon managed fisheries studies for the Districts from 1987 to 1996. Anthony Keith is an ecologist specializing in stream ecology and geomorphology, aquatic and terrestrial entomology, and watershed management. On the Tuolumne River, Mr. Keith has participated in assessments of fish and invertebrate populations, spawning gravel quality, and juvenile Chinook salmon outmigration. Noah Hume (Ph.D., P.E.) will provide technical oversight of all monitoring tasks contracted to Stillwater. Dr. Hume has over 15 years experience on a wide variety of interdisciplinary projects, as well as engineering design. Dr. Hume has been involved in projects relating to egg survival to emergence, spawning gravel cleaning, smolt survival studies, and fish population composition and distribution.

S.P. Cramer & Associates, Inc. (SPC) was established in 1987 to provide innovative solutions for issues relating to salmon and trout on the Pacific Coast. Previous and ongoing fisheries research includes, annual juvenile salmonid outmigration monitoring, adult migrant trapping, radio-tracking, and electrofishing studies. SPC has conducted seine surveys, snorkel surveys, and rotary screw trap deployment and operation on the Tuolumne River since 1998. SPC will participate in seine and snorkel surveys with Stillwater Sciences and will provide field, data management, and analysis and report writing support for carcass surveys, rotary screw trap monitoring, and Chinook salmon redd mapping. *Primary Technical Staff for the Project:* Doug Demko (Senior Consultant) manages and coordinates project activities within SPC and between cooperating agencies and supervises data analyses, interpretation, and report preparation activities. Mr. Demko received a BS in Biology in 1992, and a Juris Doctor degree in 2002. Andrea Fuller (Fish Biologist) joined SPC as a fisheries technician in 1995. Ms. Fuller coordinates field personnel and data collection activities and assists in data analyses and report preparation. Michele Simpson (Fish Biologist) joined SPC in 2002 after working as a fisheries biologist for the U.S. Bureau of Reclamation and NOAA Fisheries. She received her MS in Biology in 1997 and specializes in Endangered Species Act issues regarding salmonid populations.

D. COST

1. BUDGET

Costs for major tasks are provided in the website budget form. Table 7 provides a comprehensive budget summary with more detailed cost information for tasks and subtasks.

2. COST SHARING

TID and MID provide two full-time positions to support the Tuolumne River Restoration Program- a project manager (Wilton Fryer) and an aquatic ecologist (Tim Ford). Other specific cost-sharing has not yet been identified, but will factor into long-term river-wide monitoring as described in the following section.

3. LONG-TERM FUNDING STRATEGY

The Districts have funded over $1.3 million for a 10-year river-wide monitoring program that ends in 2004. Additional funding of monitoring, such as redd counts and carcass surveys, was provided by CDFG. The basis of several monitoring tasks in this PSP was derived from that prior work. Funding for future river-wide monitoring by the Districts and CDFG have not been identified, but the Districts anticipate that portions of the current river-wide monitoring will continue through 2016 using FERC Settlement Agreement funds. Specific levels of monitoring and associated funding levels for the 2005-2016 period have not yet been identified.

E. COMPLIANCE WITH STANDARD TERMS AND CONDITIONS

TID has reviewed and understands the standard terms and conditions for ERP grant agreements. TID will comply with these standard terms and conditions.

F. LITERATURE CITED

AMF (Adaptive Management Forum Scientific and Technical Panel). 2001. Lower Tuolumne River Adaptive Management Forum Report. Prepared for Anadromous Fish Restoration Program with assistance from the CALFED Bay-Delta Program, Ecosystem Restoration Program

CDFG (California Department of Fish and Game). 1999. California stream bioassessment procedure. California Department of Fish and Game Aquatic Bioassessment Laboratory. May http://www.dfg.ca.gov/cabw/field/csbpwforms.html.

McBain and Trush. 2000. Habitat Restoration Plan for the Lower Tuolumne River Corridor. Prepared for the Tuolumne River Technical Advisory Committee.

McBain and Trush. 2004. Coarse Sediment Management Plan for the Lower Tuolumne River. Revised Final Report. Prepared for the Tuolumne River Technical Advisory Committee.

McBain and Trush. 2004. Tuolumne River Floodway Restoration: Project Design Approach and Rationale Coarse Sediment Management Plan for the Lower Tuolumne River. Prepared for the Tuolumne River Technical Advisory Committee.

McBain and Trush and Stillwater Sciences 2000. Tuolumne River Restoration Project Monitoring: SRPs 9/10, 7/11 Mining Reach, Ruddy Mining Reach. Prepared for the Tuolumne River Technical Advisory Committee.

McBain and Trush and Stillwater Sciences 1999. Tuolumne River Restoration Project Monitoring: SRPs 9/10 and 7/11 Mining Reach. Prepared for the Tuolumne River Technical Advisory Committee.

Stewart-Oaten, A., Murdoch, W.W. & Parker, K.R. 1986. Environmental impact assessment: pseudoreplication in time? Ecology 67, 929–940.

Stillwater Sciences. 2004. Gasburg Creek Sediment Source Analysis. *Prepared for* Tuolumne River Technical Advisory Committee

TID/MID (Turlock Irrigation District and Modesto Irrigation District). 1992. Lower Tuolumne River spawning gravel studies report. Appendix 8 to Don Pedro Project Fisheries Studies Report (FERC

Article 39, Project No. 2299). *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Vol. IV. Prepared by EA, Engineering, Science, and Technology, Lafayette, California.

TID/MID (Turlock Irrigation District and Modesto Irrigation District). 1992. Lower Tuolumne River predation study report. Appendix 22 to Don Pedro Project Fisheries Studies Report (FERC Article 39, Project No. 2299). *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Vol. VII. Prepared by T. Ford, Turlock and Modesto Irrigation Districts and EA Engineering, Science, and Technology, Lafayette, California.

TID/MID (Turlock Irrigation District and Modesto Irrigation District). 1997. Redd Superimposition Report (Report 96-6). *In* Report of Turlock Irrigation District and Modesto Irrigation District Pursuant to Article 39 of the License for the Don Pedro Project, No. 2299. Vol. VI. Prepared for TID/MID by EA Engineering, Science, and Technology, Lafayette, California.

Walters, C. J., Collie, J. S., and Webb, T. 1988. Experimental design for estimating transient responses to management disturbances, Canadian Journal of Fisheries and Aquatic Sciences 45, 530-538.

H. NON-PROFIT VERIFICATION

N/A

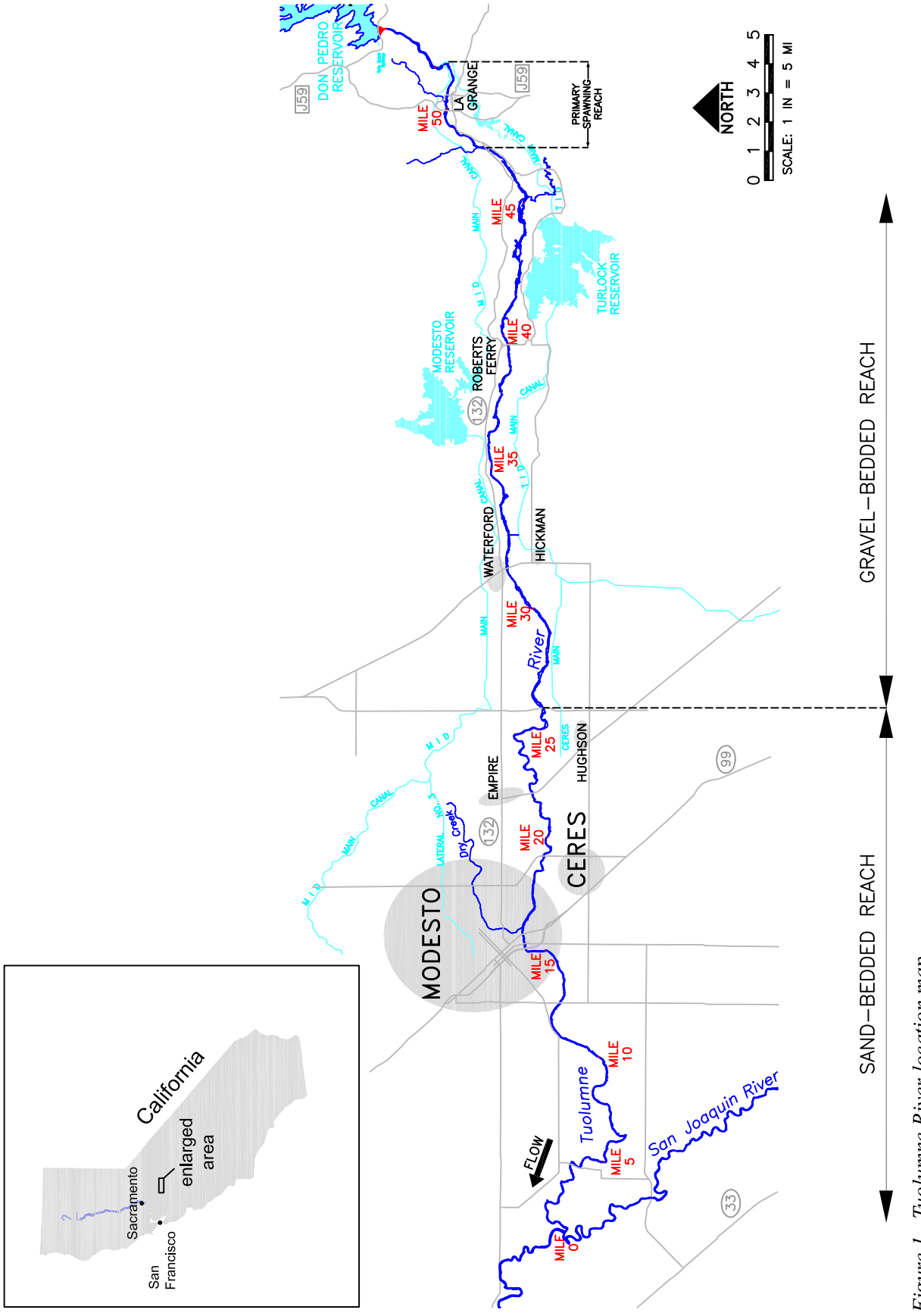


Figure 1. Tuolumne River location map.

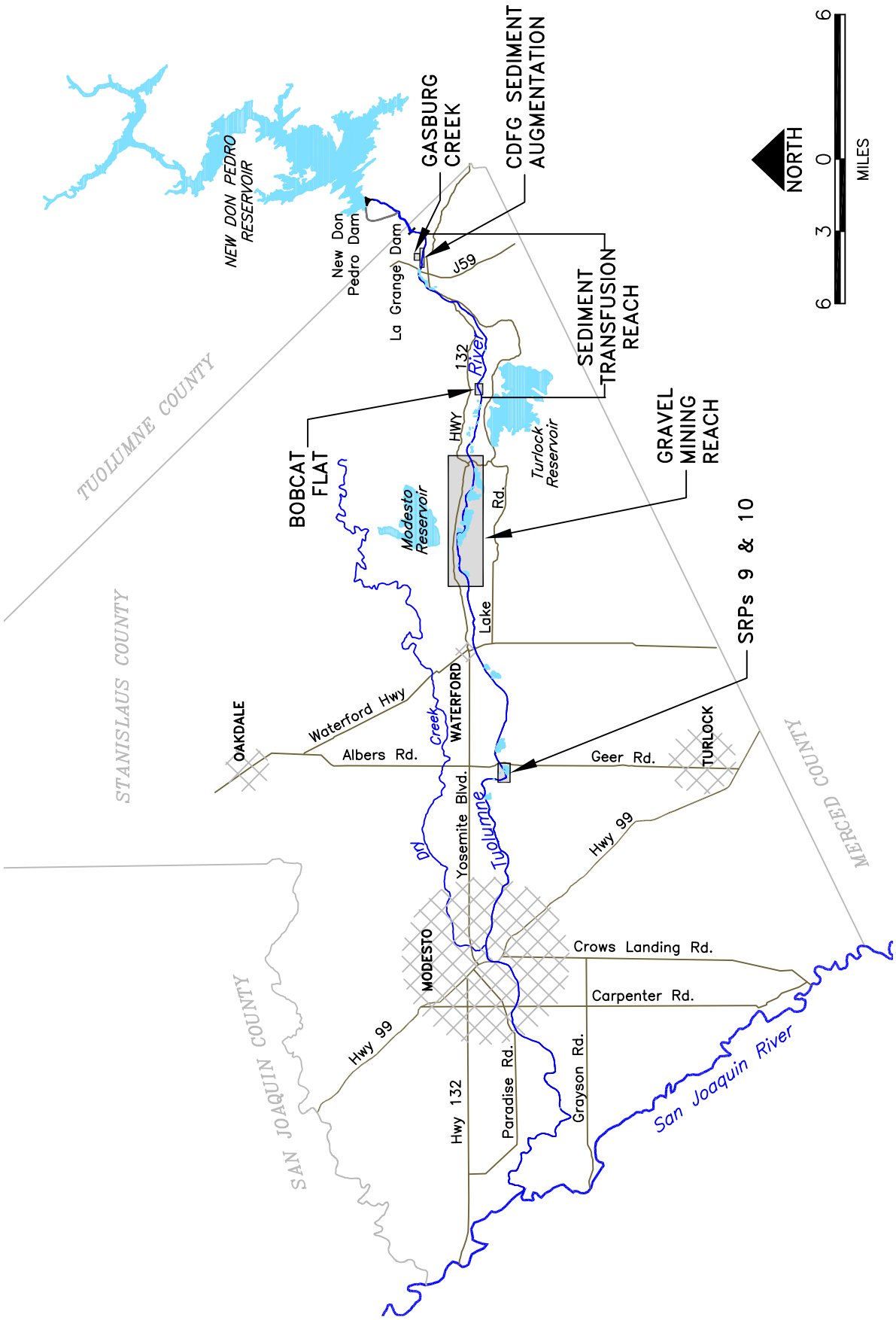


Figure 2. Tuolumne River restoration projects location map.

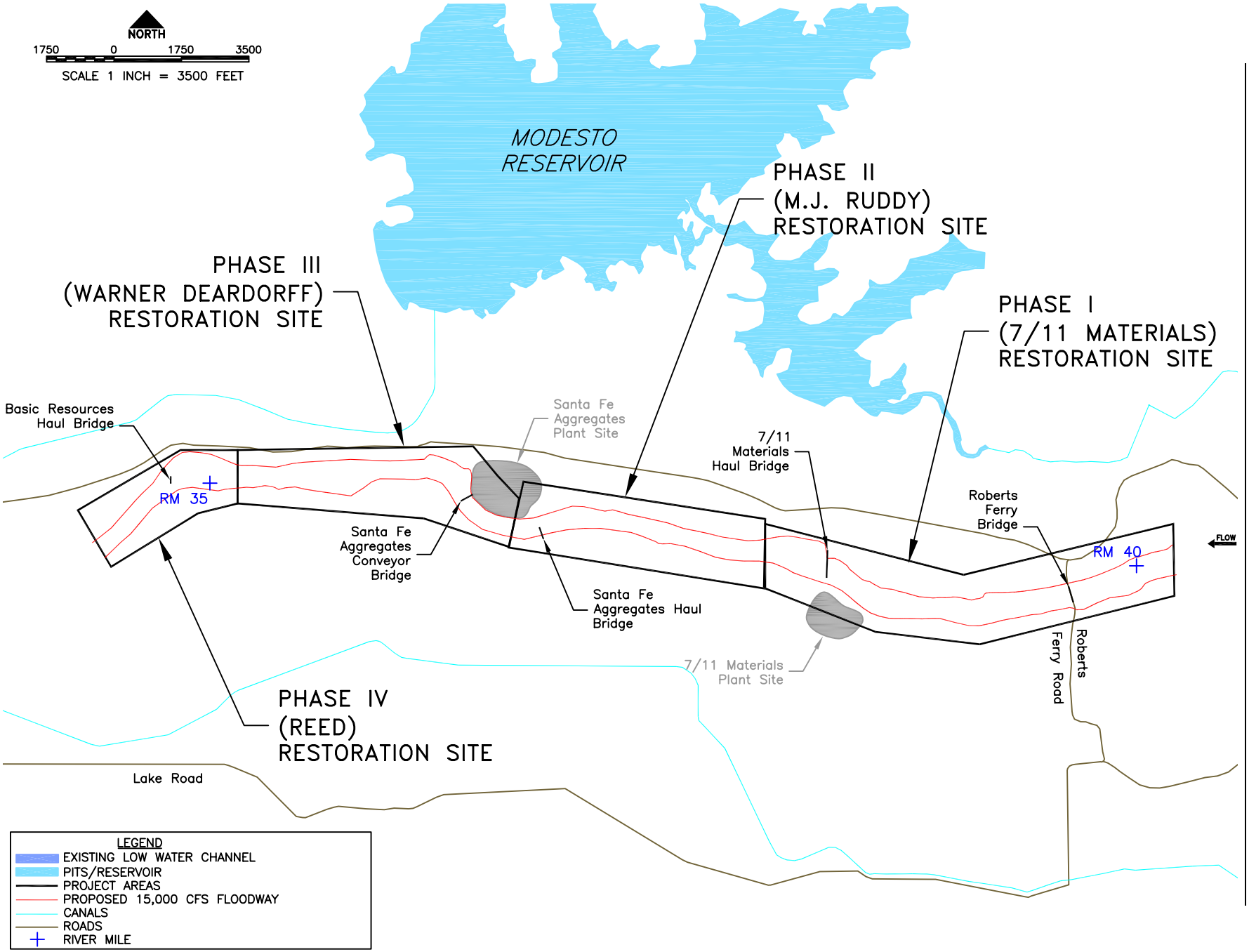


Figure 3. Gravel Mining Reach Project: boundaries of the 7/11, M.J. Ruddy, Warner/Deardorff, and Reed reaches.

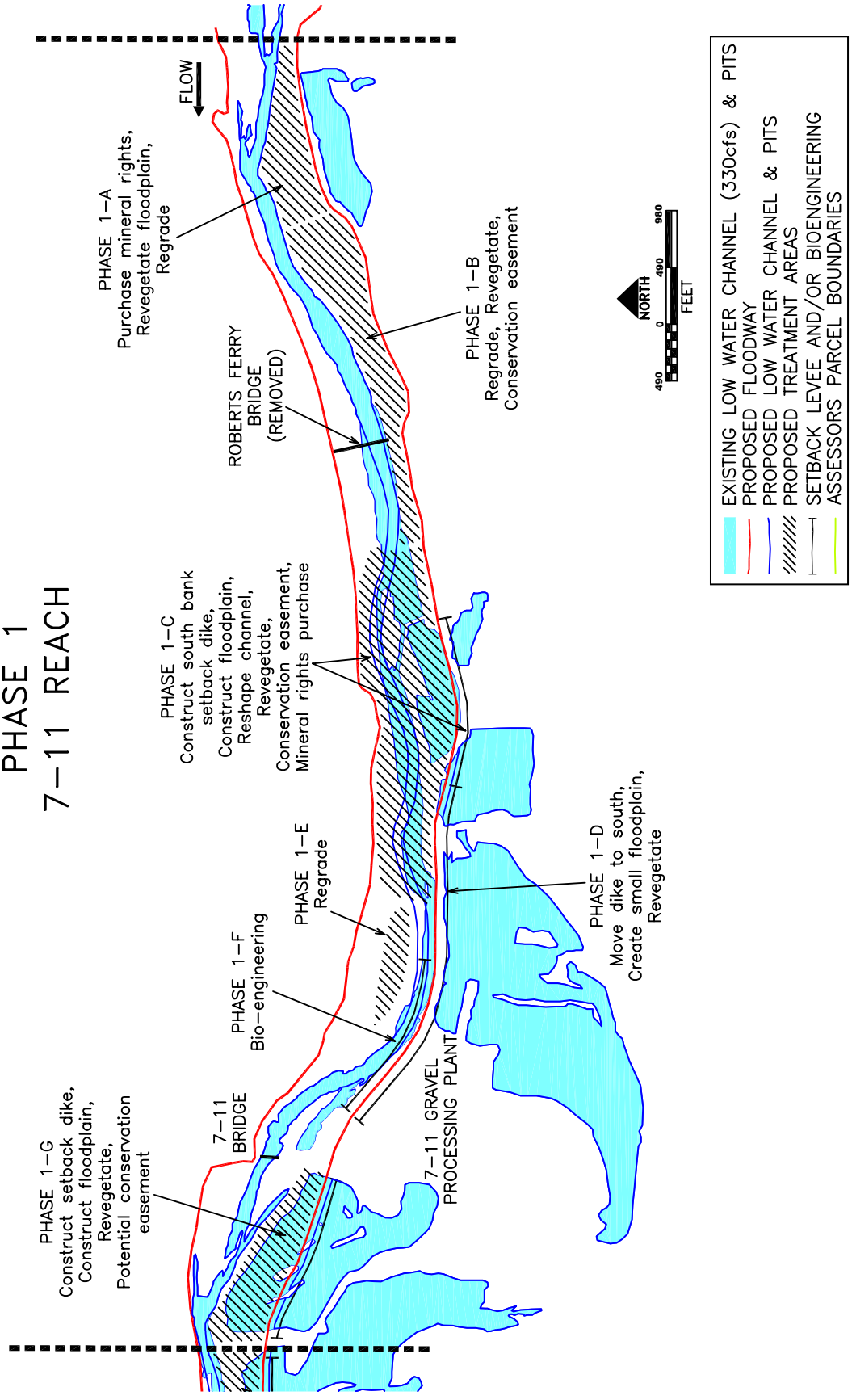


Figure 4. Conceptual design for the 7/11 phase of the Gravel Mining Reach Project, as submitted to CALFED in 1997.

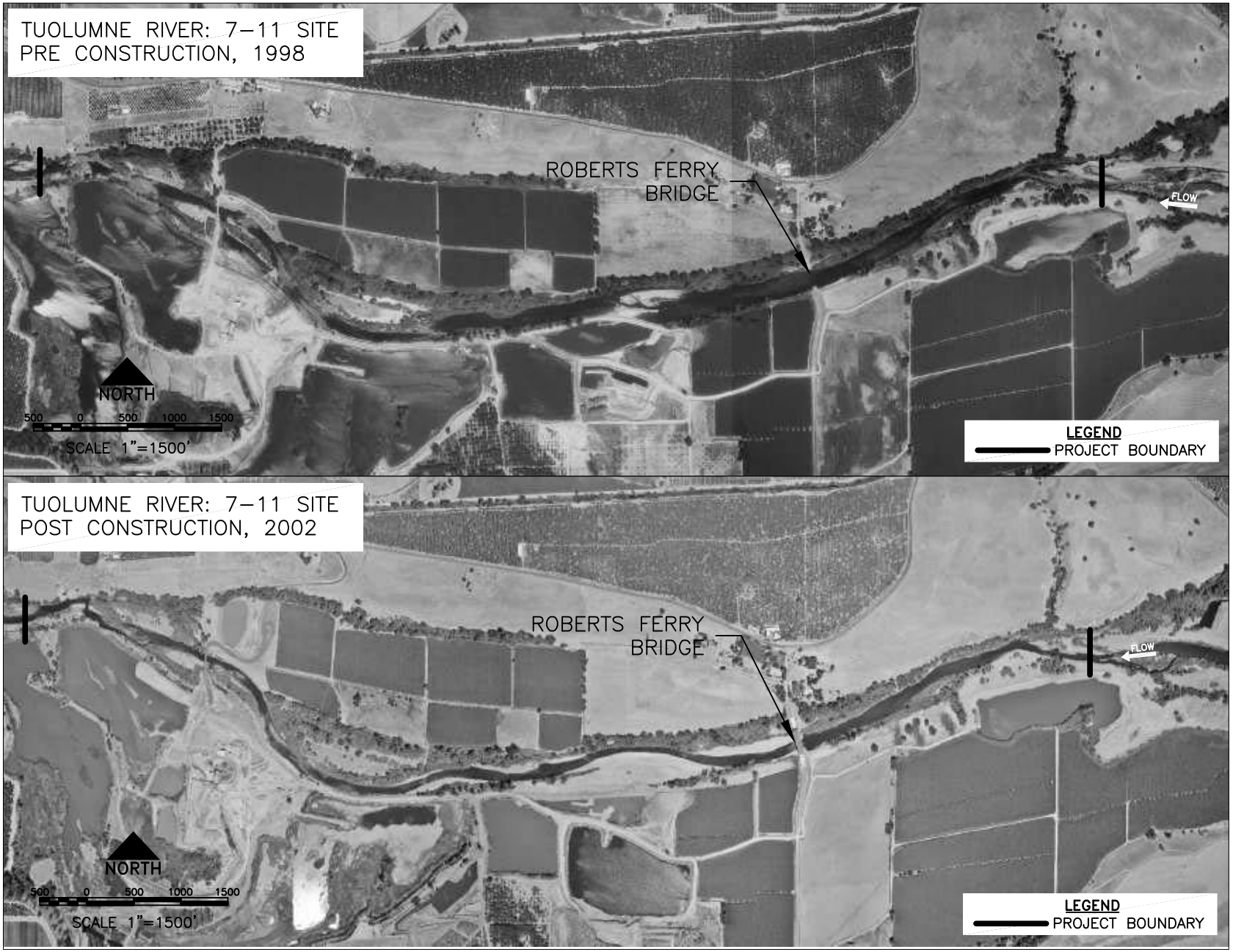


Figure 5. Aerial photographs of the 7/11 phase of the Gravel Mining Reach Project, pre- and post-construction.

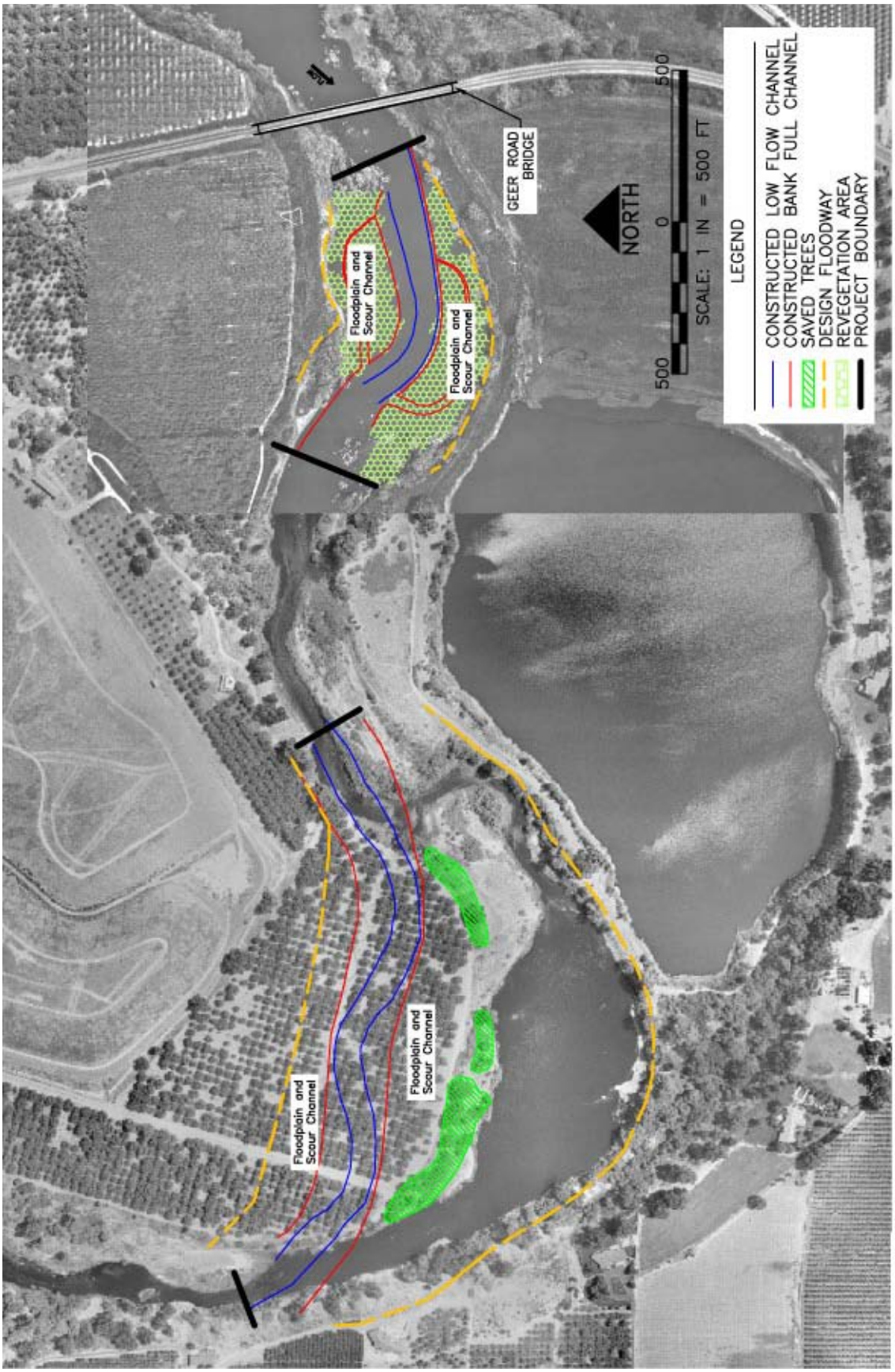


Figure 6. Conceptual designs for the SRPs 9 and 10 Projects.

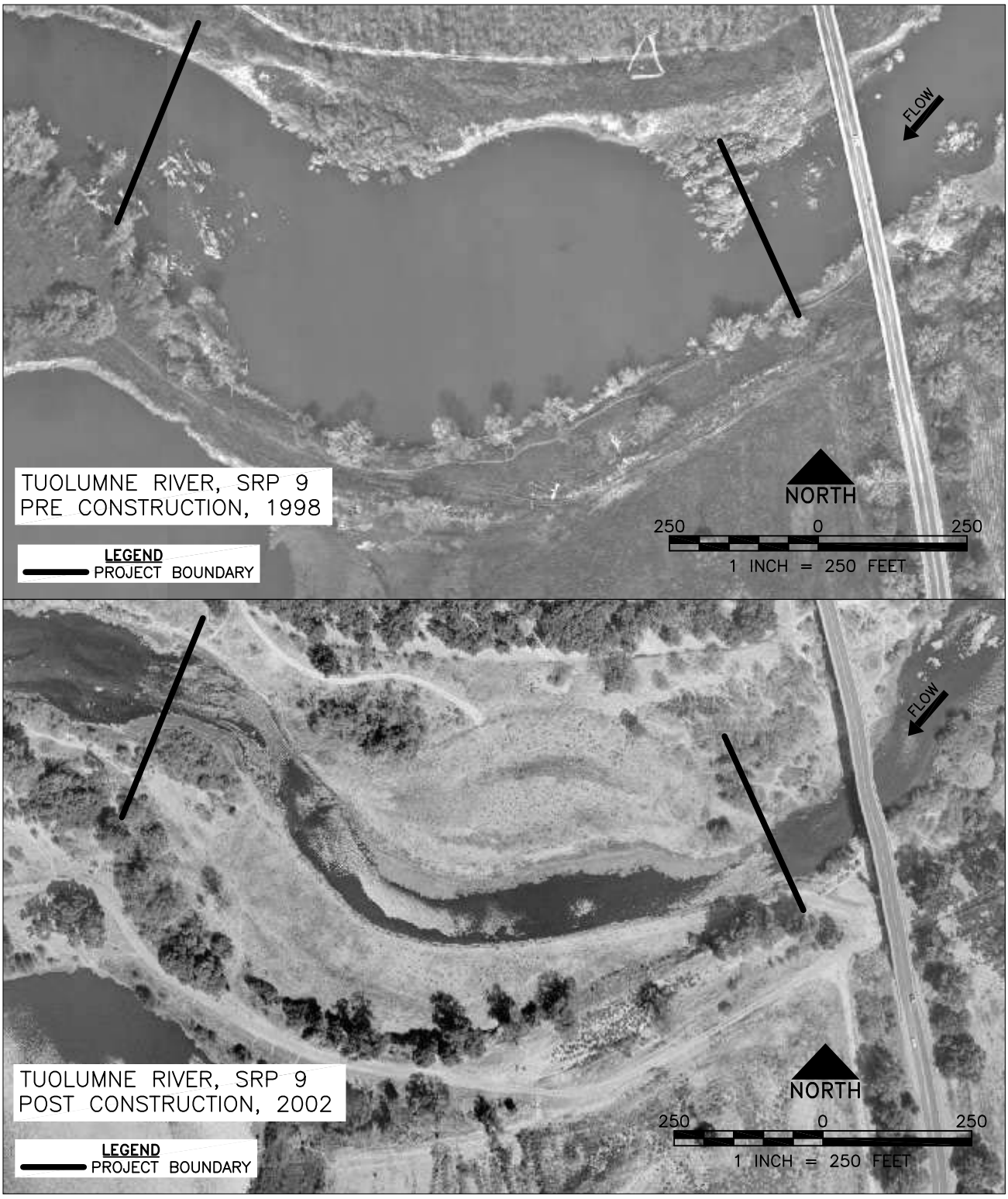


Figure 7. Aerial photographs of the SRP 9 Project, re- and post-construction.

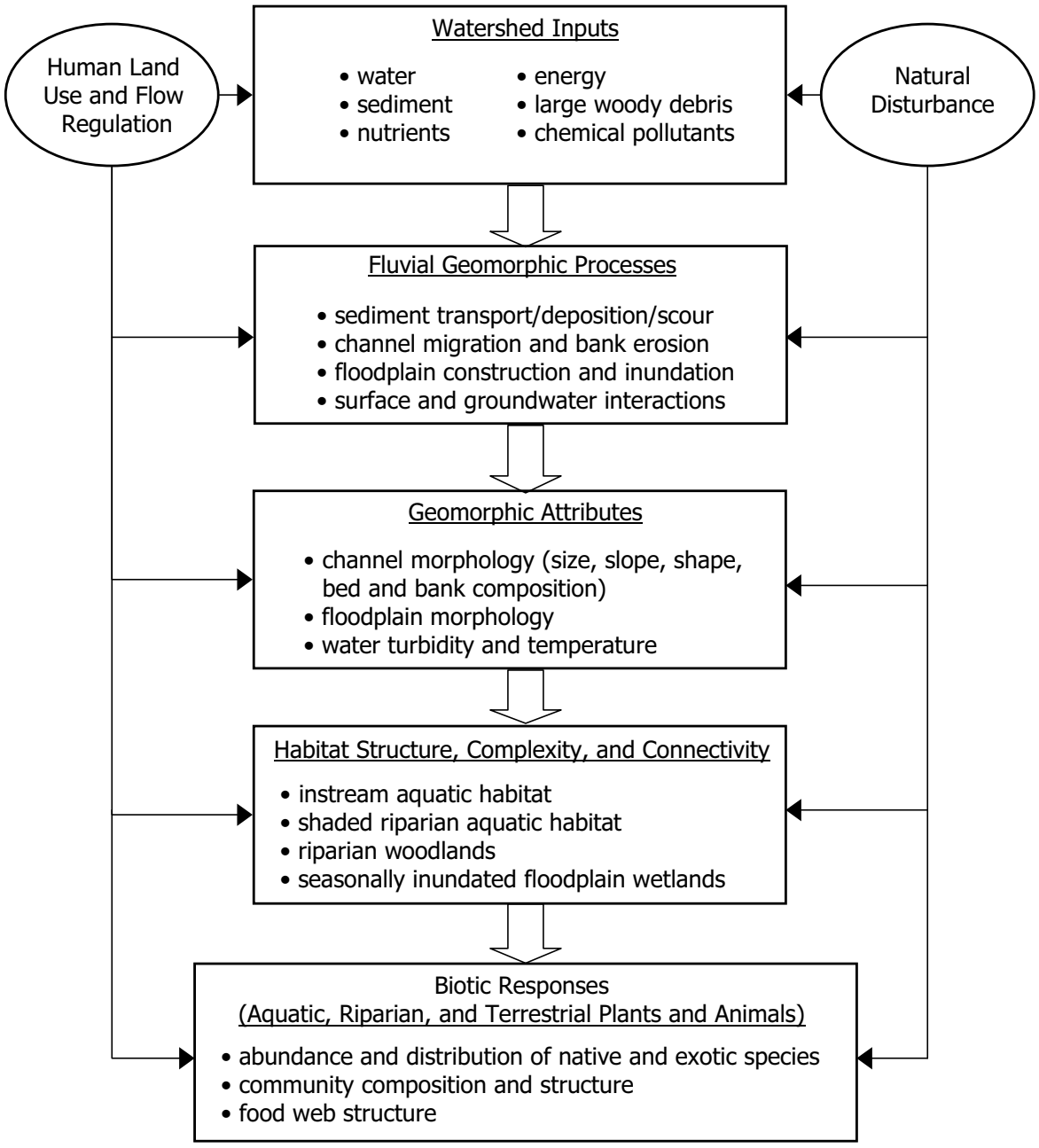


Figure 8. Simplified conceptual model of physical and ecological linkages in alluvial river-floodplain systems (source: Stillwater Sciences 2001).

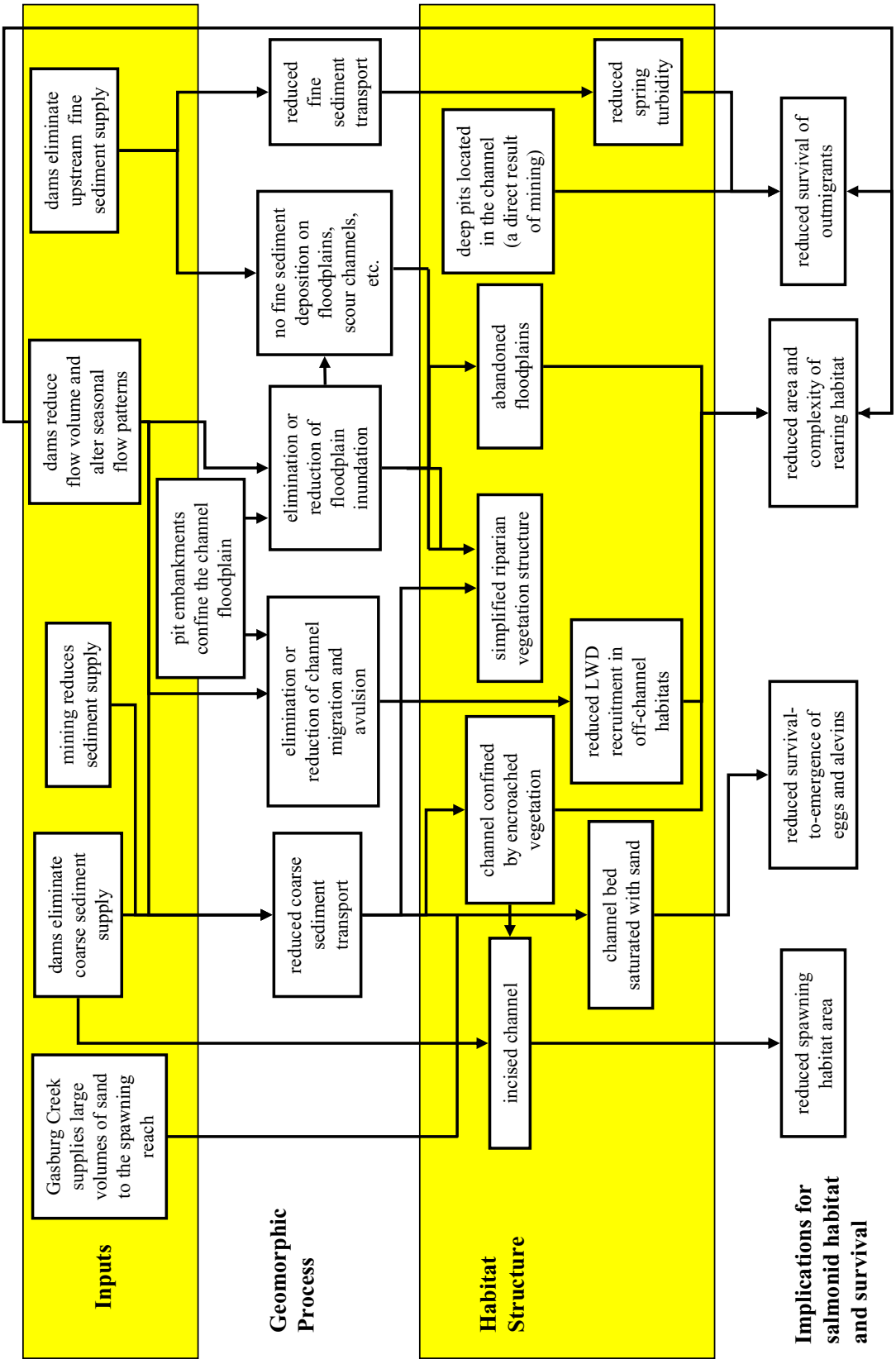


Figure 9. Conceptual model of the effects of dams and mining on geomorphic inputs and processes, habitat structure, and population response

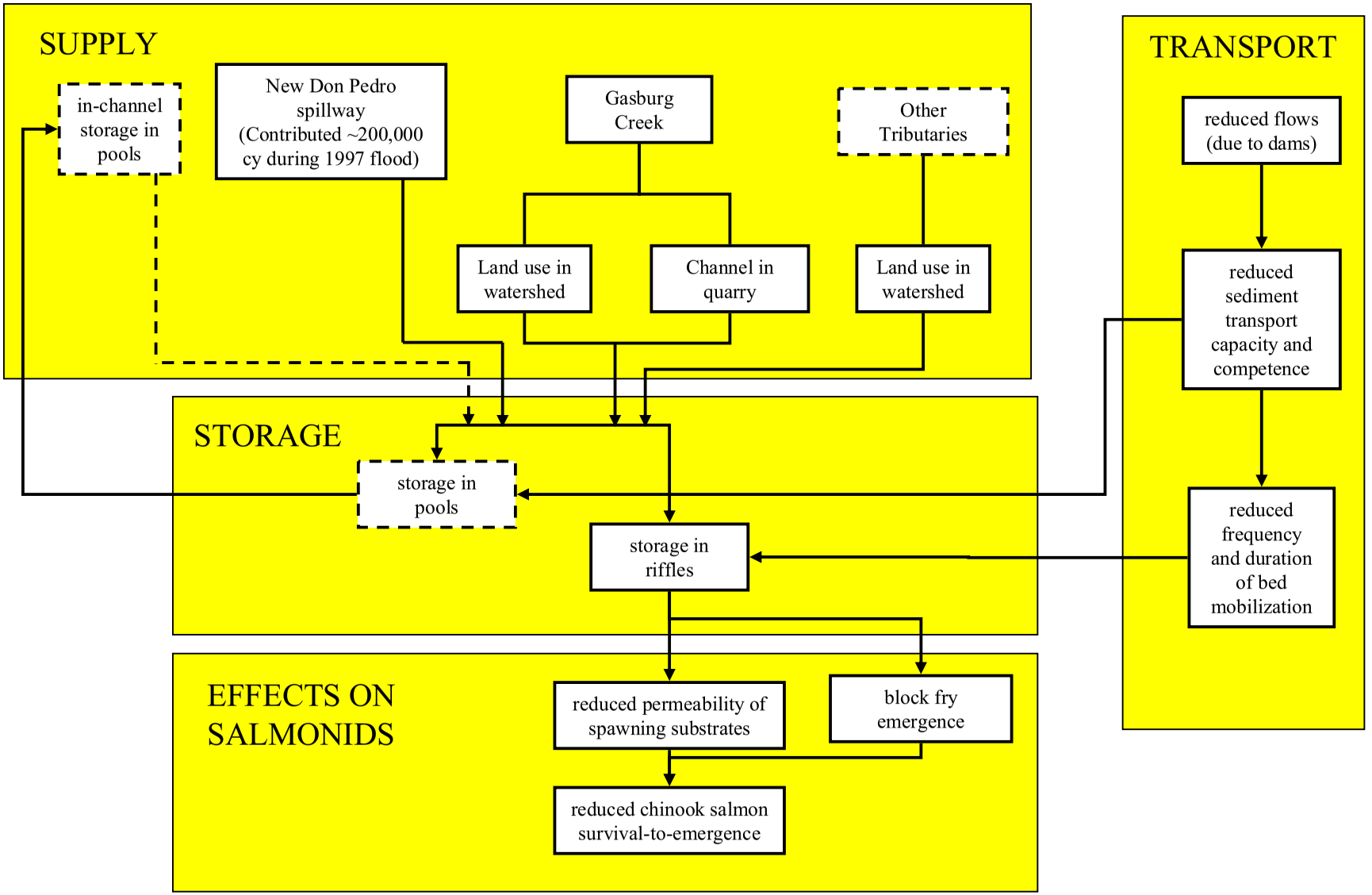
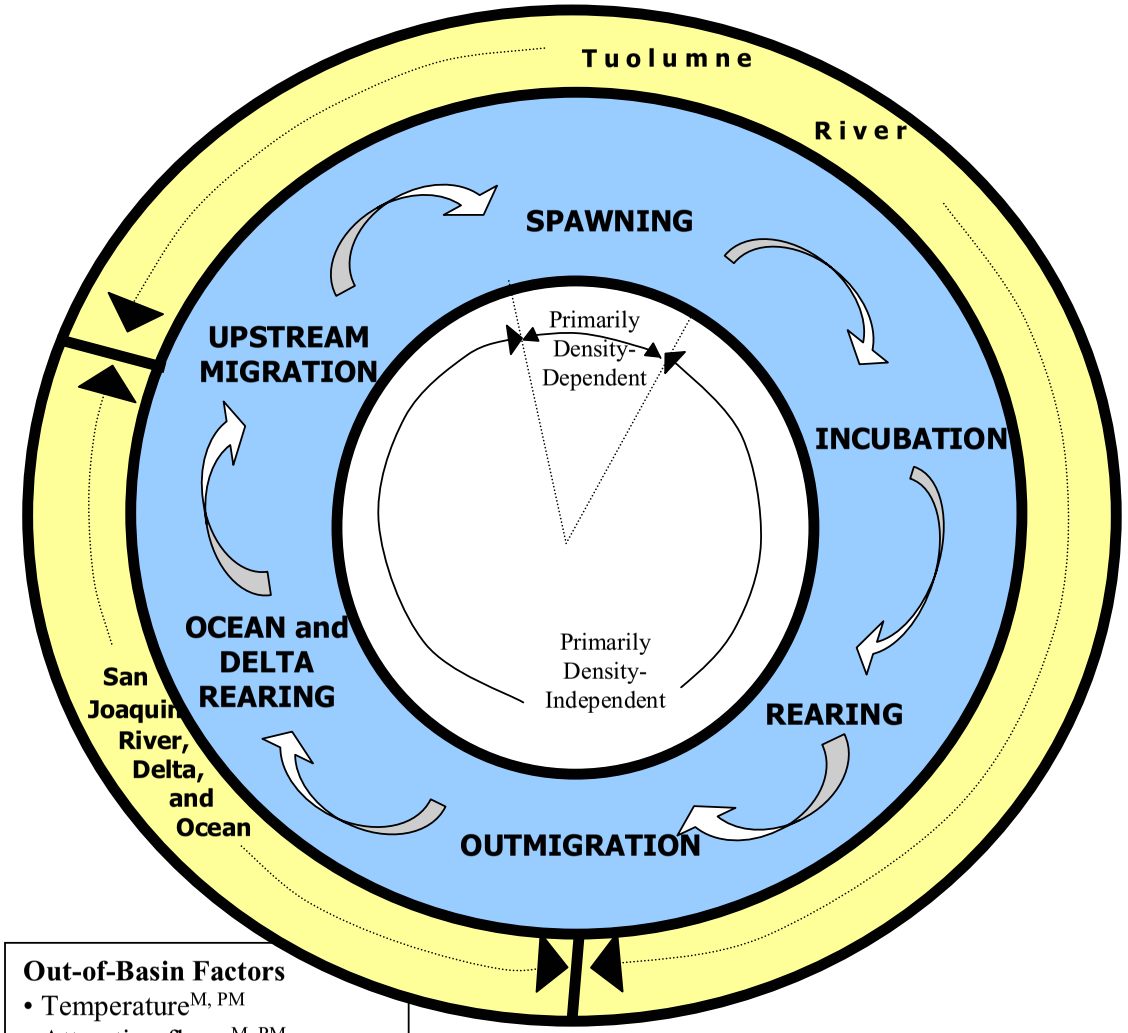


Figure 10. Conceptual model of fine sediment supply and storage in the Tuolumne River and effects in Chinook salmon survival



Key In-Basin Factors

Affecting Adult Migration
- Flow
- Temperature
- Dissolved oxygen

	submodel
Affecting Spawning and Incubation Survival	
•Redd superimposition*, PM	[S-2]
•Habitat area M, PM	[S-2, S-3]
•Substrate permeability *, PM	[S-3]
•Water temperature M, PM	[S-3]

Affecting In-river Rearing Survival
- Water temperature M, PM
- Stranding M, PM
- Food supply PM
- Flow variability M, PM
- Habitat [G-1]

Affecting Outmigration Survival

•Spring flow *, M, PM	[S-4]
•Temperature*, M, PM	[S-4]
•Predation *, M, PM	[S-4]

* Indicates factors that are considered to be limiting.
M Indicates factors that are currently being monitored.
PM Indicates factors for which past monitoring data are available.

Out-of-Basin Factors
- Temperature M, PM
- Attraction flows M, PM
- Water quality M, PM
- Dissolved oxygen M, PM
- Harvest *, M, PM
- Ocean conditions M, PM
- Delta export mortality *, M, PM

Figure 11. Conceptual model of the factors affecting Chinook salmon population abundance in the Tuolumne River

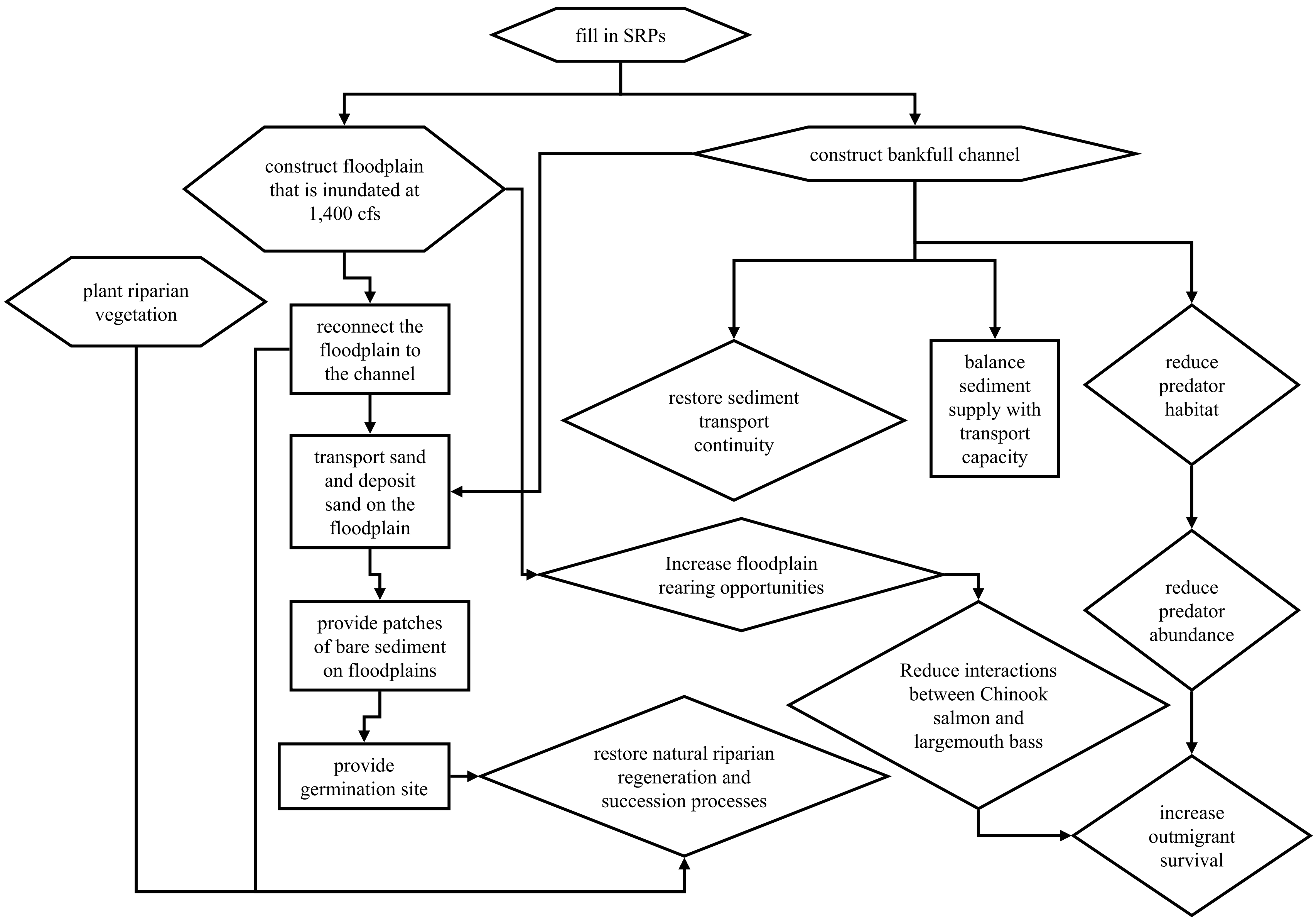


Figure 12. Conceptual model of the effects of the Special Run-Pools (SRPs) 9 and 10 Projects on geomorphic process, riparian vegetation, and Chinook salmon survival

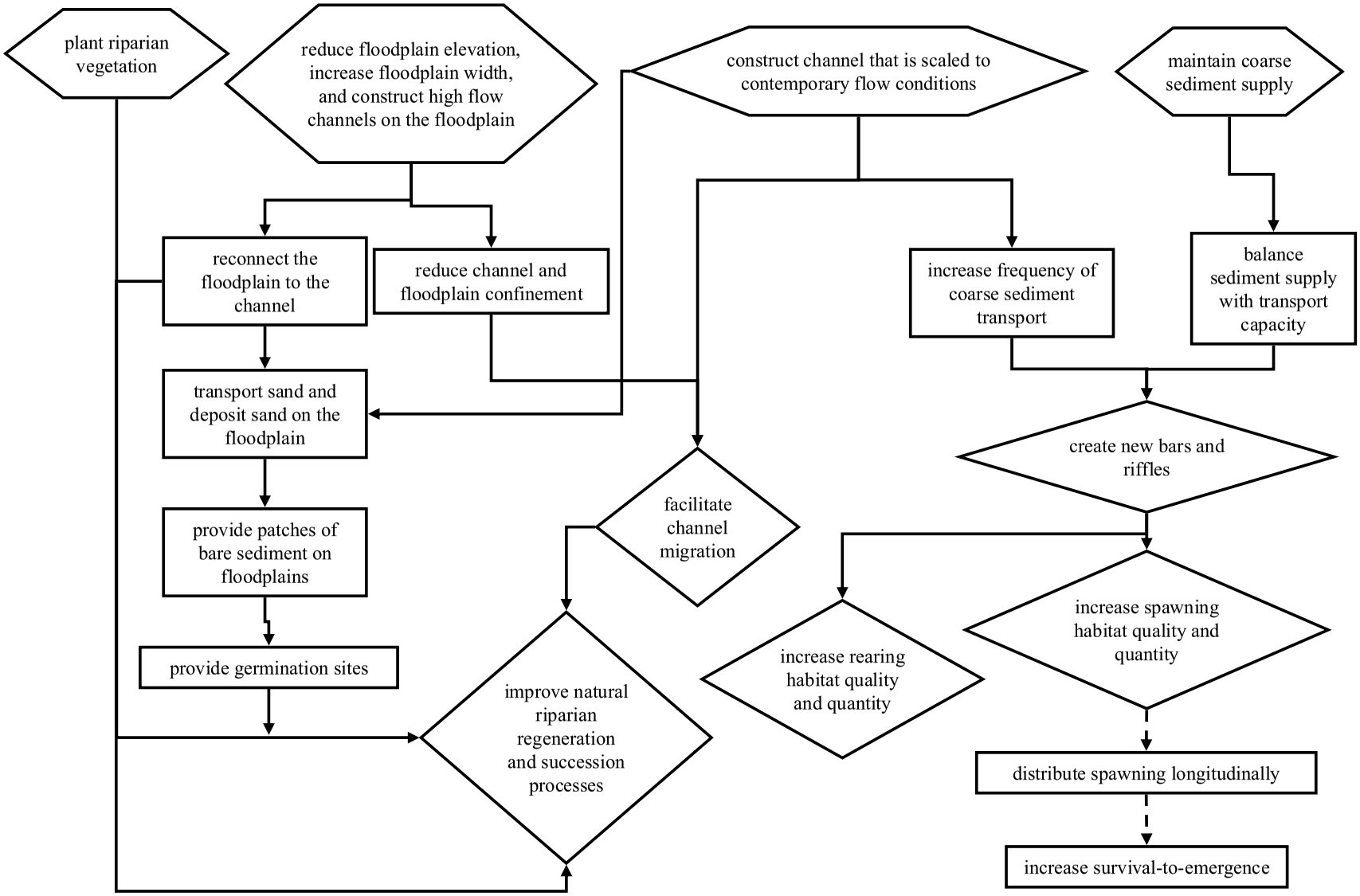


Figure 13. Conceptual model of the effects of the Gravel Mining Reach Project on geomorphic processes, riparian vegetation, and Chinook salmon survival

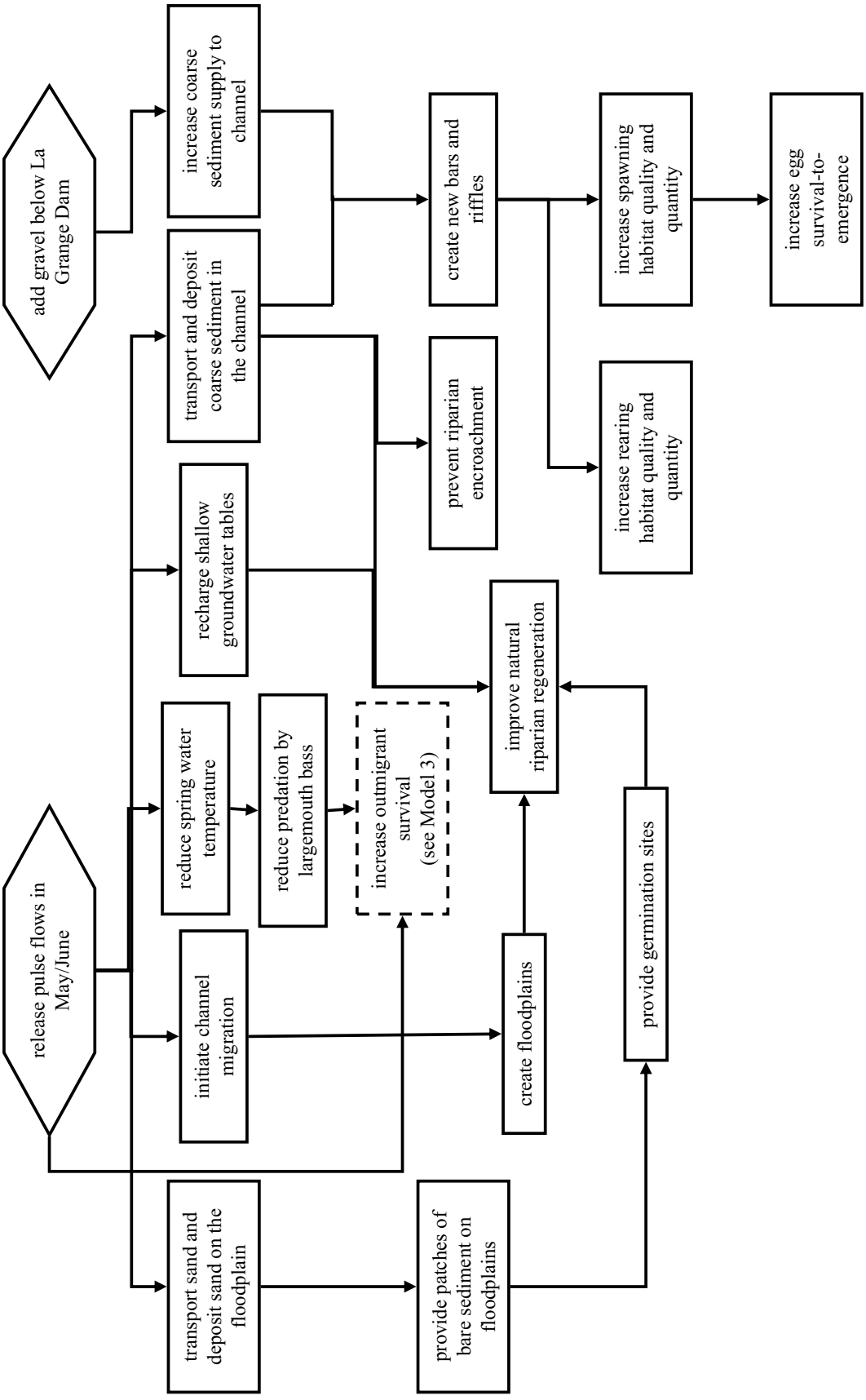


Figure 14. Conceptual model of the effects of flow and coarse sediment management on aquatic and riparian habitat

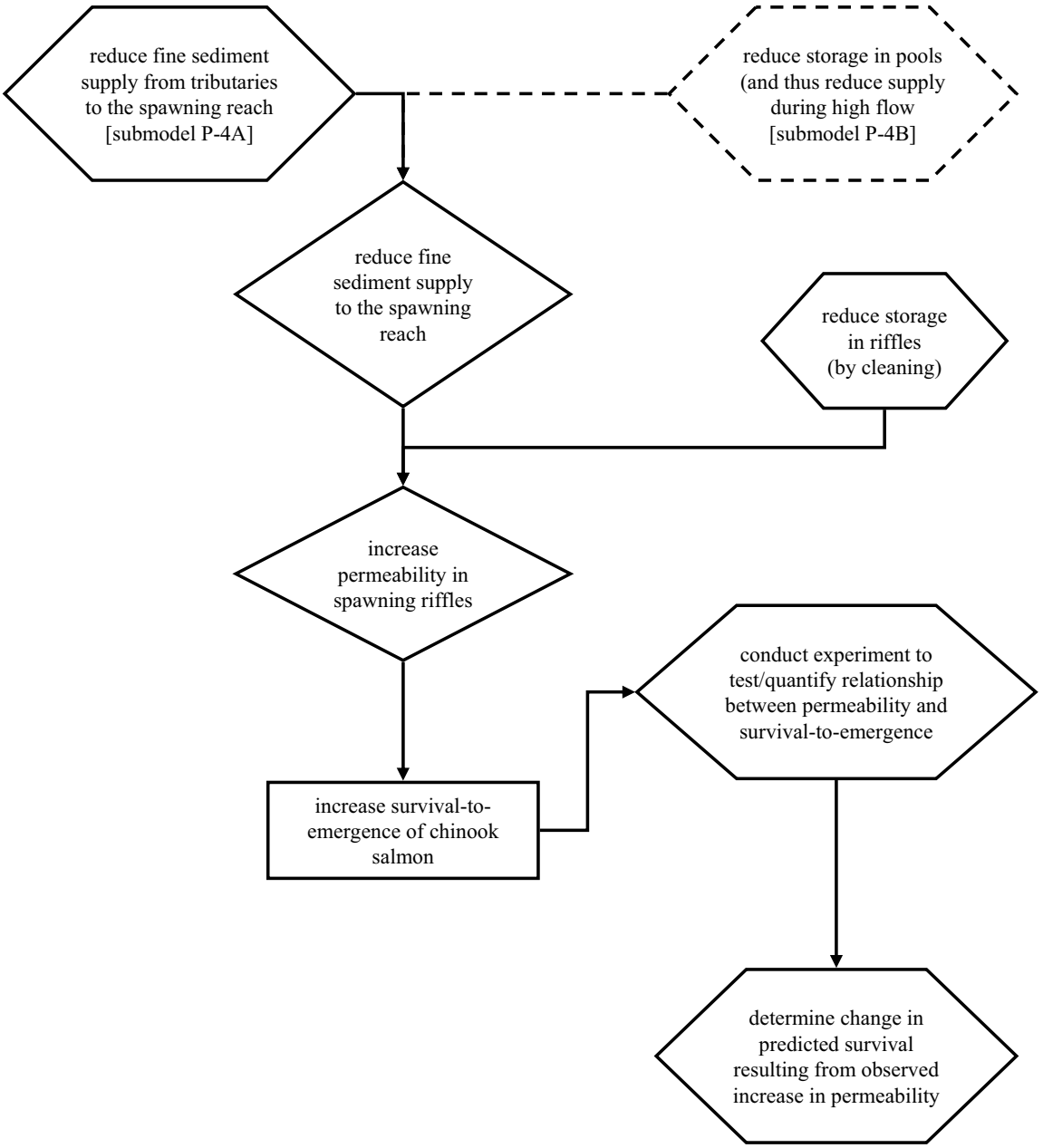
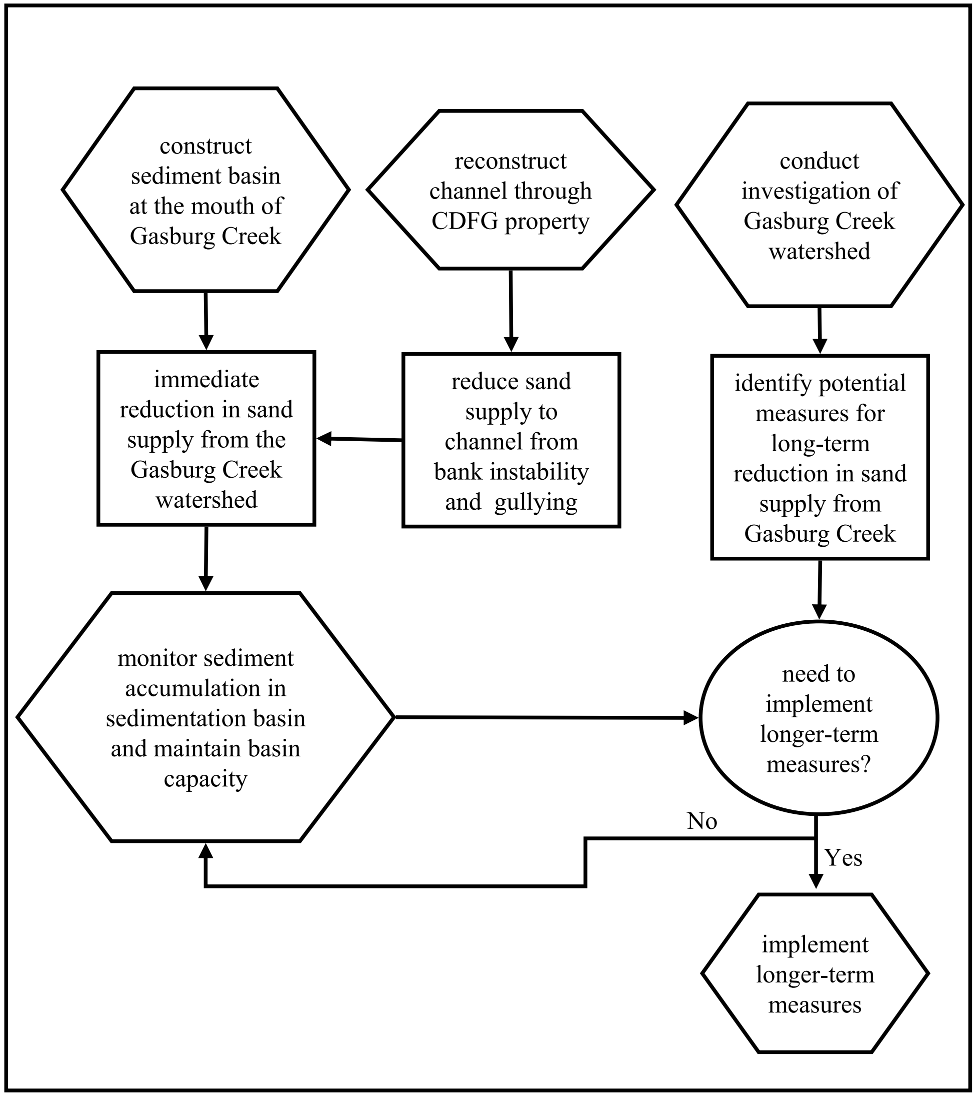
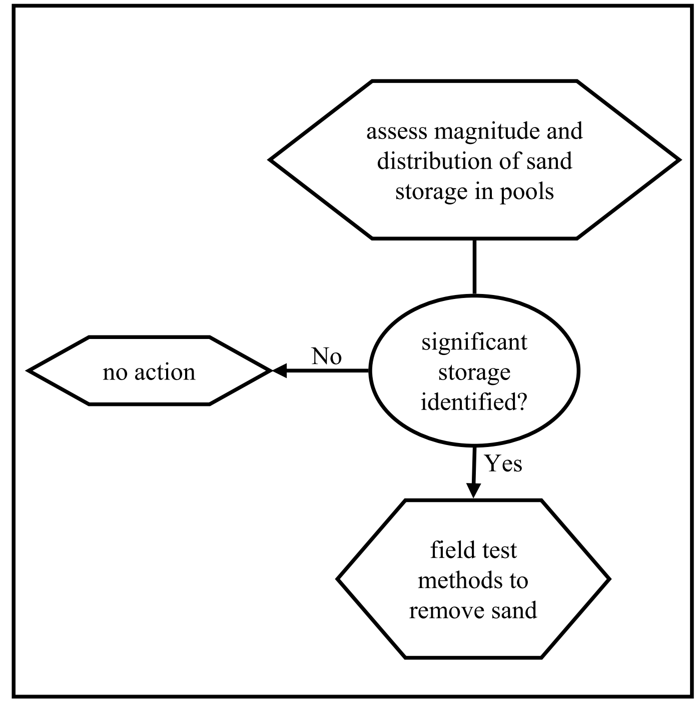


Figure 15. Conceptual model of the effects of fine sediment management on substrate conditions and Chinook salmon survival



Submodel P-4A. Reduce supply from Gasburg Creek



Submodel P-4B. Reduce storage in and supply from pools

Figure 15. Continued, submodel P-4A and P-4B

Table 1. Gravel Mining Reach funding, implementation, and monitoring status.

Project Reach (ERP and AFRP Project IDs) [Grantee]	Project Implementation Status	Project Monitoring Status
7/11 Reach (ERP-97-M09, AFRP-1997-03, ERP-98-F06) [TID]	The 7/11 Reach was funded by the CBDA for $2,801,000 and AFRP for $4,196,000, with additional funding and in-kind contributions of $448,000 from TID, MID, and CCSF. Construction of this project is complete. Grading occurred from April 2002 through March 2003, with in-channel grading limited to the summer work window defined by project permits. Planting was conducted from February through April 2003, with additional follow-up planting in January 2004. Irrigation and plant maintenance ended in September 30, 2004.	Completed monitoring includes: • Pre-project and as-built pebble counts; • Pre-project and as-built aerial photography, topography, cross sections, and profile; • Riparian vegetation as-built planting and survival (2 yrs); • Pre- and post-project Chinook salmon habitat mapping; and • Annual Chinook salmon redd counts (conducted by CDFG) • Marked rocks will be placed winter 2005 for monitoring post-project bed mobility thresholds. High flow water surface elevations will be monitored in 2005. No additional monitoring is funded at this site. Pre-project monitoring results are reported in McBain and Trush and Stillwater Sciences (1999, 2000). The as-built monitoring report is in preparation. The final report will be available in April 2005.
MJ Ruddy Segment (AFRP-1999-09) [TID]	The Project has been fully funded in the amount of $7,737,000 with $115,000 from the Districts and $7,622,000 from the AFRP. The design work is complete, ROW acquisition is underway, and construction in anticipated in the spring of 2005 with revegetation in the fall of 2005. Maintenance of revegetation plantings will extend through September 2006.	Completed monitoring includes: • Pre-project and as-built pebble counts; • Pre-project and as-built aerial photography, topography, cross sections, and profile; • Pre-project Chinook salmon habitat mapping; and • Annual Chinook salmon redd counts (conducted by CDFG) Due to a shortage of funds, CBDA eliminated post-construction monitoring from the scope of work funded by their grant. Proposed monitoring included: • As-built topography, cross sections, profile, and pebble counts; • Two repeat cross section and profile surveys with pebble counts; • Marked rock placement and maintenance for two years; • Survival, cover, and growth of planted riparian vegetation; and • Chinook salmon habitat mapping at one flow. Pre-project monitoring results are reported in McBain and Trush and Stillwater Sciences (1999, 2000). Post-project monitoring will begin in 2005.

Table 1. Continued

Warner-Deardorff (ERP-02-P19-D, AFRP-2001-02) [TID]	The Project has been fully funded with $518,670 from the US Fish & Wildlife AFRP and $10,800,000 from the CBDA. The design and permitting of the MJ Ruddy and Warner Deardorff segments has been done as one project under the District's contribution for the MJ Ruddy Segment. The design work is 90% complete; ROW acquisition will commence after completion of the MJ Ruddy ROW acquisition, and construction in anticipated in the spring of 2006 with revegetation in the fall of 2006. Maintenance of the revegetation planting will extend through September 2007.	Funded pre- and post-construction monitoring includes: • Aerial photography, topography, cross sections, profile, and pebble counts; • One repeat cross section and profile survey with pebble counts; • Marked rock placement and maintenance for one year; • Survival, cover, and growth of planted riparian vegetation; and • Chinook salmon habitat mapping at one flow. No pre-project monitoring has been conducted at this time.
Reed Segment [N/A]	While the Reed Segment has been identified as the fourth project in the Mining Reach there has been no funding by the State, Federal, or District pledged or awarded for the project at this time. In 1999 the estimated cost for this project was $3,170,000. The funding Agencies have asked to see the first three segments completed first before considering funding for the Reed Segment.	No monitoring is funded at this time.

Table 2. SRPs 9 and 10 funding, implementation, and monitoring status.

Project Reach (ERP and AFRP Project IDs) [Grantee]	Project Implementation Status	Project Monitoring Status
SRP 9 (ERP-97-M08, AFRP-1997-01) [TID]	The SRP 9 phase was funded by CBDA for $2,232,000 and AFRP for $271,000, with additional funding and in-kind contributions of $227,000 from TID, MID, and CCSF. Project construction is complete. Grading was conducted from June 1, 2001 through October 15, 2001. Revegetation was accomplished from November 1 through December 31, 2001; irrigation and planting maintenance continued through September 2003.	Completed monitoring includes: • Pre-project and as-built pebble counts; • Pre-project and as-built aerial photography, topography, cross sections, and profile; • Riparian vegetation as-built planting and survival (2 yrs); • Pre- and post-project largemouth bass and Chinook salmon habitat mapping; and • Pre- and post-project largemouth bass, smallmouth bass, and Chinook salmon habitat suitability modeling; and • Two years pre-project and one year post-project bass abundance and fish community (electrofishing) surveys. Two years of pre-project Chinook salmon survival tests were also conducted. These tests were not successful in quantifying survival through the project reach and were abandoned. Pre-project monitoring results (including survival experiments) are reported in McBain and Trush and Stillwater Sciences (1999, 2000). The as-built monitoring report is in preparation. The final report will be available in April 2005. One year of additional post-project bass abundance surveys and one year of additional assessment of Chinook salmon migration and survival was funded through an amendment in September 2004. Bass abundance surveys were attempted in October 2004 but halted sur to the presence of salmon in the river. Chinook salmon survival and bass predation assessment is scheduled for spring 2005.

Table 2. Continued

SRP 10 (ERP-99-F01, AFRP-2000-12, ERP-01-N03) [TID]	The dike repair funded by AFRP-2000-12 was completed in 2001. The remaining portions of the project are divided into two phases. Phase I involved design, ROW appraisals, and permits that has been funded by CBDA in the amount of $543,350. The design is 85% complete. Phase II has not been funded and will involve ROW acquisition, construction, and revegetation at an estimated cost of $4,250,000. It is anticipated that CBDA will have a construction funding PSP available in early 2005. Assuming the project is awarded funding by the fall of 2005 it may be possible to acquire ROW and construct in 2006. This would place revegetation in fall 2006 with maintenance extending through September 2007.	Pre-project monitoring for SRP 10 was the same as for SRP 9 and was conducted at the same time. Pre-project monitoring results (including survival experiments) are reported in McBain and Trush and Stillwater Sciences (1999, 2000). No as-built monitoring or post project monitoring is funded at this time.

Table 3. Coarse sediment augmentation funding, implementation, and monitoring status.

Project Reach (ERP and AFRP Project IDs) [Grantee]	Project Implementation Status	Project Monitoring Status
Coarse Sediment Management Plan (AFRP-2000-41) [TID]	The Tuolumne River Coarse Sediment Management Plan was completed and published in November 2003. Subsequent review of the Plan identified concerns that the coarse sediment augmentation methods and site locations included in the CSMP could adversely impact existing *O. mykiss* habitat and may not provide sufficient immediate benefit to Chinook salmon and *O. mykiss* spawning habitat. The revised CSMP was completed in July 2004.	Surveys and analyses completed for the CSMP and reported in McBain and Trush (2004) included: • Assessment of historic and current coarse sediment supply; • Baseline channel morphology surveys from La Grange Dam (RM 52) to Roberts Ferry Road (RM 39.5), including 25 channel cross sections and numerous pebble count locations; • Fine sediment and sand source evaluation and mapping of mainstem channel sand storage from La Grange Dam (RM 52) to Roberts Ferry Road (RM 39.5); • Mesohabitat mapping from La Grange Dam (RM 52) to Roberts Ferry Road (RM 39.5), including mapping of potentially important *O. mykiss* habitats. • Habitat assessment at four reference spawning riffles; • Reach-scale numerical modeling of bed mobilization thresholds and tracer rock experiments at four sites; • Reach-scale numerical modeling of bedload transport rates and bedload transport monitoring (for flows ranging from 4,020 cfs to 6,700 cfs); • Quantification of historic (pre-dam), pre-1997 flood (1988), and current riffle area; • Analysis of Chinook salmon spawning distribution based on CDFG peak redd counts (1981-2001); and • Predictive modeling of Chinook salmon population response to coarse sediment augmentation.
Spawning Gravel Introduction, Tuolumne River, La Grange at Basso Bridge (ERP-97-C11) [CDFG]	This project has been funded for $250,975 by CBDA. From 1999 through 2003, CDFG implemented several projects to place coarse sediment at Riffle 1A and Riffle A7 near La Grange. In the early 1990s, CDFG and CDWR also implemented two coarse sediment augmentation projects funded by the Four Pumps Mitigation Funf.	Completed monitoring includes: • Channel morphology (using cross section profile surveys) • Channel migration (using permanent cross section surveys) • Bed texture (using pebble counts) • Sediment transport thresholds (using tracer rocks, bulk samples); and • Pre- and post-project Chinook salmon redd counts. Results of the pre-construction and as-built monitoring are reported in CDWR (2000) and subsequent monitoring reports.

Table 3. Continued

Bobcat Flat – RM 43 ERP-00-F01 [FOT] 4 Pumps [TID]	CBDA funded a grant of $1,984,320 to Friends of the Tuolumne (FOT) for property acquisition, floodplain restoration and coarse sediment augmentation. An additional $300,000 in funding was provided to TID for coarse sediment augmentation by the California Department of Water Resources Four Pumps Project Mitigation Fund. Final coarse sediment augmentation designs are complete. Implementation is expected to occur in summer 2005.	Funded pre-project monitoring for the coarse sediment augmentation includes: • Chinook salmon habitat mapping; • Biweekly mapping of Chinook salmon redds; • Bed texture assessment (facies mapping and pebble counts); • Bed substrate assessment (bulk sampling); and • Permeability measurements at spawning riffles. Habitat mapping was completed in 2004. Chinook salmon redd mapping is being conducted November – December 2004. *O. mykiss* redd mapping will be conducted from January through June Bed texture, substrate, and permeability monitoring will be conducted in summer 2005. **No post-project monitoring is funded at this site. FOT is submitting a separate but complementary proposal for post-project *O. mykiss* and predator monitoring at this site. Post-project geomorphic and Chinook salmon monitoring is included in this proposal.**
Tuolumne River Coarse Sediment Transfusion Project (ERP-02-P29) [TID]	This project has been funded for $4,400,000 with the Districts contributing $50,000 and the CBDA contributing $4,350,000. The design and permitting work has started. The scope of the project is being amended to move funds originally slated for developing the coarse sediment sources at two offsite dredger tailings areas to purchasing of the required aggregate through commercially permitted sources. Approximately 140,000 cy of coarse sediment will be placed at in the river from La Grange to Basso Bridge. It is anticipated that placement will take two years, starting in the summer of 2005. There is no revegetation associated with the gravel transfusion project.	This project is currently under review by CBDA for a Level III amendment. If the amendment is approved, funded monitoring will include: • channel bed texture and monitor bed mobility thresholds; • reach-scale channel cross section and profile; • detailed topographic surveys at augmentation sites to quantify net sediment removal; • Reach-scale geomorphic planform and habitat mapping; and • Substrate permeability. Project design tasks in the amendment request include funds to develop a hydraulic and sediment transport model for the reach from upstream of La Grange to Roberts Ferry Bridge (i.e., the upstream end of the Gravel Mining Reach Project). Developing hydraulic and sediment transport models for the river was specifically recommended by the CALFED Adaptive Management Forum (AMF 2001).

Table 4. Fine sediment management funding, implementation, and monitoring status.

Project Reach (ERP and AFRP Project IDs) [Grantee]	Project Implementation Status	Project Monitoring Status
Fine Sediment Management Plan: Part 1 – Riffle Cleaning (ERP-01-N09) [TID]	The project has been funded by CBDA in the amount of $404,230. Project components include: (1) cleaning (i.e. removing sand and fine sediment) five Chinook salmon spawning riffles; and (2) quantifying the relationship between substrate permeability and Chinook salmon survival-to-emergence. The survival to emergence study has been conducted. Experiments to quantify the relationship between substrate permeability and Chinook salmon survival-to-emergence were conducted in 2001. Due to late implementation and the possibility of using eggs from an unripe female, many of the planted eggs died due to disease, parasites, or other factors not related to substrate permeability. Although results generally support project hypotheses, additional funding is being sought to conduct additional experiments that will data points in the mid-range of permeabilities observed in the Tuolumne River. The methods and equipment for cleaning sand from riffles were evaluated and are reported in the CSMP (McBain and Trush 2004). It is anticipated riffle cleaning will be conducted in the summer of 2005.	Funded monitoring includes permeability measurements at cleaned riffles pre-cleaning, immediately following cleaning, and one year after cleaning. Permeability monitoring at cleaned riffles will be conducted in summer 2005.
Fine Sediment Management Plan: Part 2 – Gasburg Creek Sediment Reduction (ERP-01-N09) [TID]	The project has been funded by CBDA in the amount of $590,880. Project components include: (1) quantify sediment supply and sources from Gasburg Creek; (2) design and implement restoration in lower Gasburg Creek; and (3) design and construct an interim sedimentation basin in lower Gasburg Creek. The Gasburg Creek sediment source analysis is complete and is reported in Stillwater Sciences (2004). Conceptual sedimentation basin and creek restoration designs are complete. Construction is scheduled for summer 2005. CDFG has requested the option of constructing the works and revegetation rather than going out for bids on the restoration work.	Funded monitoring includes: • As-built and 1 year post-project sedimentation basin surveys; and • As-built and 1 year post-project channel cross sections and vegetation surveys. Gasburg Creek monitoring will be conducted in 2005 and 2006.

Table 5. Monitoring hypotheses, metrics, methods, and relationships to other monitoring across spatial scales for funded and proposed tasks.

7/11, M.J. RUDDY, AND SRP 9 MONITORING (site-scale)

Hypotheses

H1. The constructed channel conveys 5,000 cfs; flows exceeding 5,000 cfs spill over onto the floodplain.
H2. The channel bed is mobilized at flows of 5,000 cfs.
H3. The constructed bankfull channel morphology is stable, where stable is defined as the longer-term channel dimensions under a dynamic channel morphology.
H4. The channel migrates under the current flow regime, although migration rates will be small.
H5. The extent and quality of Chinook salmon spawning and rearing habitat is increased.
H6. Chinook salmon spawning and rearing densities in the project reach will be similar to in nearby "healthy" river reaches and significantly higher than nearby mined reaches.
H7. Planted riparian vegetation will become established on the constructed floodplain.
H8. Natural recruitment of native riparian plant species will occur on the constructed floodplain.
H9. Riparian vegetation will not encroach into the constructed channel.
H10. Establishment of planted riparian vegetation will result in increased abundance and diversity of native, riparian nesting songbirds.

H12. Elimination of the pits will result in reduction of largemouth bass abundance at the project sites and an increase in Chinook salmon outmigrant survival at the project sites.

Hypothesis	Task	Metric	Method	Relationship to Other Monitoring of Other Metrics or Scales
H3, H9	3A	Channel morphology	Digital terrain mapping	Pre- and post-project digital terrain models for 7/11 and SRP 9 are complete.
			Cross sections and profile: Pre-project and as-built. Post-project surveyed after each of two high flow events exceeding 5,000 cfs.	Site-specific cross sections and profiles augment channel surveys that extend from RM 52 to RM 36 (see Task 5B). Twenty-five (baseline) cross sections have been surveyed from La Grange (RM 52) to Basso Bridge (RM 47.5).
	3C	Channel migration	Low altitude aerial photographs: One time following a flow > 9,000 cfs (i.e., the maximum in-channel flow under ACOE flood rules).	Site aerial photographs can also be used to assess riparian vegetation establishment at the restoration site (see Task 3F).
H1	3D, 3E	Hydraulics	Monitoring of water surface elevation during first high flow after construction that meets or exceeds design discharge	Project-specific HEC-RAS models developed for the Gravel Mining Reach can be linked to the HEC-RAS model for the La Grange to Roberts Ferry reach to developed with funds from the Tuolumne River Sediment Transfusion Project design task.
H2	3B	Bed mobility	Tracer rocks representing D_{50} and D_{84} particle sizes at two riffles in the SRP 9 reach placed at monitoring cross sections (see H3/H9 above)	Project-specific bed mobility monitoring will augment reach-scale monitoring proposed in Task 5A.
			Pebble counts and bulk samples at two reconstructed riffles in each phase	Project-specific bed texture and substrate composition data can augment reach-scale data included in Task 5A.
H5	N/A	Habitat structure and suitability	Habitat mapping at low and high flows	Pre- and post-project habitat mapping in the 7/11 Reach and habitat suitability modeling for largemouth and smallmouth bass and juvenile Chinook salmon in the SRP 9 reach is complete. No addition habitat mapping or modeling is proposed.

Table 5. Continued

H6	3H	Spawning utilization and habitat characterization	Biweekly redd counts at each reconstructed riffle in the reach, combined with measurement of flow depth, flow velocity, and temperature during spawning.	Redd counts conducted weekly by CDFG from RM 51.6 to RM 26 from 1981-2004 will provide control sites and baseline data, as well as river-wide context for spawning use at each riffle. Continuation of CDFG redd counts is proposed in Task 6D.
H6	3i	Juvenile salmonid density and size	Weekly seine surveys at least one location in each project reach	Seine surveys conducted annually by TID from 1986 through 2004 will provide control sites and river-wide context for juvenile distribution, density, and size. Continuation of these surveys is proposed in Task 6B.
H7	3F, 3G, 3J	Survival, growth, and cover of planted riparian vegetation	Plot-based survival, percent cover, and growth, with plots located along cross sections established for geomorphic monitoring at Year 0 (as built), Year 2 (end of irrigation), and Years 3 and 5. (Years 3 and 5 are not funded.)	N/A
H8	3G	Seedling establishment (for native woody riparian plants)	Annual plot-based surveys documented seedling species and age on floodplain surfaces. Analysis of flow conditions associated with seedling establishment (from water surface monitoring in 3E combined with nearby streamflow gauge data).	Seedling recruitment and establishment surveys will use methods that are comparable to seedling recruitment studies being conducted on the Merced and Tuolumne rivers by John Stella (university of California - Berkeley) and Stillwater Sciences with funding from the CBDA. Application of similar methods will support comparison of results between watersheds and will improve the utility of the recruitment models being developed to restoration design in the Central Valley.
H10	N/A	Predator abundance (SRPs 9 and 10 only)	Depletion electrofishing (at project and reference sites), baseline: summer 1998 and 1999, post-project: summer 2003.	N/A
H11	N/A	Juvenile Chinook salmon survival (SRPs 9 and 10 only)	Mark-recapture at rotary screw traps: pre-project (1998 and 1999)[1]	N/A. This monitoring was not successful. Implementation was not able to satisfy model assumptions. Results and violations of the assumptions are reported in Stillwater Sciences (1998 and 1999).
H11, H12	N/A	Predation rates on juvenile salmon	Quantification of predation rates at SRP 9 and control SRP and channel sites during spring outmigration	This task is funded under the existing SRP 10 project funds and will be implemented in spring 2004. TID is working with Stillwater Sciences to develop a proposal to submit to the Science Program in January 2005 to assess river-wide predator distribution, abundance, and population dynamics.

Table 5. Continued

FINE SEDIMENT MANAGEMENT (site-scale and reach-scale)

Hypotheses

H1. Gasburg Creek is a major source of fine sediment and sand to the Tuolumne River primary spawning reach. The interim sedimentation basin will reduce fine sediment and sand yield to the river.

H2. The reconstructed Gasburg Creek channel will remain stable in cross section and profile.

H3. Planted riparian vegetation along the reconstructed Gasburg Creek will achieve at least 75% survival following two years after irrigation is ended.

H4. Accumulation of fine sediment and sand in the bed of the Tuolumne River has reduced substrate permeability to levels that limit salmon survival-to-emergence.

H6. In cleaned riffles, substrate permeability will increase to levels that can support at least 80% survival-to-emergence (assuming that temperature or other factors do not limit survival-to-emergence). As sediment accumulates in riffles following project construction, permeability will decrease over a period of years eventually returning to pre-cleaning conditions. (The period of time over which increased permeability is observable is not known.)

H7. Reducing the volume of fine sediment stored in riffles will alter invertebrate habitat, leading to a shift from armored to soft-boded organisms and providing greater productivity and food value for salmonids and other native fish species.

H8. Chinook salmon will preferentially utilize cleaned riffles and coarse sediment augmentation sites for spawning (compared to nearby uncleaned, "natural" riffles with similar

H9. The increase in spawning habitat area (resulting from coarse sediment augmentation) will reduce redd superimposition and shift stock-recruitment curves up (i.e., increase recruitment per female spawner).

Hypothesis	Task	Metric	Method	Relationship to Other Monitoring of Other Metrics or Scales
H1	4A	Sediment accumulation in the sedimentation basin	Repeat total station surveys on the sedimentation basin	Observed sediment accumulation in the sedimentation basin can be used to verify the conclusions of the Gasburg Creek Sediment Source Analysis (Stillwater Sciences 2004).
H2	4B	Channel morphology	Repeat cross section and profile surveys	N/A
H3	4B	Survival and percent cover of planted riparian vegetation	Plot-based survival, percent cover, and growth, with plots located along cross sections established for geomorphic monitoring at Year 0 (as built), Year 2 (end of irrigation), and Years 3 and 5. (Years 3 and 5 are not funded.)	N/A
H1	4C	Suspended sediment transport	Synoptic suspended sediment monitoring in potential high yield tributaries during similar storm events	Potential high yield tributaries were identified through reconnaissance-level field surveys of watershed conditions and sediment storage in the mainstem channel funded by the Coarse Sediment Management Plan grants and are reported in McBain and Trush (2004).
H7	4D	Benthic macroinvertebrate composition, abundance, biomass and diversity	Hess samples (3/site) collected at five sites over three summers (total of seven sample events at each site)	The proposed sample design includes treated and untreated, baseline and post-treatment samples sufficient to conduct a BACI analysis. Additional reach-scale baseline data are available from invertebrate trend monitoring conducted by the Districts in 1996, 1997, 2000–2004. The 2000-2004 monitoring used the CSBP protocols. Continuation of macroinvertebrate trend monitoring is included in Task 6F.

Table 5. Continued

H8, H9	4E	Redd distribution and superimposition	Repeat redd mapping and redd characterization at six monitoring sites extending over Chinook salmon spawning season for three years, combined with measuring flow depth and flow velocity at a subset of redds.	This task also provides data for monitoring effectiveness of coarse sedoment augmentation. Redd counts conducted weekly by CDFG from RM 51.6 to RM 26 from 1981-2004 will provide additional baseline data, as well as river-wide context for spawning use at each riffle. Continuation of CDFG redd counts is proposed in Task 6D.
H6	N/A	Substrate permeability	Permeability measurements at five cleaned riffles for three years using methods and sampling described in Stillwater Sciences 2001 (This sampling approach was developed to provide sufficient power to detect a 20% change in predicted salmon survival to emergence.)	**Continued permeability monitoring at cleaned riffles is included in Task 5E.** One year of post-project permeability monitoring in the five cleaned riffles is included in the current Fine Sediment Management Plan contract. Assuming that cleaning is implemented in 2005, proposed monitoring in Task 5E would add two years to post-project monitoring.

Table 5. Continued

COARSE SEDIMENT MANAGEMENT (site-scale and reach-scale)

Hypotheses

H1. An increase in coarse sediment supply will increase low-flow and bankfull channel confinement and reduce the particle size distribution of the channel bed substrates, thereby lowering bed mobility thresholds and increasing the frequency of bed mobility.

H2. An increase in coarse sediment supply will encourage channel migration, floodplain formation, lateral bar formation important for sediment storage and fry rearing, and

H3. An increase in coarse sediment supply, reduction in particle size distribution, and an increase in the frequency of bed mobilization will increase (over existing conditions) the volume of sediment augmentation needed to maintain equilibrium of in-channel sediment storage and downstream transport.

H4. Increasing sediment supply (in conjunction with periodic high flows) will increase salmonid spawning habitat availability in the gravel-bedded zone to habitat quantities approaching the density in the reach between New La Grange Bridge and Basso Bridge.

H5. The density of fall-run Chinook salmon redds will be higher in unconsolidated introduced coarse sediment than at unrestored, embedded spawning gravels (from CMC 2002a).

H6. Salmonid spawning gravel without fine sediment added to the channel will increase intragravel flow of water in redds (from CMC 2001).

Hypothesis	Task	Metric	Method	Relationship to Other Monitoring of Other Metrics or Scales
H1	5A, 5B	Channel morphology and surface particle mobility thresholds	Survey channel cross sections to document channel readjusting its dimensions as sediment augmentation proceeds; collect pebble counts and install tracer rocks to document mobility thresholds;	As channel dimensions change, particle mobility thresholds should become lower and particle size should become smaller. Sediment transport rates and frequency of bed mobilization will increase due to lower mobility thresholds and smaller particle size;
H2	5B, 5D	Planform mapping	Map geomorphic features as baseline conditions and after implementation of Sediment Transfusion Phase III;	Seining surveys will target sampling reconstructed banks or freshly deposited bar features that have suitable rearing habitat; aerial photos will documents fine sediment deposition on floodplains, especially within project reaches
H3	5A, 5C	Channel morphology and sediment transport measurements	Sediment transport rating curve and sediment routing model	The scale of this hypothesis is across several decades, as enough sediment has been added to affect the particle size and mobility thresholds, bedload impedence reaches are restored, and sediment can route through the entire river system.
H4	5D	Planform habitat mapping	Repeat mapping of spawning habitat area through the gravel-bedded reach to document habitat availability	Increase in spawning habitat area will reduce density-dependent mortality of chinook that results from redd superimposition.
H5	5D	Planform habitat mapping	Use redd mapping data and estimates of habitat area to	Redd mapping is Task 4e
H6	5E	Permeability and particle size composition	Permeability measurements at 14 riffles for two of three years using methods and sampling described in Stillwater Sciences 2001; Data from bulk sampling to estimate percentage of fine sediments detrimental to egg incubation;	Task 5A also employs methods that would allow long-term monitoring of fine sediment deposition into restored spawning gravels.

Table 6. Project Schedule*

	TASKS	2006												2007												2008											
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1	**PROJECT MANAGEMENT**																																				
	Quarterly reports			■				■			■			■			■			■			■			■			■			■			■		
2	**PUBLIC PARTICIPATION**																																				
2a.	TRTAC participation			■				■			■			■			■			■			■			■			■			■			■		
2b.	Brochure development																															■					
2c.	CALFED Science Conference + publications																																		■		
3	**CONTINUE 7/11, MJR, AND SRP9 PROJECT MONITORING**																																				
3a.	Resurvey cross sections and a longitudinal profiles	■										■												■								■					
3b.	Deploy and maintain tracer rocks	■										■												■								■					
3c.	Map channel migration and other planform changes											■												■								■					
3d.	Monitor peak flow water surface elevations	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3e.	Continuous water surface monitoring	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3f.	Monitor planted vegetation							■													■												■					
3g.	Monitor natural recruitment							■													■												■					
3h.	Map spawning location and habitat characteristics											■	■											■	■											■	■
3i.	Conduct Seine Surveys	■	■	■	■	■								■	■	■	■	■								■	■	■	■	■								
3j.	Monitor Groundwater	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3k.	Monitor avian species					■	■											■	■											■	■						
3l.	Report preparation and distribution																																■	■	■	■	■
4	**CONTINUE FINE SEDIMENT MANAGEMENT MONITORING**																																				
4a.	Quantify annual sediment accumulation							■												■												■					
4b.	Monitor channel stability and riparian vegetation							■												■												■					
4c.	Monitor tributary fine sediment contribution	■	■	■									■	■	■	■									■	■	■	■									
4d.	Benthic Macroinvertebrate monitoring						■	■	■	■										■	■	■	■									■	■	■	■		
4e.	Quantify Chinook salmon spawning habitat selection and redd superimposition											■	■											■	■											■	■
4f.	Report preparation and distribution																																■	■	■	■	■
5	**AUGMENT BASELINE AND POST-PROJECT MONITORING FOR COARSE SEDIMENT AUGMENTATION**																																				
5a.	Map Sediment Facies, Pebble Counts, Install Tracer Rocks, Scour Cores	■										■												■								■					
5b.	Survey XS's, LP's, Topography	■										■												■								■					
5c.	Sediment Transport Measurements at R4B	■	■	■									■	■	■	■									■	■	■	■									
5d.	Planform Mapping (alluvial features and meso/microhabitat)							■												■												■					
5e.	Monitor permeability							■												■												■					
5f.	Report preparation and distribution												■												■								■	■	■	■	■
6	**MONITORING OF CUMULATIVE EFFECTS ON TARGET POPULATIONS [CHINOOK SALMON AND O. MYKISS]**																																				
6A.	Juvenile Chinook salmon production and outmigration timing	■	■	■	■	■	■							■	■	■	■	■	■							■	■	■	■	■	■						
6b.	Juvenile Chinook salmon and O. mykiss distribution, abundance, and size (winter and spring)	■	■	■	■	■								■	■	■	■	■								■	■	■	■	■							
6c.	Juvenile Chinook salmon and O. mykiss distribution (summer)						■	■	■	■										■	■	■	■									■	■	■	■		
6d.	Chinook salmon adult escapement and redd distribution										■	■	■	■									■	■	■	■									■	■	■
6e.	O. mykiss adult distribution and redd distribution	■	■	■	■	■	■					■	■	■	■	■	■	■	■					■	■	■	■	■	■	■							
6f.	Benthic macroinvertebrate composition, abundance, and diversity indices.						■	■	■	■										■	■	■	■									■	■	■	■		
N/A	Report preparation and distribution (In the scope of work, report funds are included in each task.)											■	■											■	■										■	■	■
7	**Aerial photography, orthorectification, photogrammetry, and bathymetry**																																				
7a.	Air photo flight from LaGrange to San Joaquin River		■																																		
7b.	Install ground control points	■																																			
7c.	Orthorectify aerial photographs				■	■																															
7d.	Photogrammetry topography					■	■																														
7e.	Survey channel bathymetry							■	■																												

**Schedule assumes CBDA Action by June 2005 (as stated in the PSP, p. 24) and contract issuance by December 31, 2005.*

Table 7. Summary of detailed project task and subtask costs for contractors by year.

		YEAR																	
		2006						2007						2008					2006-2008
		TID	M&T	SS	CDFG	SPC	TOTAL	TID	M&T	SS	CDFG	SPC	TOTAL	TID	M&T	SS	CDFG	SPC	TOTAL	TOTAL
TASK 1.	**PROJECT MANAGEMENT**	**$18,000**	**$0**	**$0**	**$0**	**$0**	**$18,000**	**$18,000**	**$0**	**$0**	**$0**	**$0**	**$18,000**	**$18,000**	**$0**	**$0**	**$0**	**$0**	**$18,000**	**$54,000**
TASK 2.	**PUBLIC PARTICIPATION**	**$0**	**$8,900**	**$0**	**$0**	**$0**	**$8,900**	**$0**	**$9,300**	**$0**	**$0**	**$0**	**$9,300**	**$0**	**$67,500**	**$0**	**$0**	**$0**	**$67,500**	**$85,700**
2a.	TRTAC participation	$0	$8,900	$0	$0	$0	$8,900	$0	$9,268	$0	$0	$0	$9,268	$0	$9,654	$0	$0	$0	$9,654	$27,822
2b.	Brochure development	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$25,177	$0	$0	$0	$25,177	$25,177
2c.	CALFED Science Conference + publications	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$32,627	$0	$0	$0	$32,627	$32,627
TASK 3.	**CONTINUE 7/11, MJR, AND SRP9 PROJECT MONITORING**	**$0**	**$117,600**	**$0**	**$0**	**$20,500**	**$138,100**	**$0**	**$51,300**	**$0**	**$0**	**$21,000**	**$72,300**	**$0**	**$119,000**	**$0**	**$0**	**$21,500**	**$140,500**	**$350,900**
3a.	Resurvey cross sections and a longitudinal profiles	$0	$28,552	$0	$0	$0	$28,552	$0	$9,027	$0	$0	$0	$9,027	$0	$22,189	$0	$0	$0	$22,189	$59,767
3b.	Deploy and maintain tracer rocks	$0	$8,158	$0	$0	$0	$8,158	$0	$2,579	$0	$0	$0	$2,579	$0	$6,340	$0	$0	$0	$6,340	$17,076
3c.	Map channel migration and other planform changes	$0	$4,079	$0	$0	$0	$4,079	$0	$1,290	$0	$0	$0	$1,290	$0	$3,170	$0	$0	$0	$3,170	$8,538
3d.	Monitor peak flow water surface elevations	$0	$11,220	$0	$0	$0	$11,220	$0	$4,367	$0	$0	$0	$4,367	$0	$3,259	$0	$0	$0	$3,259	$18,846
3e.	Continuous water surface monitoring	$0	$1,800	$0	$0	$0	$1,800	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,800
3f.	Monitor planted vegetation	$0	$21,840	$0	$0	$0	$21,840	$0	$0	$0	$0	$0	$0	$0	$22,890	$0	$0	$0	$22,890	$44,730
3g.	Monitor natural recruitment	$0	$5,470	$0	$0	$0	$5,470	$0	$6,860	$0	$0	$0	$6,860	$0	$12,910	$0	$0	$0	$12,910	$25,240
3h.	Map spawning location and habitat characteristics	$0	$0	$0	$0	$20,500	$20,500	$0	$0	$0	$0	$21,012	$21,012	$0	$0	$0	$0	$21,538	$21,538	$63,050
3i.	Conduct Siene Surveys	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
3j.	Monitor Groundwater	$0	$13,254	$0	$0	$0	$13,254	$0	$3,546	$0	$0	$0	$3,546	$0	$3,978	$0	$0	$0	$3,978	$20,777
3k.	Monitor avian species	$0	$15,000	$0	$0	$0	$15,000	$0	$15,000	$0	$0	$0	$15,000	$0	$15,000	$0	$0	$0	$15,000	$45,000
3l.	Report preparation and distribution	$0	$8,201	$0	$0	$0	$8,201	$0	$8,604	$0	$0	$0	$8,604	$0	$29,296	$0	$0	$0	$29,296	$46,101
TASK 4.	**CONTINUE FINE SEDIMENT MANAGEMENT MONITORING**	**$0**	**$8,400**	**$43,300**	**$0**	**$0**	**$51,700**	**$0**	**$33,200**	**$56,200**	**$0**	**$0**	**$89,400**	**$0**	**$58,900**	**$140,300**	**$0**	**$0**	**$199,200**	**$340,300**
4a.	Quantify annual sediment accumulation	$0	$0	$0	$0	$0	$0	$0	$13,106	$0	$0	$0	$13,106	$0	$12,537	$0	$0	$0	$12,537	$25,643
4b.	Monitor channel stability and riparian vegetation	$0	$0	$0	$0	$0	$0	$0	$11,393	$0	$0	$0	$11,393	$0	$19,455	$0	$0	$0	$19,455	$30,848
4c.	Monitor tributary fine sediment contribution	$0	$8,407	$0	$0	$0	$8,407	$0	$8,712	$0	$0	$0	$8,712	$0	$15,415	$0	$0	$0	$15,415	$32,534
4d.	Benthic Macroinvertebrate monitoring	$0	$0	$14,066	$0	$0	$14,066	$0	$0	$23,570	$0	$0	$23,570	$0	$0	$76,341	$0	$0	$76,341	$113,978
4e.	Quantify Chinook salmon spawning habitat selection and redd superimposition	$0	$0	$29,223	$0	$0	$29,223	$0	$0	$32,675	$0	$0	$32,675	$0	$0	$63,984	$0	$0	$63,984	$125,882
4f.	Report preparation and distribution	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$11,475	$0	$0	$0	$11,475	$11,475
TASK 5.	**AUGMENT BASELINE AND POST-PROJECT MONITORING FOR COARSE SEDIMENT AUGMENTATION**	**$0**	**$141,900**	**$27,600**	**$0**	**$0**	**$169,500**	**$0**	**$89,300**	**$17,000**	**$0**	**$0**	**$106,300**	**$0**	**$127,400**	**$11,600**	**$0**	**$0**	**$139,000**	**$414,800**
5a.	Map Sediment Facies, Pebble Counts, Install Tracer Rocks, Scour Cores	$0	$19,221	$0	$0	$0	$19,221	$0	$20,182	$0	$0	$0	$20,182	$0	$21,191	$0	$0	$0	$21,191	$60,594
5b.	Survey XS's, LP's, Topography	$0	$31,945	$0	$0	$0	$31,945	$0	$0	$0	$0	$0	$0	$0	$33,542	$0	$0	$0	$33,542	$65,487
5c.	Sediment Transport Measurements at R4B	$0	$33,938	$0	$0	$0	$33,938	$0	$35,635	$0	$0	$0	$35,635	$0	$37,417	$0	$0	$0	$37,417	$106,990
5d.	Planform Mapping (alluvial features and meso/microhabitat)	$0	$24,830	$0	$0	$0	$24,830	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$24,830
5e.	Monitor permeability	$0	$0	$27,588	$0	$0	$27,588	$0	$0	$16,967	$0	$0	$16,967	$0	$0	$11,594	$0	$0	$11,594	$56,149
5f.	Report Preparation	$0	$31,932	$0	$0	$0	$31,932	$0	$33,529	$0	$0	$0	$33,529	$0	$35,205	$0	$0	$0	$35,205	$100,666
TASK 6.	**MONITORING OF CUMULATIVE EFFECTS ON TARGET POPULATIONS [CHINOOK SALMON AND O. MYKISS]**	**$0**	**$0**	**$118,600**	**$150,700**	**$0**	**$269,300**	**$0**	**$0**	**$129,700**	**$150,700**	**$0**	**$280,400**	**$0**	**$0**	**$184,700**	**$150,700**	**$0**	**$335,400**	**$885,100**
6A.	Juvenile Chinook salmon production and outmigration timing	$0	$0	$0	$131,748	$0	$131,748	$0	$0	$0	$131,748	$0	$131,748	$0	$0	$0	$131,748	$0	$131,748	$395,243
6b.	Juvenile Chinook salmon and O. mykiss distribution, abundance, and size (winter and spring)	$0	$0	$37,609	$0	$0	$37,609	$0	$0	$41,151	$0	$0	$41,151	$0	$0	$69,963	$0	$0	$69,963	$148,723
6c.	Juvenile Chinook salmon and O. mykiss distribution (summer)	$0	$0	$33,095	$0	$0	$33,095	$0	$0	$34,419	$0	$0	$34,419	$0	$0	$35,796	$0	$0	$35,796	$103,311
6d.	Chinook salmon adult escapement and spawning distribution	$0	$0	$0	$18,961	$0	$18,961	$0	$0	$0	$18,961	$0	$18,961	$0	$0	$0	$18,961	$0	$18,961	$56,883
6e.	O. mykiss adult distribution	$0	$0	$34,000	$0	$0	$34,000	$0	$0	$34,000	$0	$0	$34,000	$0	$0	$34,000	$0	$0	$34,000	$102,000
6f.	Benthic macroinvertebrate composition, abundance, and diversity indices.	$0	$0	$13,904	$0	$0	$13,904	$0	$0	$20,091	$0	$0	$20,091	$0	$0	$44,911	$0	$0	$44,911	$78,906
TASK 7.	**Aerial photography, orthorectification, photogrammetry, and bathymetry**	**$0**	**$299,600**	**$0**	**$0**	**$0**	**$299,600**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$299,600**
7a.	Air photo flight from LaGrange to San Joaquin River	$0	$105,000	$0	$0	$0	$105,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$105,000
7b.	Install ground control points	$0	$36,750	$0	$0	$0	$36,750	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$36,750
7c.	Orthorectify aerial photographs	$0	$26,425	$0	$0	$0	$26,425	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$26,425
7d.	Photogrammetry topography	$0	$26,425	$0	$0	$0	$26,425	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$26,425
7e.	Survey channel bathymetry	$0	$105,000	$0	$0	$0	$105,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$105,000
	TOTALS	**$18,000**	**$576,400**	**$189,500**	**$150,700**	**$20,500**	**$955,100**	**$18,000**	**$183,100**	**$202,900**	**$150,700**	**$21,000**	**$575,700**	**$18,000**	**$372,800**	**$336,600**	**$150,700**	**$21,500**	**$899,600**	**$2,430,400**
	2006-2008 TOTALS	**$54,000**	**$1,132,300**	**$729,000**	**$452,100**	**$63,000**	**$2,430,400**													

Note: rounding error may occur in certain columns.

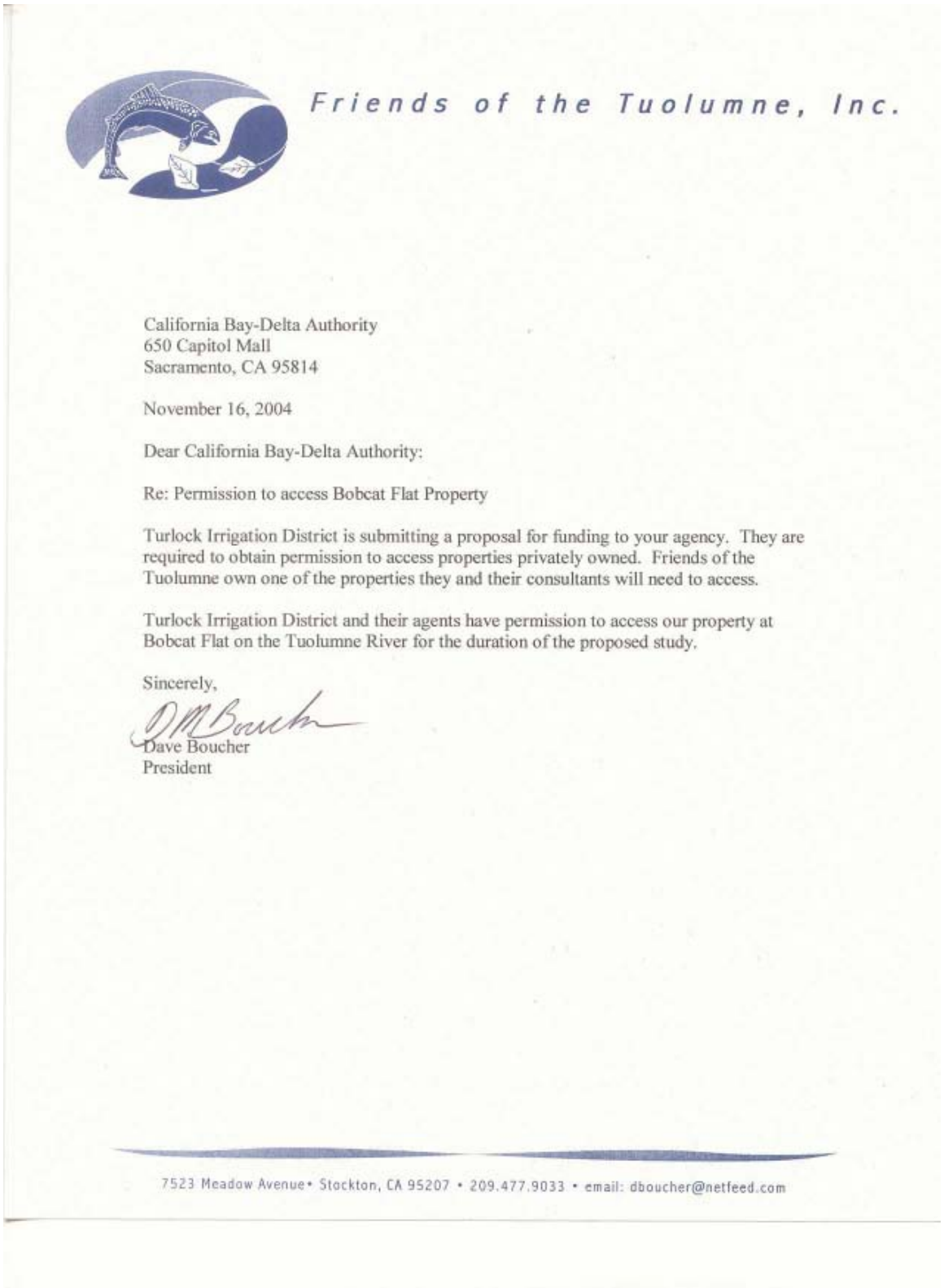
ATTACHMENT A.

CDFG Collection Permit Numbers

STAFF NAME	PERMIT #	EXPIRATION
S.P Cramer and Associates		
Andrea Fuller	801131-05	11/09/06
Rob Fuller	801131-04	11/09/06
Mike Justice	801018-03	04/30/06
Ryan Cuthbert	801137-05	11/09/06
Chrissy Sonke	801137-01	11/09/06
Doug Demko	801131-03	11/09/06
Ryan Fuller	801137-02	11/09/06
Chris Anderson	801200-02	12/17/04
Jesse Anderson	801222-01	10/02/05
Jim Inman	801043-04	04/30/06
Gabe Kopp	801043-05	04/30/06
Stillwater Sciences		
Michael Fainter	801094-03	2006 May
AJ Keith	801095-02	2006 May
Sapna Khandwala	801094-04	2006 May
Steve Kirihara	801184-01	2005 August
Russ Liebig	801087-04	2006 May
Bruce Orr	801094-01	2006 August
Ryan Peek	801183-04	2005 August
Matt Sloat	801193-05	2006 August
Wayne Swaney	801183-05	2005 August
Jesse Wechsler	803051-03	2006 August
Scott Wilcox	801095-04	2006 May

ATTACHMENT B.

Landowner Permission to Access the Bobcat Flat site



Friends of the Tuolumne, Inc.

California Bay-Delta Authority
650 Capitol Mall
Sacramento, CA 95814

November 16, 2004

Dear California Bay-Delta Authority:

Re: Permission to access Bobcat Flat Property

Turlock Irrigation District is submitting a proposal for funding to your agency. They are required to obtain permission to access properties privately owned. Friends of the Tuolumne own one of the properties they and their consultants will need to access.

Turlock Irrigation District and their agents have permission to access our property at Bobcat Flat on the Tuolumne River for the duration of the proposed study.

Sincerely,

Dave Boucher
President

7523 Meadow Avenue • Stockton, CA 95207 • 209.477.9033 • email: dboucher@netfeed.com

Tasks And Deliverables

Tuolumne River Restoration Monitoring

Task ID	Task Name	Start Month	End Month	Deliverables
1	Project Management	1	36	Semiannual and final reports, quarterly progress reports, Periodic invoices, subcontractor coordination, subcontract documentation
2	Public Participation	1	36	Quarterly progress reports, meeting summaries and minutes of the TRTAC, TRTAC Monitoring Subcommittee, and Tuolumne River Coalition meetings; one hard copy and one electronic copy of an interpretive brochure for each restoration project and related monitoring; presentation(s) at least one CBDA Science Conference; up to three manuscripts submitted to peer-reviewed journals
3	7/11, M.J. Ruddy, and SRP 9 Project Monitoring	1	36	At the end of the funded monitoring period, prepare and distribute a draft and final report presenting monitoring methods and results for each site, including synthesis of previous project monitoring methods and results (if available), as well as past and on-going reach-scale and river-wide monitoring results. Analyses and reporting will include monitoring results of geomorphic changes (cross sections, long profiles), geomorphic thresholds (tracer

				rocks, bed scour cores), planform changes (channel migration and avulsion), water surface monitoring and hydraulic model calibration, riparian vegetation success on constructed floodplains (both plantings and natural recruitment), spawning habitat and use, juvenile distribution and abundance via seining, shallow groundwater fluctuations on constructed floodplains, and bird composition and abundance at constructed project sites.
4	Fine sediment managment monitoring	1	36	One draft and one final report describing the Gasburg Creek project, monitoring methods, conclusions, and recommendations for future actions in the Gasburg Creek watershed (if needed); one draft and one final report describing locations, methods, and results of suspended sediment monitoring and providing recommendations for locations, methods, and priority of future tributary fine sediment reduction actions; one draft and one final report describing locations, methods, and results of benthic macroinvertebrate monitoring, comparing the results of this monitoring with previous macroinvertebrate monitoring on the Tuolumne River, and providing recommendations for future

				riffle cleaning and coarse sediment augmentation implementation
5	Coarse sediment augmentation project monitoring	1	36	Annual Monitoring Report containing all field data and analyses in raw and/or summary format, graphics presenting data results, and written descriptions and interpretations of monitoring results. Analyses and reporting will include monitoring results of bed texture and bed mobility thresholds, geomorphic changes (cross sections and long profiles) resulting from coarse sediment augmentation and high flows, bedload transport monitoring, coarse sediment transport model calibration, geomorphic and aquatic habitat mapping, and substrate permeability.
6	Monitoring of cumulative effects on target populations (Chinook salmon and O. mykiss)	1	36	One draft and one final report for each task describing monitoring methods, results, and conclusions. Reports will be in a format consistent with reports included in the TID/MID 2003 FERC report. Analyses and reporting will include monitoring results of juvenile Chinook salmon production and outmigration timing (rotary screw traps), juvenile salmonid distribution and abundance during different seasons, estimates of adult Chinook salmon escapement (carcass surveys), distribution of adult O. mykiss, and benthic

				invertebrate composition and abundance.
7	**Aerial photography and bathymetry**	**1**	**12**	**The photogrammetry and bathymetry topographic data will be integrated to produce a single digital terrain model for the upper 18 miles below La Grange Dam. This topography will provide baseline channel and floodplain conditions for evaluating the topographic evolution of the channel in the Sediment Transfusion reaches and in the Gravel Mining reaches. The digital terrain model will also provide the topographic data needed to construct a HEC−RAS model and a sediment routing modeling that is proposed under the revised Sediment Transfusion Project. Deliverables include digital orthorectified aerial photographs, and a digital terrain model that is based on a combination of photogrammetry data and field−based bathymetry data.**

Comments

If you have comments about budget justification that do not fit elsewhere, enter them here.

Task 5 is also included in the Tuolumne River Sediment Transfusion Project (ERP−02−p29), which was submitted to the CBDA for a Level III Amendment on November 8, 2004 to address a change in sediment source for the project. The revised project, if approved, would fund Task 5, and thus Task 5 could be deleted from this proposal. Task 5 is included in this proposal as a contingency in the event that the amendment is not approved.

Budget Summary

Project Totals

Labor	Benefits	Travel	Supplies And Expendables	Services And Consultants	Equipment	Lands And Rights Of Way	Other Direct Costs	Direct Total	Indirect Costs	Total
$45,900	$8,100	$0	$0	$2,376,400	$0	$0	$0	$2,430,400	$0	$2,430,400

Do you have cost share partners already identified?
Yes.

If yes, list partners and amount contributed by each:

Turlock Irrigation District, Modesto Irrigation District, amount contributed unknown to date (see below)

Do you have potential cost share partners?
Yes.

If yes, list partners and amount contributed by each:

Turlock Irrigation District, Modesto Irrigation District. TID and MID have funded over $1.3 million for a 10-year river-wide monitoring project that ends in 2004. The basis of several monitoring tasks in this PSP was derived from that prior work. The project included some funding of monitoring conducted by CDFG, such as redd counts and carcass surveys. Specific tasks and associated levels of funding for future river-wide monitoring by TID and MID have not been identified. A goal of this PSP is to fund monitoring that expands upon the prior long-term work started by TID and MID. TID and MID anticipate that portions of the current river-wide monitoring will continue through 2016. Specific levels of monitoring and associated funding levels for the 2005-2016 period have not yet been identified.

Are you specifically seeking non−federal cost share funds through this solicitation?
Yes.

Tuolumne River Restoration Monitoring

Tuolumne River Restoration Monitoring

Year 1 (Months 1 To 12)

Task	Labor	Benefits	Travel	Supplies And Expendables	Services And Consultants	Equipment	Lands And Rights Of Way	Other Direct Costs	Direct Total	Indirect Costs	Total
1: project management (12 months)	**15300**	**2700**	**0**	**0**	**0**	**0**	**0**	**0**	$18,000	**0**	$18,000
2: Public Participation (12 months)	**0**	**0**	**0**	**0**	**8900**	**0**	**0**	**0**	$8,900	**0**	$8,900
3: 7/11, M.J. Ruddy, and SRP 9 Project Monitoring (12 months)	**0**	**0**	**0**	**0**	**138100**	**0**	**0**	**0**	$138,100	**0**	$138,100
4: Fine sediment managment monitoring (12 months)	**0**	**0**	**0**	**0**	**51700**	**0**	**0**	**0**	$51,700	**0**	$51,700
5: Coarse sediment augmentation project monitoring (12 months)	**0**	**0**	**0**	**0**	**169500**	**0**	**0**	**0**	$169,500	**0**	$169,500
6: Monitoring of	**0**	**0**	**0**	**0**	**269300**	**0**	**0**	**0**	$269,300	**0**	$269,300

cumulative effects on target populations (Chinook salmon and O. mykiss) (12 months)											
7: Aerial photography and bathymetry (12 months)	**0**	**0**	**0**	**0**	**299600**	**0**	**0**	**0**	$299,600	**0**	$299,600
Totals	**$15,300**	**$2,700**	**$0**	**$0**	**$937,100**	**$0**	**$0**	**$0**	**$955,100**	**$0**	**$955,100**

Year 2 (Months 13 To 24)

Task	Labor	Benefits	Travel	Supplies And Expendables	Services And Consultants	Equipment	Lands And Rights Of Way	Other Direct Costs	Direct Total	Indirect Costs	Total
1: project management (12 months)	**15300**	**2700**	**0**	**0**	**0**	**0**	**0**	**0**	$18,000	**0**	$18,000
2: Public Participation (12 months)	**0**	**0**	**0**	**0**	**9300**	**0**	**0**	**0**	$9,300	**0**	$9,300
3: 7/11, M.J. Ruddy, and SRP 9 Project Monitoring (12 months)	**0**	**0**	**0**	**0**	**72300**	**0**	**0**	**0**	$72,300	**0**	$72,300
4: Fine sediment managment monitoring (12 months)	**0**	**0**	**0**	**0**	**89400**	**0**	**0**	**0**	$89,400	**0**	$89,400
5: Coarse sediment augmentation project monitoring	**0**	**0**	**0**	**0**	**106300**	**0**	**0**	**0**	$106,300	**0**	$106,300

(12 months)											
6: Monitoring of cumulative effects on target populations (Chinook salmon and O. mykiss) (12 months)	**0**	**0**	**0**	**0**	**280400**	**0**	**0**	**0**	$280,400	**0**	$280,400
Totals	**$15,300**	**$2,700**	**$0**	**$0**	**$557,700**	**$0**	**$0**	**$0**	**$575,700**	**$0**	**$575,700**

Year 3 (Months 25 To 36)

Task	Labor	Benefits	Travel	Supplies And Expendables	Services And Consultants	Equipment	Lands And Rights Of Way	Other Direct Costs	Direct Total	Indirect Costs	Total
1: project management (12 months)	**15300**	**2700**	**0**	**0**	**0**	**0**	**0**	**0**	$18,000	**0**	$18,000
2: Public Participation (12 months)	**0**	**0**	**0**	**0**	**67500**	**0**	**0**	**0**	$67,500	**0**	$67,500
3: 7/11, M.J. Ruddy, and SRP 9 Project Monitoring (12 months)	**0**	**0**	**0**	**0**	**140500**	**0**	**0**	**0**	$140,500	**0**	$140,500
4: Fine sediment managment monitoring (12 months)	**0**	**0**	**0**	**0**	**199200**	**0**	**0**	**0**	$199,200	**0**	$199,200
5: Coarse sediment augmentation project monitoring (12 months)	**0**	**0**	**0**	**0**	**139000**	**0**	**0**	**0**	$139,000	**0**	$139,000

6: Monitoring of cumulative effects on target populations (Chinook salmon and O. mykiss) (12 months)	**0**	**0**	**0**	**0**	**335400**	**0**	**0**	**0**	$335,400	**0**	$335,400
Totals	**$15,300**	**$2,700**	**$0**	**$0**	**$881,600**	**$0**	**$0**	**$0**	**$899,600**	**$0**	**$899,600**

Budget Justification

Tuolumne River Restoration Monitoring

Labor

Task 1 – Project Management Wilton Fryer, Project Manager: 65 hrs @ $47.07/hr Tim Ford, Fisheries Biologist: 400 hrs @ $30.60/hr

Benefits

Project Manager: $8.31/hr Fisheries Biologist: $5.40/hr

Travel

None

Supplies And Expendables

None

Services And Consultants

McBain &Trush, Inc. – Total: $1,132,173 Responsible for conducting geomorphic and riparian monitoring at channel reconstruction sites, monitoring fine sediment from upstream tributaries, monitoring coarse sediment transport and habitat associated with gravel augmentation, and will oversee aerial photography and topography generation. William Trush, Sr. Ecologist: 30 hrs @ $131.35/hr Scott McBain, Sr. Fluvial Geomorphologist: 395 hrs @ $120.85/hr Jennifer Vick, Sr. Ecologist: 1292 hrs @ $105.08/hr Rose Patenaude, Registered Engineer: 100 hrs @ $105.08/hr Geoffrey Hales, Registered Geologist: 651 hrs @ $84.07/hr Darren Mierau, Aquatic Biologist: 1447 hrs @ $84.07/hr John Bair, Riparian Botanist: 490 hrs @ $84.07/hr Engineering Technician: 1213 hrs @ $78.81/hr Field Technician: 1751 hrs @ $47.29/hr CAD: 1107 hrs @ $84.07/hr GIS: 335 hrs @ $78.81/hr Administration: 20 hrs @

$84.07 Clerical: 322 hrs @ $42.03/hr (Rates include salary, benefits, overtime, overhead and other indirect expenses)

Additional expenses to be charged to the grant: Travel: $47,734, Field equipment: $14,355, Office expenses: $11,059.

Also includes the following additional services (proposed partner in parenthesis): Aerial photography (Aerial Photomapping Services) – Total: $126,000 Bathymetry (Tentatively by Graham Matthews &Associates) – Total: $105,000 Surveying (Del Terra, Inc.) – Total: $36,750 Riparian planting monitoring (Jeff Hart) – Total: $44,700 Statistical Analysis (Stillwater Sciences) – $4000 Sediment Processing (Graham Matthews) – $6500

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Stillwater Sciences – Total: $728,948 Will be conducting benthic macroinvertebrate sampling, spawning habitat selection monitoring, permeability monitoring, juvenile salmonid distribution and abundance monitoring, and adult O. mykiss distribution monitoring Principal Staff: Frank Ligon, Anthony Keith, Noah Hume, Yantao Cui, Peter Baker, Bruce Orr, Mike Fainter. Senior Fishery Biologists: 1,335 hrs @ $116/hr (average) Fishery Biologists: 2,719 hrs @ $92/hr (average) Junior Fishery Biologists: 1,483 hrs @ $75/hr (average) Rates include salary, benefits, overhead and other indirect expenses.

Expenses related to the project totaling $11,000 will also be charged to the grant.

Also includes the following additional services (proposed partner in parenthesis): Adult O. mykiss Sampling (California River Restoration Fund) – $102,000

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California Dept of Fish &Game – Total: $452,125 Will be conducting the juvenile Chinook salmon production monitoring, as well as the adult escapement and spawning distribution

monitoring Tim Heyne, Biologist: 80 hrs @ $48.00/hr Associate Biologist: 2000 hrs @ 37.14/hr Scientific Aide: 4000 hrs @ $15.46/hr (Rates include salary, overtime and benefits)

Additional expenses to be charged to the grant: Travel: $5000, Field equipment: $2000, Office expenses: $2960.

Overhead charged at 25% of Labor and expenses.

SP Cramer &Associates – Total: $63,050 Will be conducting redd mapping at the channel reconstruction sites, and may assist CDFG in juvenile outmigration analyses Principal Staff: Doug Demko, Andrea Fuller Senior Fisheries Consultant: average 2006–2008 rate is $116.44/hr Fisheries Biologist: average 2006–2008 rate is $90.16/hr Biological Technician: average 2006–2008 rate is $45.74/hr

Equipment

None

Lands And Rights Of Way

None

Other Direct Costs

None

Indirect Costs/Overhead

None

Comments

Environmental Compliance

Tuolumne River Restoration Monitoring

CEQA Compliance

Which type of CEQA documentation do you anticipate?
X none
− negative declaration or mitigated negative declaration
− EIR
− categorical exemption

If you are using a categorical exemption, choose all of the applicable classes below.
− Class 1. Operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination. The types of "existing facilities" itemized above are not intended to be all−inclusive of the types of projects which might fall within Class 1. The key consideration is whether the project involves negligible or no expansion of an existing use.
− Class 2. Replacement or reconstruction of existing structures and facilities where the new structure will be located on the same site as the structure replaced and will have substantially the same purpose and capacity as the structure replaced.
− Class 3. Construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures; and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure. The numbers of structures described in this section are the maximum allowable on any legal parcel, except where the project may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies.
− Class 4. Minor public or private alterations in the condition of land, water, and/or vegetation which do not involve removal of healthy, mature, scenic trees except for forestry or agricultural purposes, except where the project may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies.
− Class 6. Basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource, except where the project may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies. These may be strictly for information gathering purposes, or as part of a study leading to an action which a public agency has not

yet approved, adopted, or funded.
– Class 11. Construction, or placement of minor structures accessory to (appurtenant to) existing commercial, industrial, or institutional facilities, except where the project may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies.

Identify the lead agency.

Is the CEQA environmental impact assessment complete?

If the CEQA environmental impact assessment process is complete, provide the following information about the resulting document.

Document Name

State Clearinghouse Number

If the CEQA environmental impact assessment process is not complete, describe the plan for completing draft and/or final CEQA documents.

NEPA/CEQA documents were completed for constructed projects. Required documents will be completed for future restoration projects. No NEPA/CEQA documents are required for proposed monitoring.

NEPA Compliance

Which type of NEPA documentation do you anticipate?
X none
– environmental assessment/FONSI
– EIS
– categorical exclusion

Identify the lead agency or agencies.

If the NEPA environmental impact assessment process is complete, provide the name of the resulting document.

If the NEPA environmental impact assessment process is not complete, describe the plan for completing draft and/or final NEPA documents.

NEPA/CEQA documents were completed for constructed projects. Required documents will be completed for future restoration projects. No NEPA/CEQA documents are required for proposed monitoring.

Successful applicants must tier their project's permitting from the CALFED Record of Decision and attachments providing programmatic guidance on complying with the state and federal endangered species acts, the Coastal Zone Management Act, and sections 404 and 401 of the Clean Water Act.

Please indicate what permits or other approvals may be required for the activities contained in your proposal and also which have already been obtained. Please check all that apply. If a permit is *not* required, leave both Required? and Obtained? check boxes blank.

Local Permits And Approvals	Required?	Obtained?	Permit Number (If Applicable)
conditional Use Permit	–	–	
variance	–	–	
Subdivision Map Act	–	–	
grading Permit	–	–	
general Plan Amendment	–	–	
specific Plan Approval	–	–	
rezone	–	–	
Williamson Act Contract Cancellation	–	–	
other	–	–	

State Permits And Approvals	Required?	Obtained?	Permit Number (If Applicable)
scientific Collecting Permit	X	X	801131-03
CESA Compliance: 2081	–	–	

CESA Complance: NCCP	–	–	
1602	–	–	
CWA 401 Certification	–	–	
Bay Conservation And Development Commission Permit	–	–	
reclamation Board Approval	–	–	
Delta Protection Commission Notification	–	–	
state Lands Commission Lease Or Permit	–	–	
action Specific Implementation Plan	–	–	
other	–	–	

Federal Permits And Approvals	Required?	Obtained?	Permit Number (If Applicable)
ESA Compliance Section 7 Consultation	–	–	
ESA Compliance Section 10 Permit	X	–	
Rivers And Harbors Act	–	–	
CWA 404	–	–	
other	–	–	

Permission To Access Property	Required?	Obtained?	Permit Number (If Applicable)
permission To Access City, County Or Other Local Agency Land Agency Name	–	–	
permission To Access State Land Agency Name	–	–	
permission To Access Federal Land Agency Name	–	–	
permission To Access Private Land Landowner Name Friends Of The Tuolumne	X	X	

If you have comments about any of these questions, enter them here.

Monitoring at the Bobcat Flat project sites requires access across property owned by Friends of the Tuolumne. A letter providing permission to access the site for monitoring is attached to the proposal (Attachment B).

TID applied for a NOAA scientific research permit in October 2000. NOAA is processing this application and has worked with the TRTAC and TID to provide short−term authorizations for immediate monitoring needs. Subcontractors (Stillwater Sciences and SP Cramer and Associates) possess CDFG Collection Permits for any needed biological sampling (Attachment A).

Land Use

Tuolumne River Restoration Monitoring

Does the project involve land acquisition, either in fee or through easements, to secure sites for monitoring?
X No.
– Yes.

How many acres will be acquired by fee?

How many acres will be acquired by easement?

Describe the entity or organization that will manage the property and provide operations and maintenance services.

Is there an existing plan describing how the land and water will be managed?
– No.
X Yes. **Stanislaus County General Plan, Stanislaus County. Provides regulations on land use within the county, as well as policies and restrictions along the river corridor**

Will the applicant require access across public or private property that the applicant does not own to accomplish the activities in the proposal?
– No.
X Yes.

Describe briefly the provisions made to secure this access.

Monitoring at the Bobcat Flat project site will require access through property owned by Friends of the Tuolumne. A letter providing permission to access the property for monitoring purposes is attached to the proposal (Attachment B). Additional monitoring sites may require access to private property, and once those sites are finalized, letters of permission will be obtained as needed.

Do the actions in the proposal involve physical changes in the current land use?
X No.
– Yes.

Describe the current zoning, including the zoning designation and the principal permitted uses permitted in the zone.

Describe the general plan land use element designation, including the purpose and uses allowed in the designation.

Describe relevant provisions in other general plan elements affecting the site, if any.

Is the land mapped as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, or Farmland of Local Importance under the California Department of Conservation's Farmland Mapping and Monitoring Program?
X No.
– Yes.

Land Designation	Acres	Currently In Production?
Prime Farmland		**–**
Farmland Of Statewide Importance		**–**
Unique Farmland		**–**
Farmland Of Local Importance		**–**

Is the land affected by the project currently in an agricultural preserve established under the Williamson Act?
X No.
– Yes.

Is the land affected by the project currently under a Williamson Act contract?
X No.
– Yes.

Why is the land use proposed consistent with the contract's terms?

Describe any additional comments you have about the projects land use.