MID Modesto Irrigation District
Water and Power

1231 Eleventh St.
P.O. Box 4060
Modesto, CA 95352
(209) 526-7373

FI-047

July 28, 1997

Kate Hansel
CALFED Bay-Delta Program
1416 Ninth Street, Suite 1155
Sacramento, CA 95814

Dear Ms. Hansel:

On behalf of the San Joaquin River Group Authority (SJRGA), the Modesto Irrigation District is pleased to submit the proposal for Category III funding entitled "San Joaquin Delta Salmon Smolt Predation Index and Abatement Study." If you have any questions, please contact me directly at 209/526-7459. Thank-you.

Sincerely,

Walter P. Ward, AGM
Water Operations

DWR WAREHOUSE
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Water and Power

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F-1-04

July 28, 1997

Kate Hansel
CALFED Bay-Delta Program
1416 Ninth Street, Suite 1155
Sacramento, CA 95814

Dear Ms. Hansel:

Please use the attached revisions to replace Chapter 1 - Executive Summary, of the proposal submitted by the San Joaquin River Group Authority (SJRGA), entitled "San Joaquin Delta Salmon Smolt Predation Index and Abatement Study." There were some inconsistencies between the summary and the budget numbers presented in Chapter 4, Table 2A. If you have any questions, please contact me directly at 209/526-7459. Thank-you.

Sincerely,

Walter P. Ward

Walter P. Ward, AGM
Water Operations

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I-001238

I. EXECUTIVE SUMMARY

a. Project Title and Applicant Name

Title: San Joaquin Delta Salmon Smolt Predation Index and Abatement Study
Applicant Name: San Joaquin River Group

b. Project Description and Primary Biological/Ecological Objectives

The reversal of the long-term trend of declining chinook salmon runs in the San Joaquin system has been identified as a major restoration objective of the Central Valley Improvement Act and the CALFED Bay-Delta Program. Very low recapture rates of marked chinook salmon smolts released in the San Joaquin River before they reach sampling sites near Chipps Island may be attributed to low San Joaquin river flows and to losses associated with entrainment into the state and federal water projects (SWP/CVP) pump intake system. Other nonflow-related factors include temperature, toxicity, and low food abundance. There are also a number of concerns about the validity of the Chipps Island sampling program. Predation losses in the San Joaquin River and Delta are known to be a major factor. Predation losses in Clifton Court Forebay have been studied extensively: as many as 90 percent of all salmon smolts entering Clifton Court Forebay are estimated to be consumed. Predation losses in the Tuolumne River are also very large and may account for the majority of mortalities of downstream migrants. Predation losses upstream of Mossdale and in other parts of the San Joaquin Delta have not been investigated. This project is designed to address a data gap by estimating the rate of predation losses of chinook salmon smolts in the Delta to complement other upstream restoration efforts and design a predation abatement program.

Large predatory fish in the Delta will be captured, their stomachs will be washed of prey, and they will be tagged and released. The tagging element of this study will give a first-order estimate of predator abundance in the main stem of the San Joaquin River as it passes through the Delta. Stomach evacuation rates related to temperature, species, and size will be taken from the literature. The stomach content data will provide an estimate of salmon smolt predation rates. Together, the three sets of data will provide a first-order estimate of salmon smolt mortality due to predation in the Delta. This proposal is for funding the first year of a 3-year study that will provide an index of mortality for comparison with historic records and other factors contributing to salmon smolt mortality. Predator sampling effort will be especially focused on the CDFG Mossdale marked smolts released in late April and May.

Data from the sampling program would be used in conjunction with other California Department of Fish and Game data to characterize the relative impact of predation and ways to enhance salmon smolt survival. Simulation studies suggest that predation losses could be reduced by 50 percent through a 20 percent reduction in the predators (Rieman and Beamesderfer 1988). A predation abatement program will be designed in the first year and instituted in the second and third years of the study. The exact form of the predator abatement program cannot reasonably be designed at this stage of the project. A literature review and extended discussions with stakeholders will clarify the best way to approach predation abatement. The role of exotics such as largemouth bass and the use of recreational fishing to reduce predator abundance will receive special considerations.

c. Approach/Tasks/Schedule

A sampling program would be designed that employed appropriate elements of randomness and replication to arrive at statistically valid conclusions. Gear and permits would be acquired in early 1985. Rigorous and safe sampling methods would be developed and refined in February. Sampling would be conducted by two teams working sequentially for the 3 months between 1 March and 31 May. The

sampling team would be set up to do all data collection, and data entry in the field, using GPS data logging equipment for locations and recording results. Whenever possible, stomach contents would be examined in the field with a portable dissecting microscope. Numbered Floy dart tags would be attached to all predators that are returned to the water. Data would be analyzed and the resulting predation index would be entered into the EACH San Joaquin River salmon population model after the field season. All data would be made available to CALFED, IEP, and CDFG. An annual report would be submitted in August, and a final report would be submitted at the end of the project.

d. Justification for Project and for Funding by CALFED

This project directly addresses Item 6 in the RFP: "Undesirable Species Interactions" as a key stressor on the native species of chinook salmon migrating down the San Joaquin River into the Sacramento-San Joaquin Delta. Virtually all the large predators, including striped bass, smallmouth bass, largemouth bass, crappie, and white catfish, are introduced species. Only squawfish and steelhead are native to the system.

e. Budget Costs and Third Party Impacts

The first year costs are set at $364,386. This cost is reduced by $58,570 from matching funds and cost-sharing for a total of $303,287 request for funding from CALFED. This proposal requests funding only for the first year of the project. The first year sampling effort is very intensive and will be designed to determine the level of sampling needed in subsequent years to arrive at a meaningful mortality index. Because of the number of unknowns regarding predator impacts and what would constitute an effective and socioeconomical appropriate abatement program, no funding is being requested at this time for the years 1999 and 2000. The SJRG and EA, the subcontractor, will cost-share through direct contributions, in-kind services, or donation of equipment usage (refer to the budget page for details).

f. Applicant Qualifications

The proposed team members are eminently qualified for the project. Wayne Swaney has extensive experience collecting predators and washing their stomachs. Dr. Robert Abbott has experience as a commercial fishermen and in collecting specimens alive from gill net operations. Mr. Swaney and Dr. Abbott both have extensive experience in tagging fish and collecting fisheries data. Dr. Peter Baker is highly respected for his work in fisheries statistics and population modeling. Additional field sampling personnel will be hired and trained at the beginning of the project. Greg Seegert and Joe Vondruska have managed many large river electrofishing fisheries sampling and stomach content analysis programs.

g. Monitoring and Data Evaluation

The project is directly engaged in the collection, distribution and interpretation of data. All data will be provided to CDFG and IEP in its raw form and in the form of monthly summary reports.

h. Local Support and Coordination with Other Programs, and Compatibility with CALFED Objectives

This project conforms to CALFED objectives of reducing losses due to predators and will be closely tied to CDFG activities in the Stockton Office. SJRG will coordinate activity with other CDFG monitoring and sampling programs in the Delta.

II. TITLE PAGE

San Joaquin Delta Salmon Smolt Predation Index and Abatement Study

Prepared for

CALFED BAY-DELTA PROGRAM
1416 Ninth Street, Suite 1155
Sacramento, California 95814

Prepared by

San Joaquin River Group
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Public Agency
Tax Exempt

RFP Project Group 3, Other Services

III. PROJECT DESCRIPTION

a. Project Description and Approach

Introduction

The enhancement and restoration of San Joaquin River chinook salmon stocks that use the Sacramento–San Joaquin River Delta is a major objective of state and federal agencies. The decline of these stockes has been attributed to many factors, including Delta flow, upstream hydroelectric dams, overharvest, the pumps of the State Water Project and Central Valley Project (SWP/CVP), agricultural diversions, water quality, temperature, low food abundance, and predation. Predation losses in particular locations along the Sacramento and San Joaquin rivers have been defined as major issues in other studies. (See the preliminary literature review in Section D below.) This proposal addresses a major data gap, which is the extent of predation losses in the lower San Joaquin. Predator abatement warrants serious study, because of the introduction of exotics, such as white catfish and largemouth bass, and because of the benefits to be gained by protecting any increased production that may come out of habitat improvements farther upstream. This proposal is a companion to a proposed toxicology and food availability study been carried out in the same part of the river.

Young salmon can be found in the Delta throughout the year (Kjelson et al. 1982) . Most fry (fish <70mm) enter the Delta from the rivers between January and June, but they reach a peak of abundance between February and March. Peak migration of smolts out of the Tuolumne occurs between mid-April and mid-May (EA 1992). Data gathered by Kjelson et al. (1982) and by Wickwire and Stevens (1971) indicate that small fry tend to stay in the upper 3 meters near the shoreline during daylight hours and then move offshore and become more evenly distributed in the water column during the night.

Smolts tend to migrate through the delta fairly rapidly. Kjelson et al. (1982) reported that smolts migrate through the Delta at a rate of 10–18 km per day but that some remain in the Delta for up to 49 days. Wickwire and Stevens (1971) estimated that smolts migrate at 8, 12, and 24 km per day in April, May, and June, respectively.

Study Design

The main elements of the study design are presented in Table 1. The lower San Joaquin River between the mouths of the Stanislaus and the North Fork of the Mokelumne River (a distance of approximately 50 miles) would be divided into four reaches, each approximately 12–18 miles long, depending on river characteristics. Each reach would be intensively sampled with gill nets and electrofishing gear for the 3 months of March, April, and May. The sampling program would be conducted by three teams: two gill net teams and one electrofishing team. Most of the electrofishing would be done at night. Each reach would be sudivided into 10 sampling stations identified by GIS coordinates. Each of the 40 sampling stations would be sampled at least twice a month with gill nets and once a month by electrofishing. One gill net sampling team would be in the field for approximately 3–4 days, followed by a second team that would work 3–4 days at a time. Sampling would take place at night and during the day, but most effort would be during the crepuscular periods, at dawn and dusk. Gill nets would be constantly manned and never left unattended. The gill net team would watch the floats and pull up that section of the net as soon as a fish entanglement was indicated.

The stomachs of all predators larger than 5 in. FL would be washed out with a gastroscope made of clear thin-walled plexiglass. Stomach contents identifiable as salmonids would be held in a labeled jar

TABLE 1 STUDY DESIGN

Definitions	
Sample Station(SS)	Location on the San Joaquin River where replicate gill net and electrofishing samples will be collected.
Sample Station Point	(STP) A point in the middle of the river at the sampling station defined by GIS coordinates.
Sampling Day (SD)	A 12-hour day by on sampling team.
Sampling zone (SZ)	The polygon surrounding the sample station point demarcated by the two opposite banks and extending 150 feet on either side of the STP up and down the river.
Gill Net Set	Gill net is full extended and anchored on the bottom.
Gill Net Team Field Day	(NSD)A 12-hour day of sampling. Usually involving 4 gill net sets.
One Unit of Gill Net Effort	(NE) Net is set in one location in the sampling zone for 2 hours. A team will make 4 sets in a field day of effort.
One Unit of Electrofishing	(EE) 2 hours moving through and around the SZ seeking predators . The electrofishing team may be able to sample four stations in a night. Many sample stations are more than ½ mile wide.

1. Sample Team and Effort

Method	Sampling Days	Units of Effort	Symbol
1) Gill Net Team 1 (N1)	4 Days/Week for 12 Weeks = 48 Field Days	192	NE
2) Gill Net Team 2 (N2)	4 Days/Week for 12 Weeks = 48 Field Days	192	NE
3) Electrofishing (E1)	4 Days/Week for 12 Weeks = 48 Field Days	192	EE
	Total	576	

2. River Reaches and Sampling Points

Reach Name	Approximate Length (miles)	Sample Stations	Symbol	
1) Stanislaus - Marsdale	16	10	SR	
2) Massdale - Stockton	16	10	MS	
3) Stockton - Andrus Island	16	10	SI	
4) Andrus Island - Makelumne River	16	10	IM	
Total Number of Sample Stations		40		

TABLE 1 (continued)

3. Effort Per Reach Per Sample Station. Each reach has 10 sample stations

	Night		Day		Total	
Reach	NE	EE	NE	EE	NE	EE
1 SR	4.8	2.4	4.8	2.4	9.6	4.8
2 MS	4.8	2.4	4.8	2.4	9.6	4.8
3 SI	4.8	2.4	4.8	2.4	9.6	4.8
4 IM	4.8	2.4	4.8	2.4	9.6	4.8

4. Gill Net Sampling Effort. Set on the hour. Pull on the hour.

Time of Day	Team A	Team B
5 -7 a.m.		
8-10 a.m.		
11-1 p.m.		
2-4 p.m		
5-7 p.m		
8-10 p.m.		
11-1 a.m.		
2-4 a.m.		

5. Electrofishing

At night: 8-12 hours/trip = up to four sample station per trip both sides of the river and traverse "X" and target probable predator locations. Sampling done in two hour units of effort.

and preserved in alcohol. No fish will be intentionally sacrificed. After the stomach is washed out, the fish will be measured for length and tagged with a numbered Floy T-Bar anchor tag. The tags will have printed instructions for returning them to CDF&G and project scientists. Because the sampling program is very intensive, we expect a reasonable number of tag returns by the sampling team themselves and to not be totally dependent on the good will of sports anglers.

The gill nets would have panels of different mesh sizes to catch the full range of salmon smolt predators. The smallest mesh size would be 2-1/2 in. stretch mesh; the largest would be 5-in. stretch mesh. Each net would be 50 yards long. Fish so obviously damaged that they could not be expected to survive (e.g., severe bleeding, torn gills) will measured for length and subsequently disposed of according to accepted CDFG procedures. Because the crew on this project is highly experienced, we expect most fish to be in fairly good shape upon being returned to the water. Being large and the top predators in the ecosystem, these study fish will have a better chance of surviving the handling experience than smaller fish would.

Methods may vary somewhat at the beginning of the project as procedures are established, but each method change will be exhaustively documented. For example, one proposed method is to fish the gear passively. An alternative is to use a heavy iron bar to repeatedly splash the water near the net. The splash causes a large underwater acoustic "sound" wave that elicits a startle response or short rapid burst of swimming activity from most species of fish. This startle response impels relatively stationary fish to lunge straight ahead. Fish facing toward a net will swim directly into it. Repeated splashes cause the fish to move around, resulting in more fish becoming entangled. Traditional fishermen in many parts of the world use this "splash" method to increase their catch per unit effort. It is especially effective during the day, when the fish might otherwise avoid the net.

Electrofishing

A very experienced team of large river electrofishing experts will implement this part of the project. There will be a two- to three-person crew, depending on reach-specific circumstances. One will drive the boat, and one will operate the gear. One or more large, long-handle nets with half-inch mesh will be used to capture the predators. The team will use an 18-foot boat with a Coffelt Model VVP 15 or equivalent fish shocking unit, set for pulsed D.C. and adjusted to optimize results. Sampling is specifically for predators, and not for all species and sizes of fish in the river. Thus the operators will use their best knowledge of species-specific behavior and habitat useage to concentrate efforts on areas where the most predators can expected to be located. We anticipate that the electrofishing gear will capture some salmon smolts. A limited number of smolts collected after the release of tagged fish at Mossdale will be retained to look for tags and as part of the companion toxicology and food availability study.

Analysis of Stomach Contents.

A gastroscope of clear plexiglass tubing (Seaburg and Moyle 1964; Dubets 1954) will be used to wash out the contents of the predator's stomachs. Since this study is focused on salmon smolt predation, most of the identification effort will be very focused on salmon. Because of the rapid rate of digestion in the highly acidic stomachs of predatory fish, many of the stomachs will have little more than a slurry of relatively unrecognizable parts of crayfish and fish. All recognizable fish will be identified to the nearest possible species. Identifiable consumed salmon smolts will be preserved for subsequent examination for marks and tags. Because of planned intensive sampling around the CDFG release site near Mossdale, we expect to catch predators with smolts in their stomachs. Consumption rates depend on numerous variables, including turbidity, prey abundance, refuge habitats, preferential alternative foods, water

temperature, and other factors (Poe and Nelson 1988). Stomach evacuation rates depend on prey size, number of prey, predator size, and water temperature. Stomach evacuation rates will be derived from the literature.

Other Data

A number of environmental factors will be documented at each sample site: water temperature, salinity, current direction, turbidity, the presence of shoreline debris, vegetation, recreational fishing, and whether the area is riprapped.

Data Processing

Data will recorded on field data sheets and logged into the GPS unit the same day. Data sets will be grouped by week. Data will be quality assurance checked (QA) by the field team leader when they return to the office and by the senior scientist. Data will be held in a ARCINFO (GIS) format, which can be downloaded to other database applications for statistical analysis.

Species of Special Concern

Based on the literature and discussions with CDFG staff familiar with the study area, the main species this project will catch are: striped bass(*Morone saxatilis*), squawfish (*Ptychocheilus grandis*), largemouth bass (*Micropterus salmonides*) (also called black bass), smallmouth bass (*Micropterus dolomieui*), crappie (*Pomoxis spp.*), and white catfish (*Ictalurus catus*). The gill nets will not catch delta or longfin smelt, because the mesh size is too large. The small-mesh panels will catch some American and threadfin shad. Since the nets will be manned at all times, these fish will be released immediately with minimum handling, and with no attempt will be made to tag or measure them. The fishing gear may capture a stray steelhead, but this is unlikely, since there are no natural populations of steelhead remaining in the San Joaquin River system. Any steelhead encountered would be strays from the Sacramento River system. Any salmon incidentally captured will be immediately released.

Modeling Predator Abundance

The catch of predators in the gill nets and fishing time recorded will be used to calculate a standardized catch per unit effort (CPUE or C/f) value. Relative CPUE value has been shown to be a good indicator of relative abundance (Ricker 1940). Thus, the CPUE values for March, April, and May 1998 can be compared to each other and to CPUE values in the subsequent years of the study. A multiple Peterson population estimate by month, species, and river mile studied will be derived from the tag and recapture data for a Schnabel census. The data sets will be analyzed to elucidate patterns of abundance by species size groups, location relative to the shore, time of day, and water quality. Analysis of the coefficients of correlation and confidence intervals on the estimates of abundance and predation rates will be used to derive a single unifying indicator of predation loss that will be termed the month- and reach-specific predation index.

Abatement Program

Predator abatement issues in the San Joaquin Delta are complex and need to be throughly reviewed. The literature, opinions of the sport fishing community, and fisheries scientist debates on predators in the Delta and predator abatement programs is complex, because of the many different species involved in this very complex ecosystem and the numerous socioeconomic and aesthetic issues involved. It is very clear that predators are one of the most significant factors affecting the abundance of juvenile salmon migrating into the Delta. It is also intuitively likely that a reduction in predator abundance or an increase in smolt escape success would lead to an increase in the number of smolts that eventually reach the

ocean. But what is much less clear is the role of the different predators. One of the main predators in the Delta is striped bass, yet stomach samples have shown relatively few identifiable salmon in striped bass stomachs (Urquhart and Beuttler, personal communication). The California Striped Bass Association is concerned that striped bass are credited with far more predation than they deserve. Part of that reputation is associated with anthropogenic influences, such as the Clifton Court Forebay. Squawfish are known to be a very significant preditor of juvenile salmon in the Sacramento River, but striped bass also undoubtably eat many squawfish, since squawfish are used by some river guides as bait for large striped bass (Beuttler, personal communication). There are also large numbers of largemouth bass, white catfish, and crappie in the Delta that may be much more responsible for salmon smolt predation than conventionally thought. Striped bass move extensively, whereas the largemouth bass and crappie tend to be much more territorial, especially in the spring. Largemouth bass tend to take up and hold positions along the river bank in preparation for spawning. Salmon smolts tend to travel along the shore in shallow water during the day and become more evenly distributed in the water column at night. Thus the smolts migratory pattern makes them especially vulnerable to near-shore predators during the day. The largemouth bass population has increased rapidly in the Delta, and there are many more largemouth bass tournaments than striped bass tournaments. White catfish tend to be on the bottom during the day and move up in the water column at night. This corresponds to the period when salmon are scattered throughout the water column.

The literature on efforts to control predation on salmon has not been exhaustively reviewed. Literature is being compiled from many sources and will be exhaustively reviewed at the inception of the project. One method that will be explored is the implementation of a largemouth bass tournament in the San Joaquin River in the last week of April and first week of May, to coincide with the releases of tagged hatchery fish at Mossdale. The objective would be to see if the sport fishing effort alone were adequate to reduce the level of abundance of the main river bank predators. The design of the sport fishing derby is identified as a separate task. Detailed discussions with local sport fishing enthusiasts and fishing tournament experts will be required to come up with a proposed configuration of promotion, incentives, and rules. Although we will document the recreational fishing effort adjacent to each sampling station, and encourage recreational fishing in the week leading up to the releases at Mossdale, there will be no attempt to implement a full predator abatement program in the first year of the study.

Digestive Rate

The calculation of predation rate estimates are very sensitive to the estimated consumption rate, which may be indicated by the rate of digestion or stomach evacuation. The stomachs of large predatory fish are very acidic and tend to decompose a prey item to a nonidentifiable slurry in just a few hours. The rate of digestion depends on the amount of food ingested at one time, predator size, and species, the size and species of the of the prey, and the ambient temperature. A study by Seaburg and Moyle (1964) indicated that largemouth bass showed a 36 percent reduction in stomach volume in 7 hours and 70 percent in 21 hours for temperatures that ranged from 64 to 74° F. We will use values from the literature to estimate digestive rates.

b. Location and Boundaries of the Project

The study area boundaries extend along the Delta reach of the San Joaquin River, from the mouth of the Stanislaus to Andrus Island, where the San Joaquin River converges with the North Fork of the Mokelumne River. This segment of the San Joaquin River is approximately 51 miles long. Figure 1 is the GIS expression of the study area, based on downloaded USGS data maps. The study

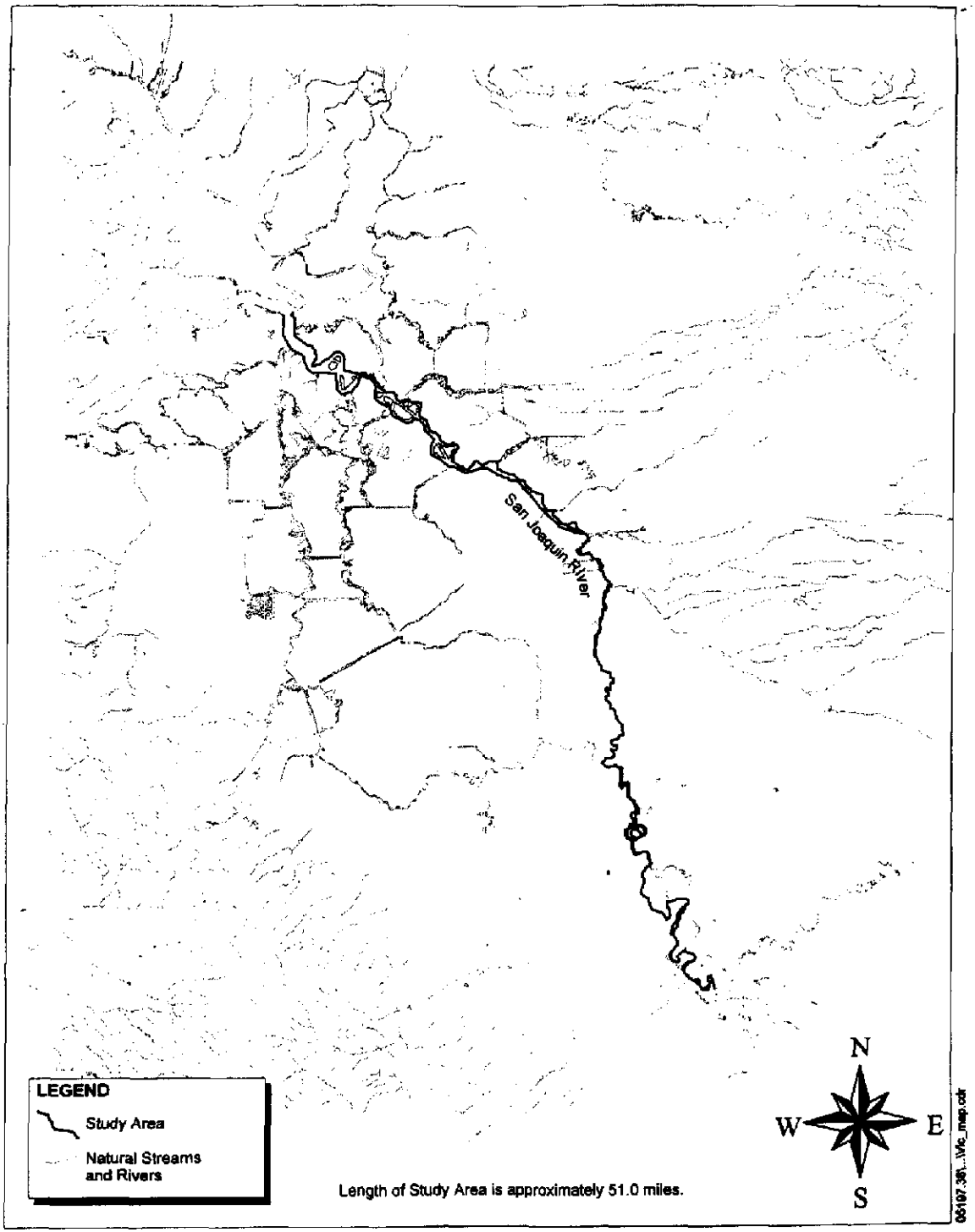

Figure 1. GIS display of hydrology data from digital USGS maps showing the predation study area..

area is within the legally defined Delta and complements the existing salmon smolt sampling number stations at Mossdale and Chipps Island.

c. Expected Benefits

There are two main beneficial outcomes to the first year of this study:

- fill a data gap and improve understanding of the extent of predation losses in the Delta
- a better understanding of ways to reduce predation in the Delta
- enhancement of habitat restoration efforts upstream.

The study is intended to clarify the role of predation as a cause of salmon smolt mortality in the Sacramento/San Joaquin River Delta. A better understanding of salmon smolt mortality from predation may lead to ways to manage predator abundance, predator distribution during peak smolt migration, predator-prey habitat relationships that favor salmon smolts, CVP/SWP project operations that may optimize predator avoidance, modification of factors predisposing individual smolts to become prey, and other elements of the predator–salmon smolt prey relationship. A better understanding of the role of predation on smolt mortality in the Delta will also help improve the validity and robustness of salmon population dynamic modeling efforts. During the second and third years of the study there will be a predator abatement program.

d. Background and Biological/Technical Justifications

Predation is considered a major factor limiting the abundance of juvenile salmonids in California, Oregon, Washington, and Alaska. The Bonneville Power Administration has funded a major long-term study of squawfish predation on Columbia River salmon fry for the last decade. Squawfish predation is responsible for approximately 80 percent of juvenile salmon losses in John Day Reservoir (Nigro, 1989). Simulation studies indicate that predation losses could be reduced by 50 percent through a 20 percent reduction in the squawfish population (Rieman and Beamesderfer 1988).

Studies on the Sacramento River have shown predation to be a major cause of salmon fry and smolt mortality. Vogel et al. (1988) and Hallock (1993) found that the Sacramento squawfish is a major predator on migrating salmon fry in the upper Sacramento River. Their estimates range from 16 percent to 77 percent of downstream migrating salmon fry moving past the Red Bluff Diversion Dam (RBDD) are lost to squawfish predation in the spring. The RBDD is just one of the many high-impact predation sites or "hot spots" along the Sacramento River.

Studies by EA (1992) indicated one of the principle causes of salmon smolt mortalities in the lower Tuolumne River was predation by smallmouth and largemouth bass. This work indicated that bass predation could account for the loss of approximately 70 percent the 90,000 smolts released by CDFG as they moved down the Tuolumne in a 1987 study. Bass predation rates were estimated to average 1.6 smolts per day.

Packard et al. (1982) studied the relative abundance of predators at three sites in the Sacramento- San Joaquin Delta in anticipation of the construction of the proposed Peripheral Canal. The main predators were striped bass, Sacramento squawfish, and steelhead. Though white catfish, channel catfish and black crappie were also captured in the nets, they made up only a very small part of the catch. Approximately 25 percent of the striped bass and 10 percent of the squawfish stomachs had some prey in their stomachs during the spring.

e. Proposed Scope of Work

The project scope of work is presented schematically in Figure 2. The work is broken into 5 specific tasks: project preparation, predator abatement, field work, data analysis, and reporting. Project preparation would start in January 1998. The first year's work would be used to refine the sampling activities that would be used in the subsequent 2 years of the project. Data analysis will be conducted at EA offices in Lafayette, CA, and a predation loss module will be integrated into the EACH salmon population dynamics model for the San Joaquin River. The project manager will submit a monthly report to CALFED and the CDFG. An annual report will be produced each year in July. A public presentation will be made at an appropriate public forum. The predation data sets would be made available to all other scientists working on California salmon issues through the Interagency Ecological Program newsletter, and an appropriate web site.

f. Monitoring and Data Evaluation

The main thrust of the project will be to obtain and analyze data, and facilitate the integration of this information into management program that will enhance salmon productivity.

g. Implementability

This project is eminently implementable. The proposed fishery scientists and technicians have conducted numerous fisheries sampling, stomach content analysis, tagging, and population estimates. The qualifications of the team members are listed in section V, Qualifications. The senior statistician and modeler is Dr. Peter Baker, is an active member of the Bay-Delta Modeling Forum and a respected member of the California fisheries statistical and modeling community. The project manager, Robert Abbott, has been involved in fisheries management studies since 1973 and worked as a commercial fishermen employing many gear types including gill nets. Robert Abbott has also been involved in many projects related to capturing fish and keeping them alive for research, and aquaculture activities. Robert Abbott also served as the president of a charter boat association and participated in many sport fishing tournaments. Greg Seegert and Joe Vondruska have extensive experience in electrofishing programs in large rivers.

San Joaquin Delta Salmon Smolt Predation Index and Abatement Project

PREDATION PHASE I

Task	Description	1998 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Task 1 - Project Preparation													
Subtask 1.1	Literature Review												
Subtask 1.2	Equipment and Supplies Acquisition												
Subtask 1.3	Obtain Permits and Access Rights												
Subtask 1.4	Field Training												
Task 2 - Predator Abatement Program													
Subtask 2.1	Fishing Community Coordination												
Subtask 2.2	Design Predation Abatement Program												
Task 3 - Field Work													
Subtask 3.1	Collect, Wash Stomachs, Tagging												
Subtask 3.2	Data Collection, Entry, Transmission												
Task 4 - Data Analysis and Modeling													
Subtask 4.1	Data Analysis												
Subtask 4.2	*Modeling*												
Task 5 - Reporting													
Subtask 5.1	Monthly Reports												
Subtask 5.2	Annual Report												
Subtask 5.3	Public Presentation												

Figure 2. Schedule of year one activities.

XLS.0519755.SCH.1

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I-001251

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IV. Costs and schedule to Implement Proposed Project

a. Budget

The budget is presented in terms of costs per task in Table 2A. The project staff are indicated, along with their total burdened labor rates. Three field technicians have yet to be named. Every attempt will be made to hire field technicians that live close to the study area. Task costs are presented as the sum of labor and other direct costs (ODC), and general and administrative costs on ODC. (One or more field technicians may be provided by SJRGA, further reducing the cost of the project.) More than two-thirds the project costs are for the field work, Task 3. Much of the Task 1 preparations will be done in anticipation of the actual work in the field. Approximately 9 percent of the costs are for reporting. The first year's work on the predation abatement program, Task 2, is approximately 7 percent of the total budget.

The total cost is $400,998. Through cost-sharing, this amount has been reduced by $58,572 resulting in a funding request from CALFED of **$342,426.** San Joaquin River Group Authority (SJRGA) and EA Engineering, Science, and Technology (EA) are committed to the objectives of the CALFED restoration goals and are making good faith contributions to the project in the form of cost reduction beyond what would normally be charged to clients. EA will not charge for usage on vehicles, faxes, telephones, computers, copies, or boat usage. Similarly, SJRGA is committed to absorbing up to $36,188 of the costs incurred in the project. This has been listed in the budget (Table 2A) in the form of 534 x the hourly billing rate for Walter Ward of SJRGA, but it will come in the form of the labor of Ward and other personnel of SJRGA members and other in-kind contributions. These reductions will be noted on each monthly invoice submitted.

Sole Source

Consistent with Government Code 4525, EA Engineering, Science, and Technology, Inc. was selected by the San Joaquin River Group to provide environmental services in connection with the proposed fisheries predation study. The selection was made on the basis of EA's qualifications, knowledge about the San Joaquin River system and demonstrated competence for the requested services, including documentation of fair and reasonable prices.

b. Schedule Milestones

The schedule of activities is shown in Figure 2. The project will start with a kick-off meeting between the project manager and CDFG staff in January 1998. Task 1 activities will be done from the time of that meeting until 28 February. The study of factors that will lead to an effective predation abatement program will be carried out at an intermittent level of activity from 1 February through May. The field work is for the 3-month period of March, April, and May. The Analysis task covers the period from 1 March through 30 June. Progress reports will be submitted monthly for the life of the project. We will submit a draft final report at the end of June and a final report by the end of July. CALFED will be billed monthly.

The project will be deemed completed upon submission of the final report in August.

c. Third Party Impacts

The "third party" issues are related to sport fishing interests and other CDFG programs. Every effort will be made to communicate with all parties to make sure that there are no conflicts.

San Joaquin Delta Salmon Smolt Predation Index and Abatement Project

TABLE 2A PHASE I (by Project Staff and Task)

Name	Labor Rate*	Task 1-Preparations Hours	Task 1-Preparations Total $	Task 2 - Abatement Hours	Task 2 - Abatement Total $	Task 3 - Field Work Hours	Task 3 - Field Work Total $	Task 4 - Analysis Hours	Task 4 - Analysis Total $	Task 5 - Reporting Hours	Task 5 - Reporting Total $	All Tasks
Ward, W**.	$67.89	106	$7,196	106	$7,196	107	$7,264	107	$7,264	107	$7,264	$36,185
Golden, F.	$184.78	4	$739	2	$370	4	$739	2	$370	4	$739	$2,956
Abbott, R.	$114.09	60	$6,845	60	$6,845	40	$4,564	80	$9,127	100	$11,409	$38,791
Baker, P.	$81.81	20	$1,636	20	$1,636	16	$1,309	320	$26,179	80	$6,545	$37,305
Vondruska, J.	$72.94	40	$2,918	8	$584	480	$35,011	0	$0	0	$0	$38,512
Seegert, G.	$121.39	8	$971	8	$971	40	$4,856	0	$0	0	$0	$6,798
Sheehan, E.	$56.40	16	$902	0	$0	160	$9,024	40	$2,256	10	$564	$12,746
Swaney, W.	$56.71	160	$9,074	160	$9,074	480	$27,221	80	$4,537	10	$567	$50,472
Wilcox, S.	$94.84	8	$759	40	$3,794	40	$3,794	40	$3,794	20	$1,897	$14,036
Kirihara S.	$51.00	80	$4,080	80	$4,080	480	$24,480	0	$0	0	$0	$32,640
Field Tech	$51.00	0	$0	0	$0	480	$24,480	0	$0	0	$0	$24,480
Field Tech	$51.00	0	$0	0	$0	480	$24,480	0	$0	0	$0	$24,480
Field Tech	$51.00	0	$0	0	$0	480	$24,480	0	$0	0	$0	$24,480
Production	$51.00	0	$0	0	$0	0	$0	0	$0	160	$8,160	$8,160
Labor Subtotals		392	$35,121	376	$34,549	3176	$191,701	560	$53,527	380	$37,145	$352,043
ODCs												
Per diem			$100		$100		$700		$100		$100	$1,100
Travel			$1,500		$100		$1,500		$100		$100	$3,300
Equipment			$0		$0		$7,750		$0		$0	$7,750
Supplies			$1,000		$100		$27,020		$500		$400	$29,020
Misc.			$100		$100		$1,000		$100		$100	$1,400
Subtotal			$2,700		$400		$37,970		$800		$700	$42,570
G &A	15%		$405		$60		$5,696		$120		$105	$6,386
Total ODC			$3,105		$460		$43,666		$920		$805	$48,956
Project Totals			$38,226		$35,009		$235,367		$54,447		$37,950	$400,998

San Joaquin River Group funded amount	(Suggested matching value for in-kind services, e.g. PM, sec, field tech etc.)	($36,188)
EA	(Service charge contributions for usage of computer, GIS, boat, fax, etc. See Table 2.)	($22,384)
Total Funding Request from CALFED		$342,426

* See Table 1B for labor rate breakdown.

** Represents the labor and materials to be furnished by SJRGA at no cost to the project.

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TABLE 2B

Name	Raw Labor +	Benefits 29.88%	Direct Labor w/Benefits	Overhead 113% +	Fee 7% =	Overhead Plus Fee	Labor Rate
Ward, W.	$41.74	$13.90	$55.64	$12.24	$0.00	$12.24	$67.89
Golden, F.	$62.50	$18.68	$81.18	$91.52	$12.09	$103.61	$184.78
Abbott, R.	$38.59	$11.53	$50.12	$56.51	$7.46	$63.97	$114.09
Baker, P.	$27.67	$8.27	$35.94	$40.52	$5.35	$45.87	$81.81
Vondruska, J.	$24.67	$7.37	$32.04	$36.12	$4.77	$40.90	$72.94
Seegert, G.	$41.06	$12.27	$53.33	$60.12	$7.94	$68.06	$121.39
Sheehan, E.	$22.12	$6.61	$28.73	$32.39	$4.28	$36.67	$65.40
Swaney, W.	$19.18	$5.73	$24.91	$28.08	$3.71	$31.79	$56.71
Wilcox, S.	$32.08	$9.59	$41.67	$46.97	$6.20	$53.18	$94.84
Kirihara, H.S.	$22.32	$6.67	$28.99	$32.68	$4.32	$37.00	$65.99
Field Tech	$17.25	$5.15	$22.40	$25.26	$3.34	$28.60	$51.00
Field Tech	$17.25	$5.15	$22.40	$25.26	$3.34	$28.60	$51.00
Field Tech	$17.25	$5.15	$22.40	$25.26	$3.34	$28.60	$51.00
Production	$17.25	$5.15	$22.40	$25.26	$3.34	$28.60	$51.00

TABLE 2C ODC BACKUP FOR FIELD WORK TASK 3

Travel Per Diem			
Per Diem			$700
	Miles	Rate	
Mileage	2,000	$0.32	$640
Supplies			
Description	Units	Rate	Total
Boat rental for gill netting/M	3	$1,240	$3,720
Electrofishing boat rental /M	3	$2,920	$8,760
GPS/M	3	$450	$1,350
Dissecting microscope	3	$350	$1,050
Variable mesh gillnets	108		$1,000
Fish tags system	1,000		$600
Plastic bottles, tags, etc.			$200
Field supplies			$500
Gas and oil for boats			$6,500
Misc. Boat Supplies			$500
Measuring board	100	$5	$500
Grastroscope	100	$5	$500
Misc.			$500
Total Supplies			$27,020

TABLE 2D EA USAGE SERVICE CONTRIBUTION

Budget Category	Usage Description	Amount	Usage Reduction
Travel	Mileage of $0.32/ mile reduced to 0.10	$2,000	$448
GIS computer use	226 hrs x $26/hr	$5,876	$5,876
Electrofishing boat	Mo. rate 16-19 ft $2,920M x 3M	$8,760	$8,760
GPS	$30/day or $450/M	$1,350	$5,000
Dissecting microscope		$1,000	$1,000
Stomach sampling kit	$5/day x 100	$500	$500
YSI Temp, salinity,		$500	$500
Secchi disk	$100/M	$300	$300
			($22,384)

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V. Applicant Qualifications

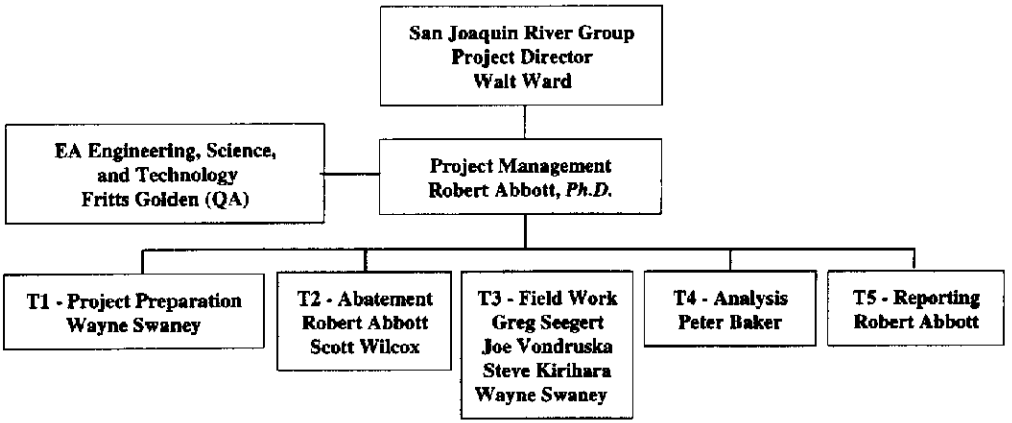

Figure 3. Project organization.

The San Joaquin River Group Authority (SJRGA) is a consortium of San Joaquin River interest groups that include the San Joaquin Tributaries Association, the San Joaquin River Exchange Contractors, and the Friant Water Users Authority. These groups represent more than 30 irrigation districts or canals in the San Joaquin River basin. The SJRGA is a forum to discuss San Joaquin River water issues and approaches to resolving problems related to the use of San Joaquin River water for urban, agricultural, and environmental uses. SJRGA is strongly committed to consensus building and the application of sound scientific information to the resolution of resource management problems. The SJRGA encourages nonflow-related, habitat restoration activities to meet state and federal mandates to increase salmon production.

EA is a full-service environmental consulting firm with a staff of more than 550. EA has strong credentials in areas such as fisheries studies, fish screens and barriers, modeling, resource inventory, environmental compliance, levees and channel maintenance, water conveyance systems, pumping stations, storage facilities, agricultural irrigation and drainage facilities, ecotoxicology, botany, and terrestrial ecology. Because of EA's past project experience in the San Joaquin Delta and its familiarity with the issues of the various stakeholders, EA's technical staff can provide CALFED with the highest possible level of expertise to assist in integrating and formulating solutions to San Joaquin Delta problems.

- **Walter Ward, Water Resource Manager** *Role:* **Project Director**

B.S., Geological Sciences, Univ. California-Santa Barbara • Graduate Studies in Groundwater Geology, Univ. of Wyoming *15 years of experience*

Mr. Ward is a professional geologist in water resources management in both the public and private sectors, including groundwater resources and water supply management for urban and agricultural end-users. For the Modesto Irrigation District he manages 75 staff in the areas of irrigation services, domestic water production, and water resource protection.

- **Robert Abbott, Ph.D., Fisheries and Aquaculture Specialist** *Role:* **Project Manager**
  PhD, Fisheries, University of Washington, 1973 • 20 years of experience

Dr. Abbott is an experienced natural resource planner with experience in fisheries management, aquaculture, and the assessment of natural resource information and market information for government agencies and the private sector. He is an experienced manager of large teams of scientists and field technicians in designing data collection programs, collecting field data, computer data entry, modeling based on field data, and the analysis of model outputs and databases.

- **Peter Baker, Ph.D., Senior Scientist, Fish Population Modeler** *Role:* **Statistical Analyst**
  PhD, Mathematics, University of California at Berkeley, 1987 • 9 years of experience

Dr. Baker developed and refined the EACH simulation model for San Joaquin chinook salmon populations, and he oversaw construction of a simulation model for chinook salmon spawning habitat use. He integrated water temperature estimates generated by a SNTEMP model with physical habitat estimates developed through PHABSIM. He developed a statistical model for estimating the effect of water temperature on survival of salmon smolts from mark-recapture data, and assisted in development of statistical models for estimating the sizes of chinook salmon runs from carcass count data.

- **B. Fritts Golden, V.P., Natural Resource Management** *Role:* **Quality Assurance**
  MS, Regional Planning, University of Pennsylvania, 1973 • 22 years of experience

Mr. Golden's experience includes river basin planning and management, permitting, natural resource management, environmental assessment, and quality assurance. He advised the President's Council on Environmental Quality regarding NEPA Section 102(2)(G). He has analyzed environmental issues and risk and reviewed issues of compliance. As part of the CALFED project evaluating management options for the SF Bay-Delta system. He supervised and was a principal author of an Environmental Impact Report for a proposed water recycling project in Alameda and Contra Costa counties.

- **Greg Seegert, Chief Aquatic Biologist** *Role:* **Big River Electrofishing Expert**
  MS, Zoology, University of Wisconsin, 1973 • 20 years of experience

Mr. Seegert's experience includes aquatic toxicology and aquatic ecology. He has conducted studies throughout the Midwest, East, and Southeast. A recognized expert on aquatic systems, he works with the private sector and regulatory agencies to desig and implement bioassay and aquatic biological studies.

- **Eric Sheehan, GIS Specialist** *Role:* **GIS/GPS Expert**
  MS, Geography and Natural Resources, University of Iowa, 1995 • 5 years of experience

Eric Sheehan, who will be responsible for Geographic Information Systems and downloading the GPS datase, has experience in computer cartography and GIS, particularly the application of GIS and remote sensing in environmental analysis and decision support and in natural resource planning.

- **Wayne Swaney, Aquatic Biologist/Data Manager** *Role:* **Database Manager/Team Field Leader**
  BS, Resource Development, Water Resources, Michigan State Univ., 1981 • 10 years of experience

Mr. Swaney has experience in supervising and performing field data collection for lake restoration studies, stream discharge/sediment, IFIM, and chinook salmon population studies. He has participated in fish population studies using backpack, barge, and boat electrofishing equipment, primarily relating to chinook salmon ecology in the San Joaquin River System, California, but also including trout population studies and fisheries surveys for species of special concern in California and Oregon.

■ **Joe Vondruska, Senior Fisheries Scientist** *Role:* **Electrofishing Team Leader**

BS, Natural Resources, Wildlife Management, Univ. of Nebraska, 1984 • 10+ years of experience

Mr. Vondruska has experience in the general areas of environmental impact assessment, aquatic ecology, and fisheries science. Fisheries investigations have included collections with drift nets, light traps, backpack and boat-mounted electroshockers, gillnets, hoop nets, seines, and trawls; evaluations of spatial and temporal distribution; age and growth; and impingement and entrainment effects.

■ **Scott Wilcox, Fisheries Biologist** *Role:* **Predator-Prey Relationship/Abatement Design**

Med. Natural Resource Management, Univ. of California-Davis, 1989 • 17 years of experience

Mr. Wilcox' expertise includes fisheries and watershed studies, specifically environmental impact analyses for fish, wildlife, and water quality; computer modeling of stream hydraulic and temperature conditions; instream flow data collection and analysis; and technical aquatic studies. Management of multidisciplinary environmental projects has included NEPA and CEQA compliance projects and regulatory compliance actions for aquatic and other sections for more than 12 hydroelectric projects.

■ **H. Steven Kirihara, Fisheries Scientist** *Role:* **Field Team Leader**

BS, University of California at Davis, Wildlife and Fisheries Biology and Zoology, 1976

Mr. Kirihara has worked on chinook salmon studies on the San Joaquin River system, including salmon escapement surveys, fry emergence and juvenile salmon development, and salmon outmigration studies. He has been involved with gravel sampling studies, restoration of spawning habitat, intragravel and surface water temperature monitoring, invertebrate population sampling, aging studies, turbidity monitoring, and flow fluctuation studies. He has also been involved in salmon predation studies, coded-wire-tag studies, and summer flow fish population studies. He has experience in seining and electroshocking sampling methods and underwater observation.

References

References are as follows:

Tim Ford	(209) 883-8275	Turlock Irrigation District	Salmon Population Studies
John Irwin	(818) 302-8945	Southern California Edison	Fisheries Studies

VI. COMPLIANCE WITH STANDARD TERMS AND CONDITIONS

a. Forms (attached)

b. Terms and Conditions Compliance

We have no objections to the standard terms and conditions presented in Attachment D of the CALFED-Bay Delta Program Request for Proposals 1997, Category III.

The San Joaquin River Group falls into the non-profit category for services indicated in Table D-1. Accordingly, we will enter into the necessary agreement with the California Department of Fish and Game and the Department of Water Resources before or at signing of the final contract.

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Item 8

NONDISCRIMINATION COMPLIANCE STATEMENT

COMPANY NAME: San Joaquin River Group Authority (SJRGA)

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code Section 12990 (a-f) and California Code of Regulations, Title 2, Division 4, Chapter 5 in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination Program. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, disability (including HIV and AIDS), medical condition (cancer), age, marital status, denial of family and medical care leave and denial of pregnancy disability leave.

CERTIFICATION

I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.

OFFICIAL'S NAME: Barbara A. Hetrick, Secretary SJRGA

DATE EXECUTED: July 25, 1997

EXECUTED IN THE COUNTY OF: Stanislaus

PROSPECTIVE CONTRACTOR'S SIGNATURE: Barbara A. Hetrick

PROSPECTIVE CONTRACTOR'S TITLE: San Joaquin River Group Authority

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME: San Joaquin River Group Authority

Item 12

Agreement No. _____

Exhibit _____

STANDARD CLAUSES --
SMALL BUSINESS PREFERENCE AND CONTRACTOR IDENTIFICATION NUMBER

NOTICE TO ALL BIDDERS:

Section 14835, et. seq. of the California Government Code requires that a five percent preference be given to bidders who qualify as a small business. The rules and regulations of this law, including the definition of a small business for the delivery of service, are contained in Title 2, California Code of Regulations, Section 1896, et. seq. A copy of the regulations is available upon request. Questions regarding the preference approval process should be directed to the Office of Small and Minority Business at (916) 322-5060. To claim the small business preference, you must submit a copy of your certification approval letter with your bid.

Are you claiming preference as a small business?

____ Yes* ___X___ No

*Attach a copy of your certification approval letter.