G1019

Attachment H

COVER SHEET (PAGE: 1 of 2)

May 1998 CALFED ECOSYSTEM RESTORATION PROPOSAL SOLICITATION

Proposal Title: Assessment of Ecosystem Function and Restoration Opportunities for Fall Chinook and Rainbow/Steelhead in the Stanislaus River

Applicant Name: Richard Martin, General Manager South San Joaquin Irrigation District

Mailing Address: 11011 East Highway 120, Manteca, CA 95336

Telephone: (209) 823-3101 Ext. 109

Fax: (209) 823-8406

Amount of funding, requested: $ 135,504.00 for 1 years

Indicate the Topic for which you are applying, (check only one box). Note that this is an important decision: see page _ of the Proposal Solicitation Package for more information.

- ☐ Fish Passage Assessment
- ☐ Fish Passage Improvements
- ☐ Floodplain and Habitat Restoration
- ☐ Gravel Restoration
- ☐ Fish Harvest
- ☐ Species Life History Studies
- ☒ Watershed Planning/Implementation
- ☐ Education
- ☐ Fish Screen Evaluations - Alternatives and Biological Priorities

Indicate the geographic area of your proposal (check only one box):

- ☐ Sacramento River Mainstem
- ☐ Sacramento Tributary: _____
- ☐ Delta
- ☐ East Side Delta Tributary: _____
- ☐ Suisun Marsh and Bay
- ☒ San Joaquin Tributary: _____
- ☐ San Joaquin River Mainstem
- ☐ Other: _____
- ☐ Landscape (entire Bay-Delta watershed)
- ☐ North Bay: _____

Indicate the primary species which the proposal addresses (check no more than two boxes);

- ☒ San Joaquin and East-side Delta tributaries fall-run chinook salmon
- ☐ Winter-run chinook salmon
- ☐ Spring-run chinook salmon
- ☐ Late-fall run chinook salmon
- ☐ Fall-run chinook salmon
- ☐ Delta smelt
- ☐ Longfin smelt
- ☐ Spittail
- ☒ Steelhead trout
- ☐ Green sturgeon
- ☐ Striped bass
- ☐ Migratory birds

May 1998 CALFED ECOSYSTEM RESTORATION PROPOSAL SOLICITATION

Indicate the type of applicant (check only one box):

☐	State agency	☐	Federal agency
☐	Public/Non-profit Joint venture	☐	Non-profit
☒	Local government/district	☐	Private party
☐	University	☐	Other: _____

Indicate the type of project (check only one box):

☐	Planning	☐	Implementation
☐	Monitoring	☐	Education
☒	Research		

By signing below, the applicant declares the following:

(1) the truthfulness of all representations in their proposal;

(2) the individual signing the form is entitled to submit the application on behalf of the applicant (if applicant is an entity or organization); and

(3) the person submitting the application has read and understood the conflict of interest and confidentiality discussion in the PSP (Section II.K) and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent as provided in the Section.

Richard Martin
(Signature of Applicant)

II. EXECUTIVE SUMMARY

ASSESSMENT OF ECOSYSTEM FUNCTION AND RESTORATION OPPORTUNITIES FOR FALL CHINOOK AND RAINBOW/STEELHEAD IN THE STANISLAUS RIVER

APPLICANT: Rick Martin, Manager, South San Joaquin Irrigation District

PROJECT DESCRIPTION & OBJECTIVES:

This project will assess ecosystem function for fall chinook and rainbow-steelhead in the lower Stanislaus River and identify restoration opportunities. We will survey the distribution and abundance of (1) fish species, (2) features of aquatic and riparian habitat, and (3) fluvial geomorphic processes. No inventory of these features and processes is available. These data will be combined with those from other studies to complete a limiting factors analysis for production of fall chinook and rainbow/steelhead. A "patient-template analysis" will be used as part of the limiting factors analysis to identify restoration needs and prescribe restoration strategies. The characterization of ecosystem state and function will provide a foundation for watershed planning and prioritization of ecosystem restoration opportunities. This pattern for formulating ecosystem restoration strategies has been recommended by several papers recently published in fisheries journals.

The project has four objectives: (1) Estimate the distribution, quantity, and quality of in-stream and riparian habitat for supporting production of salmonids in the Stanislaus River; (2) assess the dynamics of channel geomorphology in relation to river corridor land use and regulated hydrology; (3) determine the distribution and relative abundance of fish species and their use of various habitats, and (4) determine the limiting factors to natural production of fall chinook and rainbow/steelhead within the Stanislaus River, and develop a technical framework for prioritizing actions to overcome these factors.

APPROACH/TASKS/SCHEDULE: Instream and riparian habitat will be surveyed during summer low flow throughout the 58 miles of river accessible to anadromous salmonids. Surveys methods will be those developed by the Research Section of Oregon Department of Fish and Wildlife. Fish use of habitat will be surveyed by diver observations in spring during the rearing of juvenile fall chinook, and once again during summer low flow to emphasize rainbow/steelhead. Aerial photographs, resource maps, and substrate sampling will be used to identify watershed features and processes that shape fish habitat. These data will be combined with that from other studies to complete a "patient-template analysis" that identifies restoration needs and prescribes restoration strategies.

JUSTIFICATION: There is substantial uncertainty and controversy regarding the

limiting factors to salmon production in the Stanislaus Basin. This project will develop both an inventory of habitat restoration opportunities in the lower Stanislaus Basin, and a technical basis for prioritizing them to increase natural production of fall chinook and rainbow/steelhead. The project focuses on two priority habitats and two priority fish species identified by CALFED.

BUDGET & THIRD PARTY IMPACTS: Total project costs are $135,504, and OID and SSJID, may offer cofunding. No third party impacts are anticipated.

QUALIFICATIONS: Key personnel will be Senior Fisheries Consultant, Steven P. Cramer; Consulting Hydraulic Engineer, Woody Trihey; and Fishery Biologist Douglas B. Demko. Mr. Cramer (24 years as a professional) and Mr. Demko have been leading studies of fall chinook and steelhead in the Stanislaus River for the last 5 years, while Mr Trihey has invested 21 years developing and applying scientific methods to describe the response of fish habitats to changes in streamflow, stream temperature, and sediment transport. Mr. Cramer will oversee project and complete the limiting factors analysis, Dr. Trihey will lead work on stream function, and Mr. Demko will lead the field surveys.

MONITORING AND DATA EVALUATION: Our survey protocol and our draft final report will be reviewed by three qualified peers agreeable to CALFED. Most importantly, the database assembled here will provide the baseline against which to measure success of future restoration actions.

LOCAL SUPPORT & COORDINATION WITH OTHER PROGRAMS: The need for this project has been discussed by the Stanislaus Stakeholders Group, and cofunding will be considered by the two largest water right holders in the basin, Oakdale ID and South San Joaquin ID. Technical review of project design and findings will be invited from the Stanislaus Fisheries Task Force composed of biologists from CDFG, USFWS, and Fisheries Consultants actively involved in the basin. The limiting factors analysis will draw on data gathered from ongoing studies funded by USFWS, OID, SSJID, and Stockton East WD. This project address several key ERPP objectives. Under the Vision for Ecological Processes, it addresses objectives for natural flood plains and flood processes [(1):43, (2):389], and the objectives for natural sediment supply [(1):342, (2):387]. Under Habitat Visions, it addresses of the objective for riparian and riverine aquatic habitat [(1):104, (2):390]. Under the Vision for Species, it addresses the objective for chinook [(1):145, (2):394], and the objective for steelhead [(1):151, (2):395]. Under the Vision for Reducing and Eliminating Stressors, it addresses the objectives for gravel mining [(1):242], and the objectives for predation and competition [(1):272, (2):392]. This project also addresses 3 of 6 objectives from the AFRP: (1) improve the stream habitat for all life stages of anadromous fish through improved flows, water quality, and physical habitat. (2) Develop fish population and habitat data to facilitate evaluation of restoration actions. (3) Involve partners in the implementation

and evaluation of restoration of actions.

I-011067

III. TITLE PAGE

ASSESSMENT OF ECOSYSTEM FUNCTION AND RESTORATION OPPORTUNITIES FOR FALL CHINOOK AND RAINBOW/STEELHEAD IN THE STANISLAUS RIVER

APPLICANT: Rick Martin, Manager
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PRINCIPAL INVESTIGATOR:
Steven P. Cramer
S.P. Cramer & Associates, Inc.
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Gresham, OR 97080
Phone: 503-669-0133(voice), 503-669-3437(fax)
Email: spcramer@teleport.com

Type of Organization and Tax Status: *Local Government/District, tax exempt*
Tax ID Number: 94 - 6001319

Collaborators: Oakdale Irrigation District
Wayne Marcus, Manager
1205 East F Street
Oakdale, CA 95361
209-847-0341

IV. PROJECT DESCRIPTION

PROJECT DESCRIPTION AND APPROACH

This project will assess ecosystem function for fall chinook and rainbow-steelhead in the lower Stanislaus River and identify restoration opportunities. We will survey stream and watershed features in the lower Stanislaus River to determine the distribution and abundance of (1) fish species, (2) features of aquatic and riparian habitat, and (3) fluvial geomorphic processes. These data will be combined with that from other studies to complete a limiting factors analysis for production of fall chinook and rainbow/steelhead. A "patient-template analysis" will be used as part of the limiting factors analysis to identify restoration needs and prescribe restoration strategies. The characterization of ecosystem state and function will provide a foundation for watershed planning and prioritization of ecosystem restoration opportunities. This pattern for formulating ecosystem restoration strategies has been recommended by several papers recently published in fisheries journals.

PROPOSED SCOPE OF WORK

Our scope of work is composed of four objectives and attendant tasks as follow.

Objective 1 Estimate the distribution, quantity, and quality of in-stream and riparian habitat for supporting production of salmonids in the Stanislaus River.

Task 1.1 Develop sampling plan for collecting field measurements.

We will develop a specific sampling plan stratified by stream reaches that represent segments of stream with relatively homogeneous stream features, and by habitat type at sites within the reach. Reaches would be divided at points where there are sharp changes in features such as gradient, channel form (Rosgen1985), or inflow from a tributary. We will also seek to identify reaches that may have been uniquely impacted by past activities such as agriculture, erosion, road construction and gravel mining. To identify these areas, we will rely on old surveys, maps, aerial photographs and conversations with local land and resource managers. Additional reach breaks will be identified in the field as appropriate.

Task 1.2 Survey instream habitat features to estimate distribution, quantity, and quality.

Habitat will be surveyed during summer low flow using an adaptation of methods developed by the Research Section of Oregon Department of Fish and Wildlife. A field crew of two people, each responsible for specific tasks, will survey the entire river from its mouth up to Goodwin Dam (RM 58). Key features to be measured include geomorphic channel units (eg. pool, riffle, glide), surface area, depth, substrate type, instream structure, gradient, shading, water quality, active channel height and width, valley width index, streamside vegetation class, and dominant land use. The coordinates of each reach break will be established with a hand-held GPS receiver, and full measurements of length, width,

and depth will be taken on every 10th unit within the reach, and estimated for all other units. Geomorphic features summarized at the reach level will include valley width, channel type, slope, terrace height and width, sinuosity, width, depth, substrate, eroding banks, etc.

Features of instream structure to be recorded include substrate, boulders, and large woody debris (LWD). Substrate composition within each unit will be visually estimated as percentage of the surface that falls into six different size classes, starting with silt and fine organic matter. Data recorded on wood will include configuration, type, diameter class, and length class.

Task 1.3 Complete field surveys to estimate distribution, quantity, and quality of key riparian habitat features.

The same crew surveying instream features will also measure riparian features, including stream length with riparian vegetation, vegetation type, bank stability, percent overstory shading, diameter of stream-side trees. Detailed measurements will be taken every 30 units along belt transects perpendicular to the stream, extending 30 m out from the channel and 5 m wide. Data will be recorded separately within 10 m segments of the 30 m length, and the following will be recorded: surface type, slope, canopy closure, shrub cover, grass and forb cover, tree group, and tree count.

Photographs will be taken for reference. Photographs will be taken at every location where historical photographs are known to exist, looking upstream and downstream at reach breaks, tributaries, unique features and landmarks, erosion and logged areas, areas of management concern, unusual as well as representative habitat types, road crossings and culverts and at each floodplain/riparian complex. We hope to draw comparisons between present and historical photographs showing evidence of habitat degradation, areas of special management concern, and typical habitat types.

Objective 2 Assess the dynamics of channel geomorphology in relation to river corridor land use and regulated hydrology.

An assessment of existing channel geomorphology in relation to river corridor land use and regulated hydrology is a critical component of the process of identifying opportunities to enhance aquatic habitat conditions for chinook salmon in the Stanislaus River. Channel geometry, planform and cross-section stability, sediment supply and in-channel storage, and the relationship of these variables to the hydrologic regime are important for a thorough understanding of aquatic habitat and limiting factors.

The channel geomorphology assessment task will inventory the existing geomorphic features of the river and subdivide the study corridor into study reaches that are relatively homogeneous in terms of dominant fluvial processes and channel condition. Channel planform pattern, meander geometry, depositional bar types and extent, and other features of geomorphic significance will be quantitatively described for the study reaches. Review

of historical aerial photography and topographic maps, interpretation and mapping on recent aerial photography and ground truthing of a representative sample of the mapped channel condition categories will be used to complete this task

Existing historical aerial photographs that include the Stanislaus River corridor may be available from the U.S. Army Corps of Engineers or Bureau of Reclamation, the Natural Resource Conservation Service, the U.S. Fish and Wildlife Service, or Stanislaus County. We anticipate that recent aerial photographs suitable for geomorphic inventory and mapping could be obtained through the California Department of Water Resources, Department of Fish and Game or local sources such as various special districts. Reproduction and enlargement of existing photographs would be required, but no new stereo photography would be flown.

For each of the identified study reaches, we will describe the sediment abundance relative to transport capacity, as evidenced by the type, extent and frequency of features such as lateral bars, mid channel bars and riffles. The dominant sources of bed load in the system will be described on the basis of available reports, map and aerial photography interpretation of bank conditions and surrounding land use, and field reconnaissance.

We will examine the historical and future anticipated hydrology of the Stanislaus River, and describe the relationship of the channel geometry and channel condition to the flow regime. Channel dimensions, meander geometry and sediment features will be analyzed in relationship to flood frequency (using post January 1997 storm statistics). We will analyze how the magnitude and duration of flows has interacted with the sediment supply to affect channel conditions in the study reaches and to estimate future trends and geomorphic condition .

The results of the channel conditions, sediment and hydrology analyses will be correlated with the results of the aquatic habitat inventory and assessment. The relationship between existing channel conditions, hydrologic regime, aquatic habitat, and fish use of the habitat will allow completion of a limiting factor analysis .Understanding the relative value of aquatic habitat and how it relates to the channel conditions will provide the template for establishing restoration or enhancement priorities. Geomorphic influences on limiting factors will provide both site-specific and system-wide information to guide restoration / enhancement planning. Study reaches with the geomorphic conditions that require adjustment, or with geomorphic features that facilitate certain types of restoration or enhancement activities will be identified.

Objective 3 Determine the distribution and relative abundance of fish species and their use of various habitats.

Fish use of habitat will be surveyed by diver observations in spring during the rearing of juvenile fall chinook, and once again during summer low flow to emphasize rainbow/steelhead. A team of two to three divers will snorkel the 1st and 5th habitat unit

of each type, for each reach between Oakdale (RM 40) and Goodwin Dam (RM 58). The divers will enter the water at the downstream end of the unit and proceed slowly upstream. The divers will position themselves near the midline of the habitat unit, and move parallel to one another using hand signals to coordinate their movements. Observed fish will be identified (species and approximate age or size class), counted and recorded on underwater slates. Association of fish with habitat features, such as depth, substrate, and structure will also be recorded.

Data from the snorkel surveys will be used to determine geographic distribution of fish, and habitat preferences of the various species, by size class. The types of habitat in shortest supply can then be determined from the distribution and preference data. Note that the intent of these surveys is not to estimate total fish abundance, but to determine their distribution throughout the river, and their relative demand for habitat features within reaches of the river.

Objective 4 *Determine the limiting factors to natural production of fall chinook and rainbow/steelhead in the Stanislaus River, and develop a technical framework for prioritizing actions to overcome these factors.*

In order to identify the most constraining habitats and stream functions, we will compare (1) the present state of habitat availability, (2) the present stream functions that shape habitat, and (3) the habitat function sought by chinook and rainbow/steelhead at each life stage(Figure 1). Completion of this objective will require integrating information obtained from surveys of this project, with that obtained from ongoing studies in the Stanislaus Basin of fall chinook spawning distribution, egg survival, and juvenile migration time and survival. This analysis must be completed by fish life stage, because habitat needs of the fish vary between life stages. We will also compare survival estimates to habitat features, including biotic factors, to identify probable mechanisms leading to mortality. In each case that stream processes are not likely to replenish limiting habitats for priority fish species, then restoration opportunities would be identified. This analytic process will enable deduction of the weakest ecosystem link for natural production of chinook and rainbow/steelhead.

A "patient-template analysis" will be used as part of the limiting factors analysis. Historic data on fish and habitat in the basin will be reviewed to establish the template, and the surveys we perform, combined with recent fish life-history data, will describe the patient. Differences between the patient and template will be used to diagnose restoration needs. Stream processes would be considered for their effects on longevity of alternative restoration actions, and an effectiveness score or index would be given. This score should aid prioritizing actions and prescribing the optimum restoration strategy (Figure 2).

Deliverables:

1. Monthly progress summaries consisting of 1-2 page narrative accompanied by pertinent summary tables or graphs.

2. Monthly invoices showing daily schedule of time invested by each worker and all expenses.
3. Final Report. This report will fully document our methods, results and findings. All data will be presented in tabular summaries, and important relationships will be illustrated with graphs and photographs. The physical, hydrological and biotic components of the drainage will be described and their relationships to one another analyzed. We will produce 1:24,000 maps showing key habitat features, including potential fisheries and watershed restoration and enhancement projects. The report will first be submitted as a draft, and then revised to final form, based on comments received.

PROJECT LOCATION

The project area is the Stanislaus River and its riparian corridor from its confluence with the San Joaquin River, upstream 58 miles to the base of Goodwin Dam. This is the full river segment accessible to anadromous fish. Snorkel surveys to count fish and their association with habitat features will be limited to the upper 18 miles above Oakdale where most juvenile chinook and rainbow/steelhead rear.

EXPECTED BENEFITS

Both a full set of habitat restoration opportunities, and a technical basis for prioritizing them to increase natural production of fall chinook and rainbow/steelhead will be developed. Habitat restoration opportunities have been identified, to date, primarily by their visibility at easy access points. This project will provide the data needed for a limiting factors analysis, which in turn will provide a quantitative basis for assigning priority to habitat restoration activities. A full inventory of habitat features, including their spatial distribution, their dynamic relationship to stream processes, and their present use by priority fish species, will be quantified. The Limiting Factors Analysis will identify which restoration opportunities will provide the greatest gain for production of fall chinook and rainbow/steelhead. This project will greatly reduce the uncertainty about potential benefits and longevity of various restoration projects.

BACKGROUND AND BIOLOGICAL JUSTIFICATION

There is substantial uncertainty and controversy regarding the limiting factors to salmon production in the Stanislaus Basin, so there is no clear basis for establishing priorities on actions to restore fish habitat. Without a thorough inventory of physical and biological features within the anadromous fish zone of use, and an assessment of how they are influenced by stream processes, it is easily conceivable that millions of dollars could be spent on fish habitat restoration, only to find that some key limiting factor is precluding full project benefits. Restoration projects have been proposed to add gravel, clean gravel, and reconfigure the stream channel at specific locations, but the data have not been available to establish whether or not the specific habitats addressed by these projects are the key limiting factors to natural production of fall chinook and rainbow/steelhead, nor whether the methods are appropriate within the context of stream processes.

This project address several key ERPP objectives. Under the Vision for Ecological Processes, it addresses objectives for natural flood plains and flood processes [(1):43, (2):389], and the objectives for natural sediment supply [(1):342, (2):387]. Under Habitat Visions, it addresses of the objective for riparian and riverine aquatic habitat [(1):104, (2):390]. Under the Vision for Species, it addresses the objective for chinook [(1):145, (2):394], and the objective for steelhead [(1):151, (2):395]. Under the Vision for Reducing and Eliminating Stressors, it addresses the objectives for gravel mining [(1):242], and the objectives for predation and competition [(1):272, (2):392]. This project also addresses 3 of 6 objectives from the AFRP: (1) improve the stream habitat for all life stages of anadromous fish through improved flows, water quality, and physical habitat. (2) Develop fish population and habitat data to facilitate evaluation of restoration actions. (3) Involve partners in the implementation and evaluation of restoration of actions.

MONITORING AND DATA EVALUATION

Our survey protocol will be reviewed by three qualified peers prior to implementation, and our final report will similarly be reviewed by three peers. We will provide full explanation of how we use the comments received from these reviewers. Reviewers will be selected at the discretion of CALFED, and we will offer names of qualified reviewers for CALFED consideration. Most importantly, the database assembled here will provide the baseline against which to measure the effectiveness of future restoration actions.

IMPLEMENTABILITY

(1) No sampling permits are required for snorkel surveys.
(2) Even if fall chinook or rainbow/steelhead should be listed under the federal ESA, we have confirmed with NMFS that snorkel surveys do not require a permit.
(3) We have determined from previous snorkel surveys in the Stanislaus River at Oakdale (RM 40) and above that water clarity is sufficient to freely observe fish. We do not plan snorkel surveys below Oakdale.
(4) Our previous experience in the basin indicates we will have cooperative landowners for allowing access to the stream, but we can access the entire stream by canoe if necessary.

(5) The Stanislaus Basin Stakeholders have identified the need for this work, and the two major water right holders in the basin are offering financial support for this work.

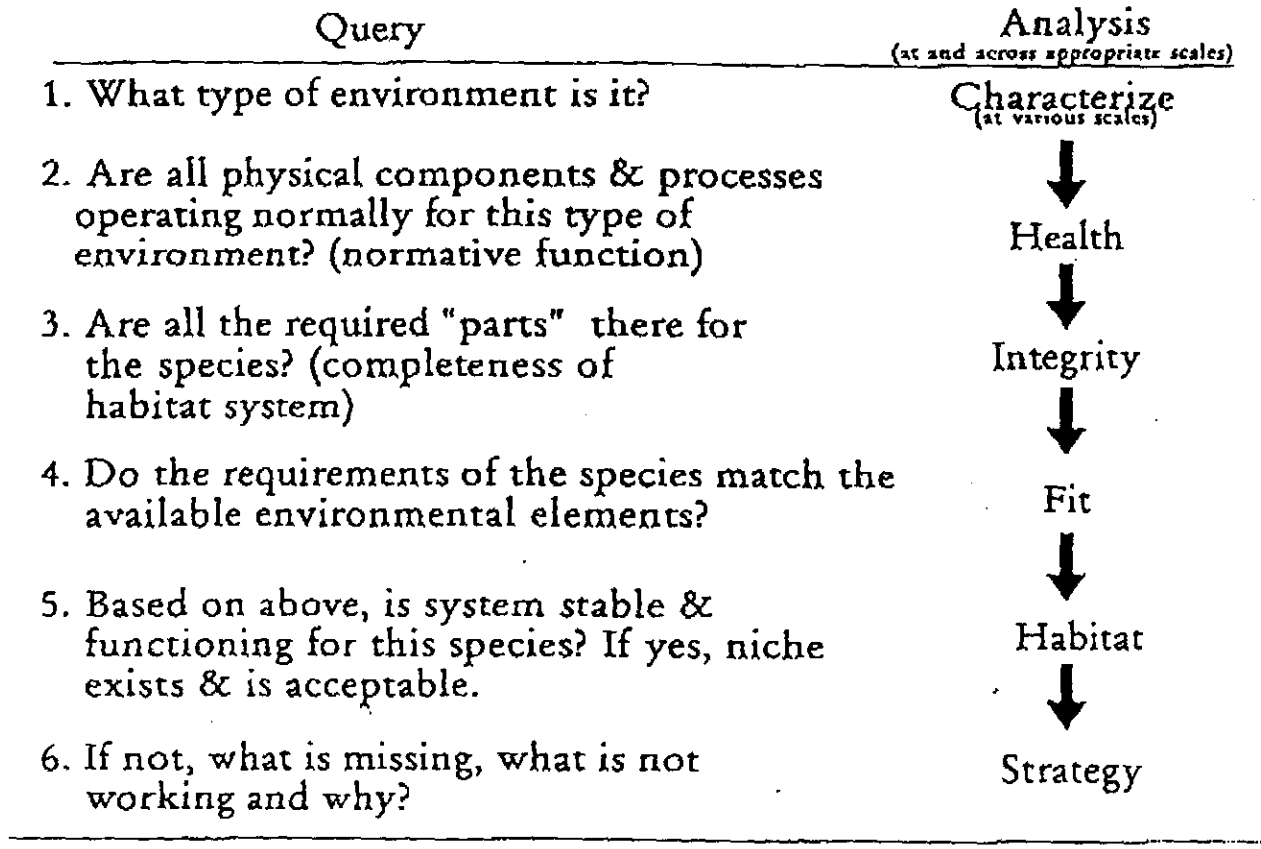

Figure 1. Logical sequence of questions and analysis that lead to a restoration strategy. From: Imhof, J.G., J. Fitzgibbon, and W.K. Annable. 1996. A hierarchical evaluation system for characterizing watershed ecosystems for fish habitat. Can. J. Fish. Aquat. Sci. 53(Suppl. 1): 312-326.

I-011075

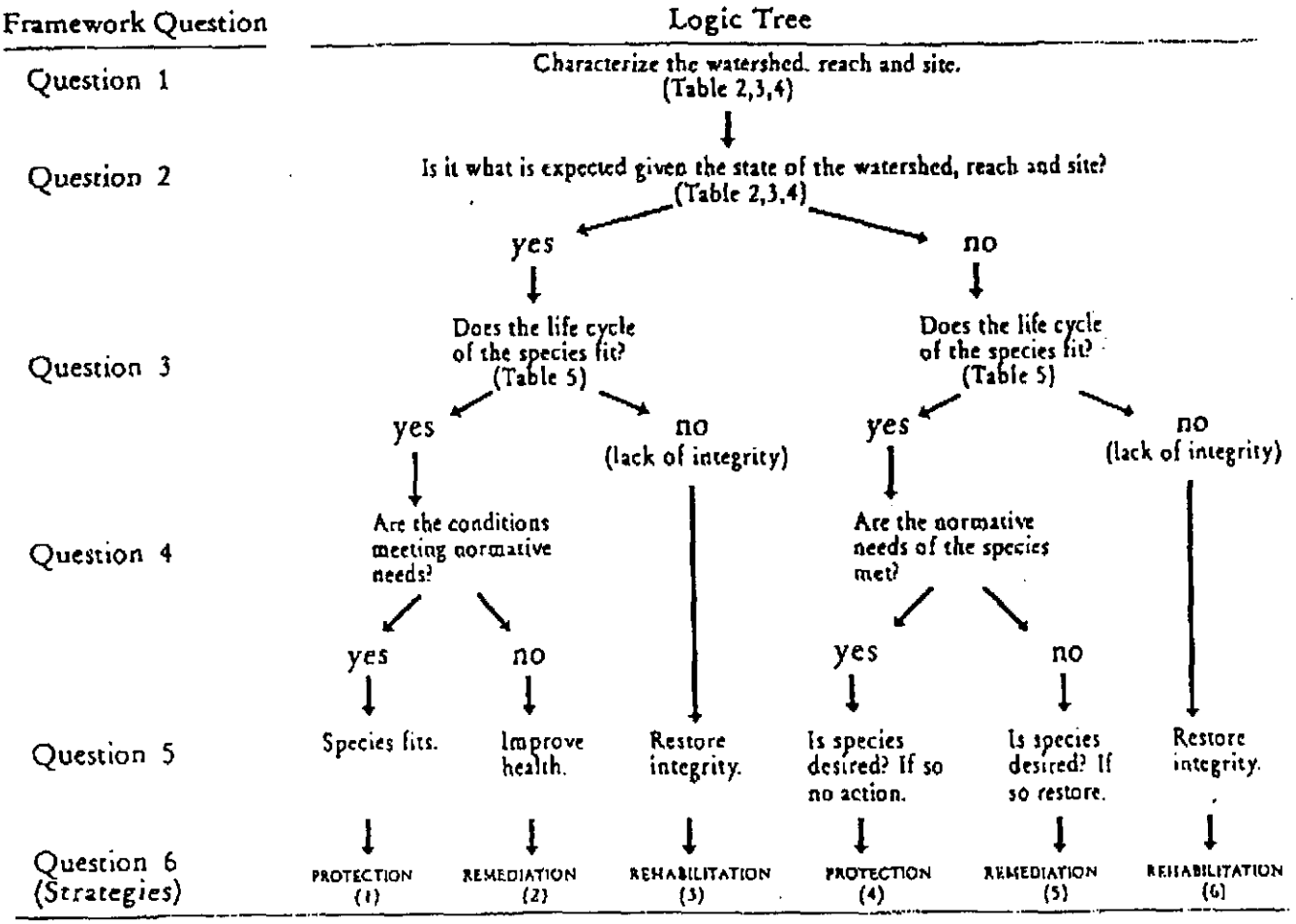

Figure 2. A logic tree showing the analysis pathways that would be followed in response to the questions in Figure 1. From: Imhof, J.G., J. Fitzgibbon, and W.K. Annable. 1996. A hierarchical evaluation system for characterizing watershed ecosystems for fish habitat. Can. J. Fish. Aquat. Sci. 53(Suppl. 1): 312-326.

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V. COSTS AND SCHEDULE

BUDGET

This is a new project that has not been proposed to other funding sources, nor are there any plans to fund this work outside of the CALFED process. As an outcome of this project, desirable restoration projects will be identified, but they will be separate from this project and can be considered independently for funding. Because the specific restoration projects are unknown at this time, we have no estimate of costs for those projects.

The Oakdale and South San Joaquin Irrigation Districts will consider cofunding a portion of this project. Full costs are displayed in the following table, according to the CALFED format.

Task	Personnel	Labor Hours	Direct Salary & Benefits	Overhead Labor	Service Contracts	Supplies	Misc. Direct Costs	Total Cost
Objective 1. Stream Habitat Survey								
	Senior Consultant (Cramer)	30	$1,228	$1,412				
	Fish Biologist (Demko)	250	$6,045	$6,955				
	Fisheries Technician	500	$3,456	$5,544				
	Project Administrator/Support	40	$608	$792				
		Subtotal	$11,336	$14,704	$0	$2,000	$2,000	$30,040
Objective 2. Assess Geomorphic Processes								
	Senior Consultant (Trihey)	385		$5,925	$59,247			
		Subtotal		$5,925	$59,247			$65,172
Objective 3. Fish Use Survey								
	Senior Consultant (Cramer)	24	$982	$1,130				
	Fish Biologist (Demko)	125	$3,023	$3,478				
	Fisheries Technician	250	$1,728	$2,772				
	Project Administrator/Support	40	$608	$792				
		Subtotal	$6,340	$8,172	$0	$0	$0	$14,512
Objective 4. Limiting Factors and Restoration Strategy								
	Senior Consultant (Cramer)	80	$3,274	$3,766				
	Fish Biologist (Demko)	60	$1,451	$1,669				
	Project Administrator/Support	40	$608	$792				
		Subtotal	$5,332	$6,228	$0		$1,500	$13,060
Report Preparation								
	Senior Consultant (Cramer)	80	$3,274	$3,766				
	Fish Biologist (Demko)	40	$967	$1,113				
	Project Administrator/Support	60	$911	$1,189				
		Subtotal	*$5,152*	*$6,068*	$0	$500	$1,000	$12,720
		PROJECT TOTAL	$28,161	$41,096	$59,247	$2,500	$4,500	**$135,504**

SCHEDULE MILESTONES

Following is the expected schedule for completing work on major segments of this project. Where a range of dates are given, the first date is the starting time, and the second date is the completion time. These dates assume that the contract will be in place by January 1, 1999.

Jan-March 1999	Complete operational plan for field surveys, including identification of reach breaks
Jan-Sept 1999	Assemble supporting information for Patient-Template Analysis, Limiting Factors Analysis, and geomorphic process assessment.
Jul-Aug 1999	Survey instream and riparian habitats
May 1, 1999	Snorkel survey of fall chinook distribution and habitat use
Jul-Aug 1999	Snorkel survey of rainbow/steelhead distribution and habitat use
Aug-Sept 1999	Synthesis of data from habitat surveys
Sept 1999	Complete Patient-Template Analysis and Limiting Factors Analysis
Sept 1999	Complete geomorphic process assessment
Nov 1999	*Submit Draft Report*
Feb 2000	Submit Final Report

Invoices will be submitted monthly for actual time and expenses invested. Invoices will be accompanied by a written summary of progress. About 90% of the project and its expenses should be completed in 1999, and 10% in 2000.

The subcontract bid from Entrix for completing the work on fluvial geomorphology was chosen based on (1) the outstanding qualifications of the contractor, (2) the contractor's proximity to the project, and (3) our past favorable experience in working with Entrix. We have worked with Entrix on several projects and have been pleased with their outstanding performance and effective people skills.

THIRD PARTY IMPACTS

We do not foresee any impacts to third parties.

VI. QUALIFICATIONS

Our project leader will be Senior Fisheries Consultant, Steven P. Cramer, and he will be supported by Consulting Hydraulic Engineer, Woody Trihey, and Fishery Biologist Douglas B. Demko. Mr. Cramer will oversee project implementation, lead the limiting factors analysis, and serve as lead editor for the final report. Mr. Trihey will lead all work on stream function, including data analysis, and will coauthor the final report. Mr. Demko will lead the field surveys with two fisheries technicians, synthesize the data gathered from those surveys, and coauthor the final report. Additional support can be drawn from the expert staffs of S.P. Cramer & Associates, and Entrix. Our fisheries technicians and supporting administrative staffs are highly qualified, experienced, and specifically trained in the tasks they assist with.

A portion of our funding for studies on the Stanislaus River over the past several years has come from the AFRP, administered through the Stockton office of the USFWS. Please contact Pat Brandes, Scott Spaulding, or Marty Kjelson (916-946-6400) regarding our performance. For additional references, contact the managers of the two irrigation districts collaborating on this project (see title page for names and phone numbers).

Steven P. Cramer, Principal, S.P. Cramer & Associates, Inc.

Steven P. Cramer has been a fisheries consultant to private firms, state and federal agencies, and Indian tribes for the past 11 years after serving 13 years with the Oregon Department of Fish and Wildlife (ODFW) where he directed major research programs on the Rogue and Columbia basins. The focus of his research and consulting has been the population dynamics of salmon and steelhead populations in the western United States. Mr. Cramer has designed and supervised studies of juvenile chinook outmigration from the Stanislaus River for the last 6 years. He has led studies directly relating instream habitat to natural production of salmonids for sockeye salmon in Wallow Lake (NE Oregon), steelhead and spring chinook in Walla Walla River (SE Washington), spring chinook, fall chinook, and steelhead in the Clearwater River (Idaho), and cutthroat trout in the Umpqua River. He has been the led author on reports presenting detailed analyses of limiting factors for Sacramento spring and late-fall chinook, Willamette River spring chinook, Snake River spring and fall chinook, steelhead in all California and Oregon, and coho in all Oregon. For 12 years, he led studies by ODFW to determine downstream effects on fish from temperature and flow alteration by dams in the Rogue River Basin. He has authored over 70 distributed reports relating to the dynamics of salmon and steelhead populations. For further details, see our web site at www.spcramer.com.

Douglas B. Demko, Fisheries Biologist, S.P. Cramer & Associates, Inc.

Doug Demko has served as a Fisheries Biologist with S.P. Cramer & Associates for 8

years, including 6 years that he has led field studies of anadromous salmonids in the Stanislaus River. He has worked closely with state and federal biologists in the Stanislaus Basin, and has conducted spawner surveys, snorkel surveys of juvenile rearing, mark-recapture studies of juvenile chinook survival, and outmigrant trapping studies in the Stanislaus River. He has organized and led historical data gathering searches in Idaho, Washington, Oregon and California. He has been the crew leader of fish habitat surveys on the Big Quilcene River in Washington (US Forest Service), and of snorkel surveys of fish abundance and habitat use in the Umpqua River in Oregon (Douglas County), and three streams on the Thousand Springs Ranch near Mt. Shasta. Mr. Demko has authored numerous reports distributed to public agencies. For further details, see our web site at www.spcramer.com.

E. Woody Trihey, Principal Consulting Engineer, Entrix.

Woody Trihey is a registered engineer who specializes in quantifying the response of fish habitat to naturally-occurring or project-induced changes in river processes. Mr. Trihey's professional experience and technical background emphasize the management and performance of instream flow investigations, aquatic habitat, hydrologic, and river engineering studies to support hydropower licensing and environmental permitting throughout the United States. His professional experience includes more than 20 years developing and applying scientific methods to describe the response of fish habitats to changes in streamflow, stream temperature, sediment transport, and ice processes. Mr. Trihey has appeared as an expert witness on numerous occasions to explain the effects of altered streamflow patterns on fish habitat and to provide instream flow recommendations

Mr. Trihey has completed several engineering analyses to evaluate the effects of sediment transport processes on stream channel stability and fish habitat conditions. He performed the first time-series analysis of scour effects on salmon spawning habitat while conducting the instream flow studies for the Terror Lake Hydroelectric Project in Kodiak, Alaska. While working on the Susitna River Hydropower Licensing Studies, Mr. Trihey analyzed streambed scour in Portage Creek and Indian River, directed the evaluation of channel stability at the mouths of 22 tributary streams, and reviewed the reservoir sedimentation and channel stability analyses performed by Harza Engineering for the Susitna River. Mr. Trihey has completed channel stability assessments for the Genesee River in New York, the Tuolumne and West Fork San Gabriel Rivers in California, and several streams in Central Utah. He developed a reservoir drawdown and sediment management plan for Bridgeport Reservoir, California.

VII. COMPLIANCE WITH STANDARD TERMS AND CONDITIONS

We accept the terms and conditions specified in the RFP.