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**Philip Williams & Associates, Ltd.**  
Consultants in Hydrology

DWR WAREHOUSE

97 JUL 28 PM 12:45

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July 24, 1997

(PWA Ref. # 96124)

CALFED Bay-Delta Program Office  
1416 Ninth Street, Suite 1155  
Sacramento, CA 94814

To the CALFED Bay-Delta Program:

Philip Williams & Associates, Ltd. (PWA) in coordination with the Geology Department of the University of California, Davis, is pleased to submit ten copies of our proposal for the Ecosystem Restoration Projects and Programs entitled "Tools for Enhancing River-Floodplain Processes on the Cosumnes."

The proposed project will provide analytical tools to assist in the maintenance and restoration of several priority habitats along the Cosumnes River. In addition, this project will assist the river-floodplain restoration effort by developing support building educational tools. Finally, the proposal has been developed in full partnership with The Nature Conservancy (TNC), and has the support of TNC and the County of Sacramento Department of Public Works (see attachment).

Thank you for your consideration.

Sincerely,

*Mikki Steinberg for*

Betty Andrews, M.S.  
Principal

I. EXECUTIVE SUMMARY

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a. PROJECT TITLE AND APPLICANT NAME

Project Title: Tools for Enhancing River-Floodplain Processes on the Cosumnes
Applicants Name: Philip Williams & Associates, Ltd. and the Geology Department, UC Davis.

b. PROJECT DESCRIPTION AND PRIMARY BIOLOGICAL/ ECOLOGICAL OBJECTIVES

This project will provide analytical tools to assist in the restoration and maintenance of the following priority habitats along the Cosumnes River: 1) tidal perennial aquatic habitat (freshwater); 2) seasonal wetland and aquatic; 3) instream aquatic; 4) shaded riverine aquatic; and 4) North Delta agricultural wetlands and the following priority species: 1) east side tributary fall-run chinook salmon; 2) steelhead; and 3) splittail. It may also benefit Delta smelt. This project is designed to provide analytical tools and information that can be used to identify the most promising alternatives for restoring river-floodplain processes with respect to the following:

- 1. provide the frequency and duration of floodplain inundation necessary for vegetative regeneration and provision of ecologically-useful aquatic habitat;
2. minimize off-site flood hazards, necessary for floodplain project permitting; and
3. enhance the ability of the stream channel to make lateral adjustments that will support the generation of riparian vegetation and maintenance of healthy riverine habitat, both in-channel and on the floodplain.

In addition, this project will assist these objectives by developing educational tools for building support for the river-floodplain restoration effort. (Developing an educational program using those tools is reserved for a subsequent phase). Lastly, the fall flow enhancement element of the project will identify physical conditions necessary to enhance fall stream flow conditions to facilitate the escapement of anadromous fish. This element may be appropriate for CVPIA funding. Each of the items proposed should be considered separable for funding purposes.

c. APPROACH/TASKS/SCHEDULE

We propose to undertake the development of three elements under this proposal for an initial phase of work. The first two elements are the development of analytical tools: a computer model of the hydrodynamics of river-floodplain interactions and a computer model of river channel meander evolution. Each tool has an immediate short term value as a means to evaluate discrete potential levee modification alternatives, an activity which The Nature Conservancy (TNC) and others are pursuing vigorously. In addition, these analytic tools will be used to develop an efficient and effective regional levee modification strategy. Lastly, each model has a substantial capability to be employed for the purposes of public education as a result of its ability to display results in an easily understood animated display, a critical need for building community support for proposed levee modification projects. The third element proposed is a preliminary effort to assess the potential for raising fall flows to enhance anadromous fish escapement.

Hydrodynamic Model Development

*October 1997 - September 1998*

Meander Evolution Model Development

*October 1997 - September 1998*

Preliminary Assessment: Fall Flow Enhancement Opportunities

*October 1997 - June 1998*

**d. JUSTIFICATION FOR PROJECT FUNDING FROM CALFED**

The above section on "Project Description and Primary Ecological Objectives" identified the many habitats and species that would be benefitted from the funding of this project. Yet the most compelling reason for the funding of this project is that the Cosumnes represents the very best opportunity available for large-scale restoration of the full complex of natural processes on a tributary to the Delta. The tools and analysis being proposed herein will be extremely useful, perhaps even critical, to achieving this goal.

**e. BUDGET COSTS AND THIRD PARTY IMPACTS**

The total cost of this proposal is \$391,000, with \$244,000 for the hydrodynamic model development, \$110,000 for the meander model development, and \$37,000 for the fall flow enhancement assessment. No third party impacts are anticipated.

**f. APPLICANT QUALIFICATIONS**

Philip Williams & Associates, Ltd. (PWA) is a consulting firm specializing in hydrology that has 20 years of experience in performing the type of work described herein. PWA has recently completed a study of the Cosumnes for TNC, including development of a steady-state flood model for the river. Dr. Larsen is a Research Scientist in the Departments of Geology and Civil Engineering at the University of California, Davis, with unique expertise (e.g., upper Sacramento, Mississippi River) in developing the type of meander model being proposed. Dr. Mount is a professor and chair of the Geology Department at UC Davis and the author of "California Rivers and Streams: The Conflict Between Fluvial Processes and Land Use".

**g. MONITORING AND DATA EVALUATION**

The project includes the installation of short-term gages for river stage and one year of groundwater monitoring. Additional years of monitoring are not proposed as part of this project, but could be undertaken in the future if warranted.

**h. LOCAL SUPPORT/COORDINATION WITH OTHER PROGRAMS/COMPATIBILITY WITH CALFED OBJECTIVES**

The proposed project has been developed in full partnership with TNC, which is a landowning partner in the Cosumnes River Preserve. TNC has chosen not to administer the project to avoid the associated overhead costs. The County of Sacramento is very interested in the development of a hydrodynamic floodplain modeling and mapping tool as a means of better accomplishing their floodplain management goals in the corridor. The U.S. Geological Survey, which developed a steady flow flood model in the wake of the 1997 floods, has also been consulted and will provide data used in the development of their model, although they are not able to make any formal commitment for their involvement at this time. The project will support exactly the kinds of ecosystem restoration projects that CALFED has expressed the greatest interest in: those that restore natural physical processes on a broad scale to the benefit of Delta fish and wildlife.

## II. TITLE PAGE

**a. TITLE OF PROJECT**

Tools for Enhancing River-floodplain Processes on the Cosumnes

**b. NAME OF APPLICANT/PRINCIPAL INVESTIGATORS**

**Applicant and Principal Investigator**

Philip Williams & Associates, Ltd.  
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Vincent Neary, Ph.D., Senior Associate  
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**Principal Investigator**

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Davis, CA 95616  
(916) 752-8336 voice; (916) 752-0951 fax  
ewlarsen@ucdavis.edu  
jfmount@ucdavis.edu

**c. TYPE OF ORGANIZATION AND TAX STATUS**

Philip Williams & Associates, Ltd.  
University of California

S-Corporation  
Educational Facility

**d. TAX IDENTIFICATION NUMBER**

Philip Williams & Associates, Ltd.  
University of California

94-3083005  
94-6036494-W

**e. TECHNICAL AND FINANCIAL CONTACT PERSONS**

**Technical Contact Persons:** Same as above

**Financial Contact Person:** Alyse Jacobson, CFO Philip Williams & Associates, Ltd.

**f. PARTICIPANTS/COLLABORATORS IN IMPLEMENTATION**

The Nature Conservancy (See Attachment)

The County of Sacramento Department of Public Works (See Attachment)

The US Geological Survey (potential)

**g. RFP PROJECT GROUP TYPE**

Other services

### III. PROJECT DESCRIPTION

#### a. PROJECT DESCRIPTION AND APPROACH

The Cosumnes River is the last major undammed river draining the Sierra Nevada. It is therefore relatively intact in a hydrologic sense, and supports the largest remaining stand of valley oak riparian forest in the Central Valley. The oak forests and fertile wetlands near the mouth have been recognized by a host of agencies that have acted to acquire title to specific parcels to preserve their ecologic wealth.

The river has demonstrated value to fall-run salmon, steelhead, and splittail and may also serve as a rearing area for delta smelt. It presently provides shaded riverine aquatic habitat in the spring and fall and provides valuable foraging areas for juveniles in the winter and spring in the areas where the floodplains are freely accessible to the river.

The value of the Cosumnes as riverine habitat linked to the Delta, though substantial, is greatly limited by the present system of levees along the river. An increase in the areas of floodplain that are freely accessible to provide flooded foraging areas and a source of nutrients to the stream system and the Delta would directly benefit aquatic species in the Delta. If coupled with an easement or fee title purchase system that would allow an increase in the generation of riparian forest within a buffer zone, the benefit to aquatic species would increase and a benefit to terrestrial wildlife and vegetative species would also accrue. For the greatly modified river channels entering the Delta today there are simply very few opportunities for restoration of a river system that begin to approach what is possible on the Cosumnes.

The great New Year's Day flood of 1997 also underscored the fragility of the present system of levees along the Cosumnes. More than 20 levee breaks along the river have created a tremendous potential to rethink the approach to managing floods along this river. As the hydraulic modeling completed by The Nature Conservancy's (TNC's) consultant, Philip Williams & Associates, Ltd. (PWA), has shown, the levees along the river are inadequate to protect the lands behind them from even a 5-year flood.<sup>1</sup> Moving the levees away from the river would provide greater capacity to convey floods, reduce flood elevations, provide floodplain storage that would lower peak flood flows, and reduce the exposure of the levees to frequent, erosive, flows. The Governor's Flood Emergency Assistance Team has acknowledged that development of a broader floodway along the Cosumnes may be a flood solution worth pursuing.

In addition, the study by PWA showed that the present system of levees is actually putting both the river's ecologic resources and the levee system itself at risk by creating a self-reinforcing system of forces that are causing the river to downcut and undermine the river banks and the levees and trees atop them. The downcutting may also threaten the existing salmon spawning beds upstream of Meiss Road.

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<sup>1</sup> This result is reportedly confirmed by the hydraulic modeling of the river presently being completed by the U.S. Geological Survey.

For all of these reasons, The Nature Conservancy (TNC) and others (e.g., the Natural Resources Conservation Service) are investigating the potential for breaching, relocating, or removing levees at selected locations along the Cosumnes. TNC is submitting a separate proposal to CALFED for a block grant for land and/or easement acquisition for this purpose. Successful implementation of this program, however, will require both cooperation from Cosumnes River landowners and an ability to show that flood hazards will be either unchanged or improved as a result of the changes proposed. This proposal seeks to address those two needs through the development of two models. The first is a dynamic flood model of the river—drawn heavily from work previously completed by PWA and the U.S. Geological Survey (USGS)—from the mouth upstream to Dillard Road. A dynamic meander migration model will also be developed and used to plan geomorphically-effective areas for levee changes. The two models will be linked to existing Geographic Information System (GIS) mapping of the corridor for ease of model development, evaluation of alternatives, and demonstration of the effects of proposed actions to a cross-section of audiences. These models will allow the identification of a levee change strategy that addresses all three objectives for levee modification projects: flood management, riparian restoration, and erosion management.

Lastly, this proposal seeks to initiate an investigation of the *physical* requirements for enhancing the streamflows in the river in the autumn, a pre-requisite for significantly improving the usefulness of the Cosumnes as spawning habitat for anadromous fish. Addressing this question requires that we develop a clearer understanding of the surface water-soil water-groundwater interaction at the Cosumnes river corridor. The groundwater table in the vicinity of the lower Cosumnes is severely depressed compared to historic conditions; it is estimated to have dropped approximately 60 feet since colonization. Each summer, the river dries up for approximately 100 days, opening only with the onset of significant winter rainfall. In some years, the opening does not occur until the wave of fall escapement is already past. This phenomenon is predictable given the condition of the area's groundwater and the seasonality of rainfall. This proposal will take the preliminary steps necessary to characterize, in a general fashion, the relationship between surface flow in the river upstream at the Michigan Bar gage and 1) surface flow downstream in the lower reaches and 2) the relationship between surface flow and subsurface water conditions in the immediate river corridor. With this information it will be possible to identify potentially feasible strategies to address this impediment to increased use of the Cosumnes for spawning by fall-run salmon. (The present size of the run is 5,000 fish; estimated spawning capacity is 17,000.)

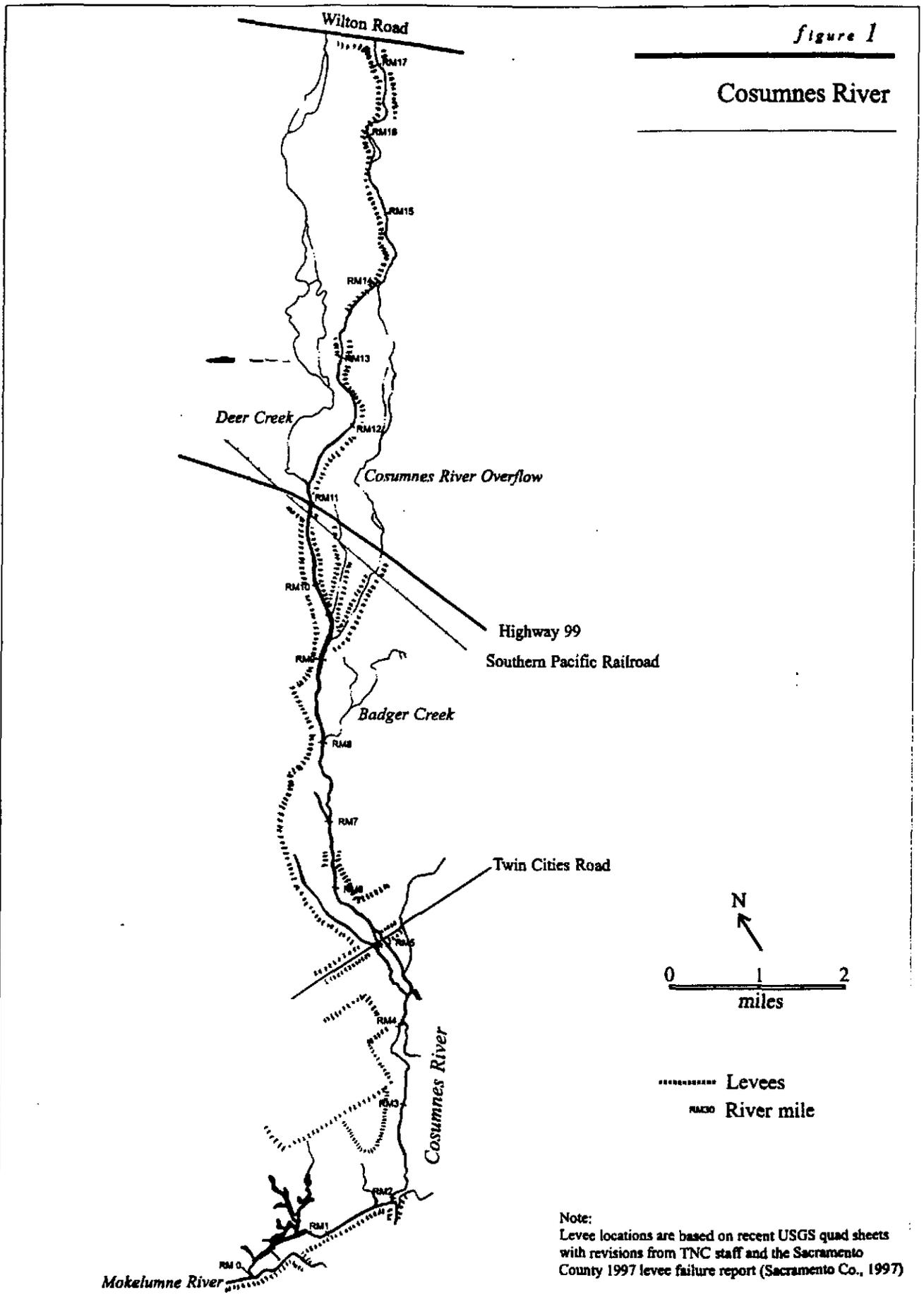
**b. LOCATION AND/OR GEOGRAPHIC BOUNDARIES OF PROJECT**

The proposed project will address the conditions in the Cosumnes River in the reach downstream of Michigan Bar. (See Figures 1 and 2.) This study reach lies entirely within Sacramento County. The hydrodynamic model will specifically extend from the mouth of the river to the vicinity of Dillard Road, while the meander model will extend from the mouth to Highway 16. The fall flow enhancement assessment will address conditions throughout the study reach.



figure 1

Cosumnes River

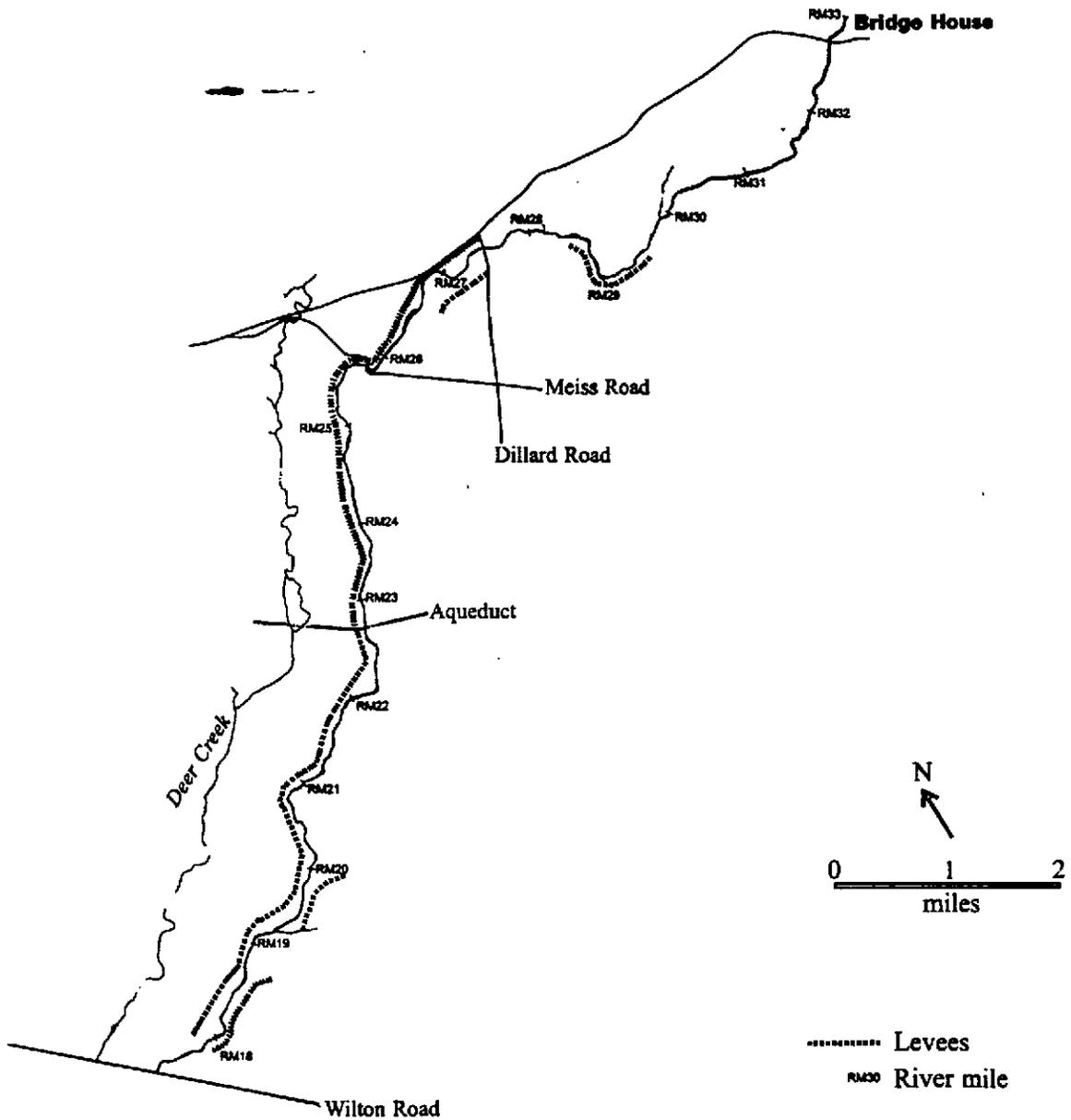


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Note:  
 Levee locations are based on recent USGS quad sheets with revisions from TNC staff and the Sacramento County 1997 levee failure report (Sacramento Co., 1997)

Figure 2

Cosumnes River



Note:  
Levee locations are based on recent USGS quad sheets  
with revisions from TNC staff and the Sacramento  
County 1997 levee failure report (Sacramento Co., 1997)

96-124-1.cdr7.22.97

**c. EXPECTED BENEFITS**

This project will provide analytical tools to assist in the restoration and maintenance of the following priority habitats along the Cosumnes River: 1) tidal perennial aquatic habitat (freshwater); 2) seasonal wetland and aquatic; 3) instream aquatic; 4) shaded riverine aquatic; and 4) North Delta agricultural wetlands and the following priority species: 1) east side tributary fall-run chinook salmon; 2) steelhead; and 3) splittail. It may also benefit Delta smelt. These priority habitats and species will be benefitted at a secondary level to the extent that levee modification and fall flow enhancement projects proceed as a result of this project.

It will be necessary to have the analytic tools available which will allow proposed levee setback and levee modification projects to be prioritized and evaluated for their influence on flood hazards and erosion conditions on other properties along the river. Permitting will require such analysis prior to implementation. The models we have proposed to develop will perform this job. In addition, they could also be developed—in a subsequent phase of effort—into powerful tools for public education and the development of support for these projects.

The preliminary assessment of the physical requirements for enhancing fall flows will lay the groundwork necessary to identify what would be required to achieve improved fall-run salmon escapement flow conditions on the Cosumnes. Depending on the results of this work, subsequent effort by ourselves or another entity may be appropriate to allow the feasibility and desirability of flow acquisition—or another mechanism for enhancing fall flows—to be fully explored.

A third party benefit will also accrue to the County of Sacramento through the development of powerful flood modeling tools that can be used for floodplain management planning.

**d. BACKGROUND & BIOLOGICAL/TECHNICAL JUSTIFICATION FOR PROJECT**

There is presently tremendous interest in performing levee modifications along the Cosumnes River. As previously described, these projects will directly reconnect the river with its floodplains, providing sources of nutrients for the river and the waters downstream, foraging and rearing habitat for aquatic species, improvements in riparian vegetation, enhancement of a Delta-foothills wildlife corridor, and assist in the conservation of riparian vegetation and spawning gravels that are threatened by the river's present downcutting. The corridor's mix of riparian forests, freshwater tidal marshes, and seasonally flooded habitats will be enhanced and/or enlarged as levees are breached and river-floodplain interactions are restored along this last stream subject to relatively natural Sierra hydrology.

A preliminary study<sup>2</sup> has indicated that the habitat provided by the inundated floodplains may be responsible for improved growth rates in juvenile salmon, potentially leading to improvements in their survival during the downstream migration. Non-aquatic species such as declining neotropical migrant passerine bird species, the giant garter snake, the western pond turtle, and other species will also benefit from improvements in the riparian vegetation.

Interest in large-scale restoration of river-floodplain interactions on the Cosumnes led to a TNC-initiated project in 1996-1997, conducted by PWA, to assess the status of river-floodplain

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<sup>2</sup> Harris, Amy, 1996. *Survey of the Fish Populations of the Lower Cosumnes River* (unpublished manuscript).

interactions and develop a floodplain restoration proposal. Total project costs were approximately \$73,000, funded by TNC with a significant contribution by PWA. (A project report was released in May, 1997, and is available from TNC.) Due to the limited funding, PWA developed only a steady-state hydraulic model for the Cosumnes from near the mouth to Wilton Road as part of our work on this project.

Until the 1997 efforts of PWA, and later the USGS, to model the Cosumnes River flood flows, no hydraulic model of the Cosumnes River was available to assess flood hazards along most of the river. The models developed by PWA and the USGS are similar in that they are both steady flow, step-backwater models of flood conditions, which cannot evaluate the effect of floodplain storage and resulting peak flow attenuation or the effect of a changing downstream tidal boundary condition. The flood model proposed for development as part of this project is a hydrodynamic model which has neither of these limitations. Many of the lands targeted for priority easement or fee title acquisition are in the tidally-influenced portion of the Cosumnes, which would be much more accurately modeled for both flood hazards and floodplain inundation frequency by the type of hydrodynamic model proposed than could be achieved with existing tools. In addition, the ability to demonstrate reductions in peak flood flows due to proposed projects would greatly assist in securing flood management-derived funding for their implementation. It would also help secure the base of public support which will be necessary for broad implementation of floodplain restoration along the river.

We propose to use MIKE-11, a pseudo 2-dimensional unsteady flow model developed by the Danish Hydraulic Institute (DHI) which was specifically developed to address the need for modeling river-floodplain systems. This model has a long history of use in Europe (10 years) and has additional capabilities that we believe to be invaluable for the Cosumnes: 1) automated floodplain mapping using GIS, a great benefit when a sequence of levee modification projects are anticipated; and 2) graphical animation capabilities, which can very effectively display the impact of a proposed project or projects in an immediately accessible fashion to the lay public.

Alternative and similar looped network unsteady flow models exist which could be applied for this purpose, such as UNET. UNET is presently targeted for incorporation into the US Army Corps of Engineers' River Analysis System of river modeling. Because MIKE-11 is presently less well-known in the U.S. than UNET, we are also proposing parallel development of a UNET version of the model despite its significant limitations in terms of both interface and display capabilities. The incremental cost of developing the UNET model for the same reach of river using the same data is relatively small, and will provide two benefits. First, because it will be developed by the same entity using the same data, it will be a comparable alternative to the MIKE-11 model for those who might be better able to use this software because of cost or other considerations. This will minimize the chance of another UNET model of the Cosumnes being developed that is fundamentally inconsistent with the MIKE-11 model. Staff of Sacramento County Department of Public Works believe that development of a UNET model for the river will certainly happen at some point in the future. If the UNET model that is developed is inconsistent with the MIKE-11 model, significant disputes among those entities using MIKE-11 and those using UNET are likely to develop that may hamper the implementation of floodplain restoration efforts along the river. Second, parallel development of a UNET will provide another means of validating the MIKE-11 modeling results.

Alternatively, the UNET model alone could be developed to address the need for a flood hazard analysis tool. However, we believe that the strength of the GIS capabilities available through MIKE-11 in terms of ease of use of the model, directly usable output, and educational potential make it a far preferable choice to UNET. A second alternative would be to develop the MIKE-11 model without funding the incremental cost of the UNET model. This alternative would still meet the immediate goals of CALFED, but would also have the drawbacks identified above and would also not provide the County with the tool they believe they could most readily use.

The meander migration model to be developed as part of this project will identify priority areas for levee setbacks on the basis of river planform evolution, or the locations where the channel banks are at greatest risk of being attacked by long-term erosional processes of the river channel. The meander migration model will be used to explore the impact of different levee change alternatives on the evolution of the river meander pattern. This analysis tool would allow strategies for levee change to be developed which present the greatest opportunity for reducing problems caused by channel erosion.

The meander migration model that will be applied to the Cosumnes was successfully applied to model a selected reach of the Mississippi River in Dr. Larsen's Ph.D. research. Since that time, the model has been successfully used to model migration of the Santa Clara River, and as a planning tool for The California Department of Parks and Recreation on the Upper Truckee River. In addition, a version of the meander migration model is currently being adapted for the California Department of Water Resources to model the channel planform evolution of the Upper Sacramento River. The model is currently being used to develop a management plan for developing a riparian conservation zone along the Upper Sacramento River.

An alternative to developing the meander model would be to develop a qualitative assessment of erosional hazards of different levee change options. This approach provides less precise information with which to distinguish between alternatives, and fails to provide the foundation for an educational tool that is offered by the model's dynamic graphical display.

The fall flow enhancement assessment will rely primarily on an analysis of existing data and studies of groundwater and recharge conditions developed by Sacramento County and others. Two forms of analysis are anticipated: 1) analysis of streamflow data; 2) development of a simple model of recharge and flow through the river channel, probably using analytic methods appropriate to "border irrigation" hydraulics. Field data will be collected in the form of observations of the distance traveled by discrete flood waves and discharge estimates at a location downstream of the stage gate at McConnell during the fall months.

More expensive and elaborate modeling and data collection approaches could be applied to this analysis, but were considered to be of marginal value when the nature of the physical conditions controlling the fall flow phenomenon were still relatively unknown.



**e. PROPOSED SCOPE OF WORK**

**Hydrodynamic Flood Model**

- Phase I* • Collect data, develop and calibrate models based on existing conditions using historical flooding records and new stage gages.
- (proposed) • Apply models to alternative levee configurations to assess impacts on flooding and resultant habitat restoration potential, prepare report, present model capabilities and results to agencies.
- Phase II* • Develop detailed topographic mapping of the potential restored floodplain corridor.
- Develop and conduct a workshop on floodplain restoration for property owners and management agencies using the available modeling tools.
- Phase III* • ~~Collect~~ new survey data downstream of Highway 99.
- Extend the model downstream along the Mokelumne as appropriate given potential restoration opportunities in the region.

**Meander Migration Model**

- Phase I* • Develop input data, adapt model to the Cosumnes River, and calibrate the model based on the channel planform from various time periods.
- Simulate meander migration of the channel in order to provide channel location and hydraulic data for flood modeling, prepare report.
- Phase II* • Use simulated migration results and predicted flood regimes derived from the floodplain modeling to develop optimization schemes for set-back levees, prepare report.
- Develop an educational workshop on floodplain restoration for property owners and management agencies using the available modeling tools.

**Fall Flow Enhancement Assessment**

- Phase I* • Collect existing and new field data.
- Review available studies; analyze available data, develop model.
- Prepare report, including recommendations for Phase II work, if any.

**f. MONITORING DATA AND EVALUATION**

The projects being carried out are not directly restoration projects, and are therefore not appropriate for monitoring *per se*. The project products themselves will, however, be subject to peer review through cooperating agencies such as TNC, Sacramento County, and the USGS. Informal interagency workshops, such as that conducted by TNC in June, 1997 on Cosumnes River initiatives, as well as project reports, will provide a mechanism for disseminating the results of our work.

**g. IMPLEMENTABILITY**

Since this project consists of technical research and development, it is not subject to typical implementability concerns. With adequate funding, and completion of the USGS flood study, (due in August, 1997) the project can be fully implemented by the applicants. Coordination with TNC's easement/fee title purchase program will enable us to identify an appropriate site specific levee modification study to perform as part of this work, and coordination with the County of Sacramento will ensure development of a work product that can be directly employed in a broad fashion for floodplain management analyses.



## IV. COSTS AND SCHEDULE TO IMPLEMENT PROPOSED PROJECT

### a. BUDGET COSTS

The needs for analytic tools for levee modification planning are driven by both flood management and restoration needs. However, restoration goals seek to achieve far more change in the status quo along the river, and will therefore only be satisfactorily supported by tools that are more elaborate than those typically employed for flood management planning. Thus, CALFED funding is sought for the floodplain and meander migration modeling efforts proposed in this application. The UNET model development component might be eligible for funding by another entity primarily concerned with flood management, but such a funding source has not been identified. The fall flow enhancement assessment is in support of flow-related changes that may be proposed on the river, and might therefore be suitable for CVPIA funding rather than CALFED funding.

The project elements being proposed are reasonable first steps towards developing much-needed tools and information for restoration of the floodplains of the Cosumnes. They are far from being the complete answers to even the specific questions they will help us address (river-floodplain hydrodynamics and meander migration under different scenarios, and the physical requirements for fall flow enhancement for fall-run salmon). But they are excellent cost-effective first steps towards providing these answers.

The results of our work in Phase I and the turn of events external to our study may strongly suggest the need for subsequent phases of work that build on the results of this project. For example, easement acquisition on lands downstream of the mouth of the Cosumnes, such as the McCormack-Williamson Tract may require an assessment of the hydrodynamic and flood impacts of proposed changes. That possibility may require that the MIKE-11 model be extended downstream. Alternatively, levee modification plans may drive the need for photogrammetric data collection that could be incorporated into the GIS database used by MIKE-11 for more efficient floodplain mapping and modeling. Our fall flow enhancement assessment may suggest that groundwater recharge goals of Sacramento County can be met, in part, by the large quantity of water required to saturate the river channel and sustain surface flows, thereby creating a new partner in our efforts and the need to assess the potential for developing a project of mutual interest. Alternatively, our work could prove highly inconclusive due to wide variability in the data and suggest the need for additional data collection and analysis. Our best estimates at the present time for potential phases of work and their costs have been included in the following cost table.

**b. SCHEDULE MILESTONES**

Work would be initiated upon authorization to proceed, anticipated to be October 1, 1997. All project elements would begin immediately.

**Fall Flow Enhancement Assessment**

- October 15, 1997 — Install temporary flood flow/low flow gages.
- June 30, 1998 — Complete fall flow enhancement assessment and report.

*Deliverable: Project Report (to include an estimate of the volume and conditions of flow required to make the Cosumnes fully accessible to fall-run salmon in most years)*

**Floodplain Modeling**

- April 30, 1998 — Complete floodplain model calibration.
- July 31, 1998 — Complete floodplain modeling studies.
- September 30, 1998 — Complete project report, presentation to agencies.

*Deliverable: Presentation to the Agencies of the capabilities of the model, including a demonstration of the graphics capabilities of MIKE-11 and the GIS.*

*Deliverable: Project Report (to include demonstration GIS graphics and studies of existing conditions, one site-specific levee modification alternative, one regional levee modification alternative)*

**Meander Migration Modeling**

- December 31, 1997 — Complete data collection and development.
- September 30, 1998 — Complete model calibration and migration simulation, project report.

*Deliverable: Project Report (to include planform maps and computer code. The report will discuss the underlying assumptions of the analytical model, the calibration procedure, hydraulic input parameters, and the performance of the model simulations. )*

Costs will be invoiced monthly based on real time and materials costs.

**c. THIRD PARTY IMPACTS**

No direct negative third-party impacts are anticipated as a result of these research and development projects.

**Table 1. Cost Breakdown**

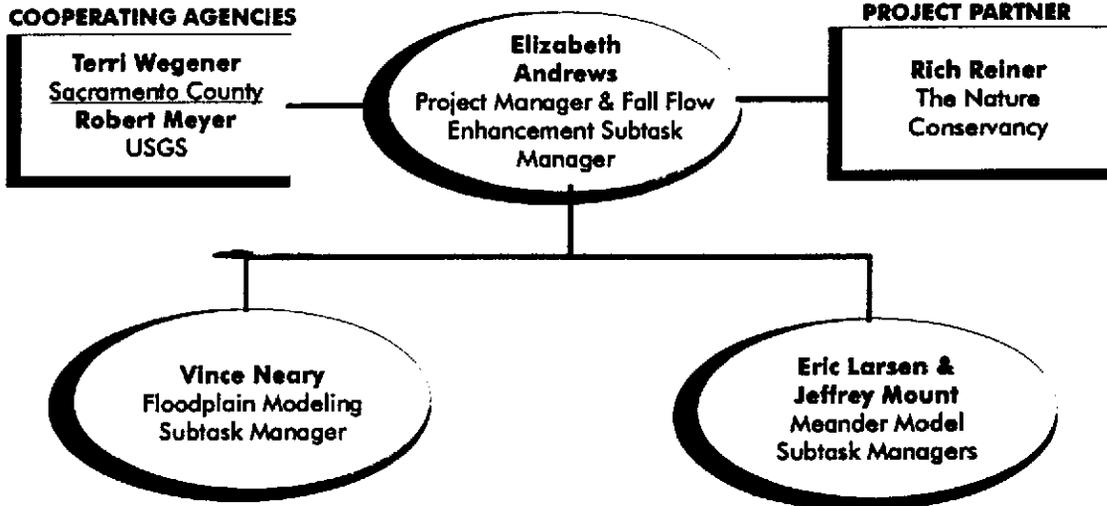
Project Phase and Task	Direct Labor Hours	Direct Labor Costs & Benefits	Overhead Labor G&A + Fee	Service Contracts	Misc. & Other Direct Costs	TOTAL
<b>PHASE I (PROPOSED)</b>						
<b>Floodplain Modeling (MIKE-11)</b> (Work completed to date: \$66,000 from TNC and \$6,600 in-kind contribution from PWA for floodplain restoration study; \$270,000 flood modeling study by USGS, funded by FEMA)						
Data collection	392	\$13,080.32	\$18,317.36	\$0.00	\$5,000.00	\$36,397.68
GIS Digital Model Development	180	\$6,231.72	\$8,776.32	\$0.00	\$10,000.00	\$25,008.04
MIKE-11 Model Formulation	184	\$6,588.80	\$9,279.28	\$0.00	\$0.00	\$15,868.08
Model Calibration and Verification	96	\$3,455.12	\$4,866.00	\$0.00	\$0.00	\$8,321.12
Model Application	348	\$12,753.96	\$17,962.08	\$0.00	\$10,000.00	\$40,716.04
Analysis of Results	348	\$12,435.88	\$17,514.00	\$0.00	\$5,000.00	\$34,949.88
Preparation of project technical report	248	\$8,466.64	\$11,923.68	\$5,000.00	\$3,200.00	\$28,590.32
Coordination with County, TNC, USGS	40	\$1,592.40	\$2,242.72	\$0.00	\$1,000.00	\$4,835.12
Presentation to Agencies	112	\$4,098.00	\$5,771.44	\$0.00	\$2,000.00	\$11,869.44
<b>Subtotal—Floodplain Modeling (MIKE-11 only)</b>						<b>\$206,555.72</b>
Parallel UNET development	428	\$15,022.16	\$21,156.20	\$0.00	\$1,000.00	\$37,178.36
<b>Subtotal—Floodplain Modeling (MIKE-11 and UNET)</b>						<b>\$243,734.08</b>
Fall Flow Enhancement Assessment	416	\$14,982.00	\$21,099.84	\$0.00	\$500.00	\$36,581.84
Meander Migration Modeling	200	\$7,019.40	\$9,885.72	\$83,317.00	\$9,500.00	\$109,722.12

Project Phase and Task	Direct Labor Hours	Direct Labor Costs & Benefits	Overhead Labor G&A + Fee	Service Contracts	Misc. & Other Direct Costs	TOTAL
<b>PHASE II (POTENTIAL)</b>						
Meander Model Continuation						\$105,000.00
Detailed River Corridor Topography						\$350,000.00*
Educational Workshops (2)						\$65,000.00*
Fall Flow Enhancement Planning <i>or</i> further Data Collection <i>or</i> Analysis						to be determined
<b>PHASE III (POTENTIAL)</b>						
Floodplain Model Enhancement						\$40,000.00*
Floodplain Model Extension						\$100,000.00*

\* These costs are provided as approximate estimates only. Actual values will depend in significant part on the results of Phase I work.

## V. APPLICANT QUALIFICATIONS

Philip Williams & Associates, Ltd. (PWA) will act as the primary administrator of the project, though the project will be jointly conducted and managed with Dr. Larsen.



Elizabeth S. Andrews, M.S., P.E. of PWA will serve as the overall Project Administrator and the Subtask Manager for the Fall Flow Enhancement Assessment Element. Vince Neary, Ph.D. of PWA will be the Subtask Manager for the Floodplain Model Element. Eric Larsen, Ph.D. will be the Subtask Manager for the Meander Migration Model Element.

**Elizabeth S. Andrews, M.S., P.E.** (Principal, PWA) has a special interest in the restoration and enhancement of river and stream systems and the management of floodplains. She is experienced as a project manager and has focused her professional work in the arena of geomorphic, hydrologic, and hydraulic processes. Ms. Andrews conducted the study of the Cosumnes previously completed by PWA. She has also managed many projects with the firm, including a Flood Insurance and Floodplain Mapping study of more than 70 miles of streams in Placer County, CA. She is quite familiar with the Cosumnes project site, its geomorphology, and flood conditions.

**Vince Neary, Ph.D.** (Senior Associate, PWA) is a hydraulic engineer specializing in numerical modeling of flow and sediment processes in river and estuary environments. He also has a strong theoretical background in unsteady flood modeling, sediment transport mechanics and open-channel hydraulics. Over the last year and a half he has worked on several floodplain and tidal marsh restoration projects in North San Francisco Bay and Napa River, and presently serves on the technical modeling committee for the North Bay Wetlands.

**Eric Larsen, Ph.D.** (Research Scientist, University of California at Davis) has over ten years of research experience relating the mechanics of fluvial processes with geomorphic forms. He is currently involved in research projects on the mechanics of alluvial channel formation. Dr. Larsen also has extensive experience in field studies. He supervised and conducted a four year field research program for his Ph.D. research on streams in Wyoming and Colorado. He also supervised

field research for the US Forest Service and the Department of Justice for a major case on Water Rights litigation in Colorado in 1988-1990. He has taught, and continues to teach, seminars in field techniques in fluvial geomorphology as well as in the theoretical mechanics of fluvial geomorphology.

**Jeffrey Mount, Ph.D.** (Professor and Chair, Geology Department UC Davis) has more than 17 years experience as a stratigrapher and sedimentologist working in the fields of marine and non-marine sedimentation. He has also successfully managed eight large NSF and several ACS research grants during this time. During the past five years Dr. Mount has been actively involved in science education about the state's rivers, through UC Davis classes, UC Extension trips, and courses and lectures. This emphasis on river related education has culminated in a book titled "California Rivers and Streams: The Conflict Between Fluvial Process and Land Use". This book is a comprehensive look at fluvial processes and landscape evolution within California as well as a study of the impacts of various land uses on the state's rivers. Development of his book has afforded him the opportunity to evaluate many fluvial research programs in California.

Coordination with TNC will occur through Rich Reiner, Ph.D., Restoration Biologist at TNC. Coordination with Sacramento County Department of Public Works is expected to occur through Terri Wegener, P.E., Senior Engineer; with the Sacramento County Water Resources Department through Pete Ghelfi, Senior Engineer; and with the USGS, through Robert Meyer. TNC will identify any other active agencies or entities with an interest in the implementation of this project that may wish to participate in project coordination meetings.

#### **Representative Projects and Papers**

PWA internal report #1148 *Analysis of Opportunities for Restoring a Natural Flood Regime on the Cosumnes River Floodplain*

PWA work done for TNC described briefly on page III-1 of this proposal.

PWA internal report #796 - *Town of Loomis, Placer County, California Flood Insurance Study*

This Flood Insurance Study was conducted by PWA to provide existing condition 100-year floodplain mapping of areas that had been previously studied under the Federal Flood Insurance Program. The study was carried out as part of an analysis of more than 70 miles of streams in Placer County using new hydrologic information based, in part, on re-analysis following the February, 1986 flood.

PWA internal report #929 - *A Geomorphic Evaluation of Meander Migration and Identification of Effective Bank Stabilization Locations*

The purpose of this study was to evaluate the future trends of bank erosion along the Santa Clara River and to identify the most appropriate sites for demonstration bank stabilization projects. The prediction of future erosion trends was obtained using a river meander model developed by Dr. Eric Larsen.

PWA internal report #1154 - *Recommendations for Data Collection, Monitoring, and Modeling for the Napa-Sonoma Marsh Complex*



PWA developed recommendations for an integrated data collection, monitoring and modeling program for the Napa-Sonoma Marsh Complex in the North Bay Wetlands. The program considers the technical issues of concern to restoration efforts and modeling requirements.

PWA internal report #1073 - *Napa River Model: A Tool for Integrated Watershed Management Phase I: Pilot Modeling and Concept Demonstration*

PWA, in collaboration with the Napa County Resource Conservation District and the Danish Hydraulic Institute, developed an unsteady one-dimensional MIKE-11 hydrodynamic and advection-dispersion model of the Napa River from Oak Knoll Avenue to Mare Island Strait Causeway.

PWA internal report #1185 - *Napa River Sediment* (work in progress)

PWA developed a MIKE-11 model of the lower Napa River to assess impacts of tidal marshplain and floodplain restoration on sedimentation processes. A hydrodynamic model was first developed which successfully simulated main channel-marshplain-floodplain interactions, including floodplain storage and tidal water surface fluctuations. The model was then used to simulate cohesive and noncohesive sediment transport, including the morphology of the channel, tidal marshplain, and floodplain.

Larsen, E.W. 1995. *The Mechanics and Modeling of River Meander Migration*, Ph.D. Dissertation, University of California Berkeley.

Larsen, Schadlow, and Mount, 1997. *The Geomorphic Influence of Bank Revetment on Channel Migration: Upper Sacramento River, Miles 218-206*, Proceedings of the International Association of Hydraulic Research (IAHR) XXVI Congress, San Francisco, California.

Larsen, E.W., 1997. *Future Channel Migration of the Upper Truckee River*, report prepared for the California Department of Parks and Recreation, Sierra District, Tahoe, California.

## VI. COMPLIANCE WITH STANDARD TERMS AND CONDITIONS

The required terms and conditions for a Service Contract have been reviewed. The following forms are attached:

- Item 8, Non Discrimination Compliance Statement
- Item 12, Small Business Preference Statement.

We request consideration of the following deviations from the Attachment D Terms & Conditions:

Section 8. Rights in Data: ~~Whereas~~ data and information obtained or received under contract shall be in the public domain, PWA would not be able to disclose or permit use of proprietary software subject to licensing or copyright restrictions. In addition, we wish to limit our liability for misuse or inappropriate use of PWA generated materials for purposes outside the contract given the fact such information will be in the public domain. Therefore, we request the following language to be added to this section: "Proprietary computer software and its applications, unless expressly developed as a work product for use by the Client as part of the scope of services, remains the property of PWA or the software developer. Further, reports, recommendations and other materials resulting from PWA's efforts are intended solely for purposes of this Agreement; any reuse or modification by Client of others for purposes outside this agreement without PWA's written permission shall be at the user's sole risk."

Section 9. Indemnification: PWA requests to limit the indemnification to claims or losses resulting from our negligent performance. Further, we will request that PWA is indemnified and held harmless from claims or losses resulting from the negligent acts or omissions of other parties not under our control.

Section 11. In the event of termination for default, it is customary that the maximum costs applied to a Contractor be limited to the total contract amount. Under the current language a contractor could have unlimited liability which is not insurable nor appropriate (i.e., a Contractor could be asked to pay the State \$100,000 to hire someone else to complete a contract originally executed for \$20,000).

Section 12. We request the substitute language for this section to read: "Without the written consent of the other party, neither the State nor the Contractor may assign this agreement in whole or in part."

In Attachment "D1: Standard Clauses", PWA will request the following modifications:

Termination Clause: Delete "The State" in sentence 1 and substitute "Either party" may terminate this contract without cause upon 30 days' advance written notice.

**ATTACHMENTS**

**ITEM 8: Nondiscrimination Compliance Statement**

**ITEM 12: Small Business Preference and Contract Identification Number**

**Letters from Participants/collaborators in Implementation**

The Nature Conservancy

The County of Sacramento Department of Public Works

**NONDISCRIMINATION COMPLIANCE STATEMENT**

COMPANY NAME

PHILIP WILLIAMS & ASSOCIATES, LTD.

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

JEFFREY P. HALTNER

DATE EXECUTED

7/22/97

EXECUTED IN THE COUNTY OF

SAN FRANCISCO

PROSPECTIVE CONTRACTOR'S SIGNATURE

*Jeffrey P. Haltner*

PROSPECTIVE CONTRACTOR'S TITLE

PRINCIPAL

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME

PHILIP WILLIAMS & ASSOCIATES, LTD.

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\*

No

\*Attach a copy of your certification approval letter.

# Cosumnes River Preserve

13501 Franklin Boulevard  
Galt, California 95632  
(916) 684-2816 Fax: (916) 683-1702 crp@ns.net

## Cooperators

Bureau of Land  
Management  
Ducks Unlimited, Inc.  
California Department  
of Fish and Game  
California Department  
of Water Resources  
California Wildlife  
Conservation Board  
Sacramento County  
Department of Parks  
and Recreation  
The Nature Conservancy

July 23, 1997

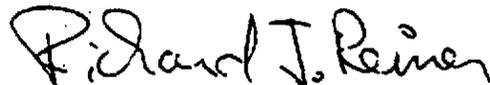
CALFED Bay-Delta Program  
1416 Ninth Street, Suite 1155  
Sacramento, California 95814

Dear CALFED Staff,

The Nature Conservancy would like to voice our support for Philip Williams and Associates proposal to the Category III program. Their proposal titled Tools for enhancing river-floodplain processes on the Cosumnes River has been review by our staff. We feel proposed project will provide critical information and analytical tools needed for the restoration of the Cosumnes River floodplain.

In the wake of the new years flood, and the recognition by agencies and the public as to the need to design and initiate a solution, there is an unprecedented window of opportunity to restore a major floodplain of the Delta in concert with flood control objectives. This completion of this proposal will be a significant step in beginning the restoration planning process.

Sincerely,



Richard J. Reiner, Ph.D.  
Area Ecologist  
The Nature Conservancy

**PUBLIC WORKS AGENCY**

**WARREN H. KARADA, Administrator**  
**CHERYL CRESOM, Director**  
County Engineering  
**ROBERT F. SHANKS, Director**  
District Engineering  
**PATRICK L. GROFF, Director**  
Public Works Administration



**COUNTY OF SACRAMENTO**

**WATER RESOURCES DIVISION.....KEITH DEVORE, Chief**  
County Administration Building Phone: (916) 440-6851  
827 Seventh Street, Room 301 Fax: (916) 552-8693  
Sacramento, California 95814

Post-It® Fax Note	7671	Date	7-23-97	# of pages	1
To	VINCE NEARY	From	PETE HALL		
Co./Dept.	PHILLIP WILLIAMS	Co.	SACRO. COUNTY		
Phone #		Phone #	(916) 552-8640		
Fax #	(415) 981-5021	Fax #			

Dr. Joan Floursheim  
Phili Williams & Associates, Ltd.  
Pier 35, The Embarcadero  
San Francisco, CA 94133

**Re: Proposed Cosumnes Flood Modeling Study**

Dear Dr. Floursheim:

The Sacramento County Public Works Agency supports the project you have proposed to develop an unsteady-flow model of the Cosumnes River and its floodplain from the Dillard Road crossing to the mouth. While the modeling work presently being completed by the US Geological Survey will assist our floodplain management activities upstream of Highway 99, information regarding flood hazards in the reach of the river downstream is also important to the County. Development of the MIKE-11 and UNET unsteady flow models will provide maximum flexibility to the County for floodplain management planning and developing analyses of flood events in the future. Sacramento County hydrology standards should be used for the hydrologic input.

Sacramento County Water Resources Division would be happy to cooperate with your effort. We will be pleased to consult with your project team as work on the models progresses, so that you have the benefit of our expertise and knowledge in developing the models.

Sincerely,

Craig E. Crouch  
Principal Civil Engineer

cc: Terri Wegener, WRD  
Keith DeVore, WRD  
Mike Eaton, The Water Conservancy