B1002

Attachment H

COVER SHEET (PAGE 1 of 2)

May 1998 CALFED ECOSYSTEM RESTORATION PROPOSAL SOLICITATION

Proposal Title: Sacramento River Small Diversion Fish Screen Evaluation Project
Applicant Name: Family Water Alliance
Mailing Address: P.O. Box 365, Maxwell, CA 95955
Telephone: (530) 438-2026
Fax: (530) 438-2940

Amount of funding requested: $285,697.98 for 3 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
- ☐ Splittail
- ☐ Steelhead trout
- ☐ Green sturgeon
- ☐ Striped bass
- ☐ Migratory birds

COVER SHEET (PAGE 2 of 2)

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.

Rita M. Grainer, Project Coordinator

(Signature of Applicant)

CALFED
CATEGORY III
EXECUTIVE SUMMARY

Project Title: **Sacramento River Small Diversion Fish Screen Program Evaluation Component**

Applicant: Family Water Alliance
P.O. Box 365
Maxwell, CA 95955

Project Description and Primary Biological Objectives:
The Small Diversion Fish Screen Program is an on-going program to screen small agricultural diversions n the Sacramento River. The Small Diversion Fish Screen Program screens agricultural diversions that average 40cfs, or less. The CalFed EERP has identified water diversions as one of the main stressors to the anadromous fish populations in the Sacramento River. The Small Diversion Screen Program focuses on the recovery of the winter, spring, fall and late-fall run chinook salmon, as well as steelhead trout. There are hundreds of small agricultural diversions along the Sacramento River in northern California which are considered to have a cumulative impact on the shrinking populations of salmon. CalFed, NMFS, CDF&G, NRCS, and FWA have joined in an effort to address this aspect of fisheries restoration. This proposal will enhance the existing Small Diversion Fish Screen Program by adding a operational monitoring component that will ensure the mechanical, and hydraulic performance of these small screens.

Approach/Tasks/Schedules:
The current screening program is a cooperative project with private landowners along the Sacramento River mainstem, Family Water Alliance, and State and Federal agencies. A total of twenty-four small screens have either been placed, or have funding secured for their placement over the next three years. Once a year a diving team (two) with a knowledge of hydraulic measurement and mechanics will dive the screen installations to determine the mechanical and hydraulic aptitude of the installed positive fish barriers. The information gathered will be forwarded to interested agencies, and adaptive management technics (screen modifications) will be applied as necessary. This monitoring program will last for three years.

Justification for Project and Funding by CALFED:
Positive fish barriers applied to small diversions is a relatively new approach to fish protection. It is important to protect the taxpayers investment in fisheries restoration. Monitoring will assure that the screens are working to the specifications of the National Marine Fisheries Service, and the California Department of Fish & Game. Information gathered over the three year time frame will allow for defining approaches that are working, correcting current flaws in the design of small screens, and the application of this information to future fish screen installation.

Budget Costs and Third Party Impacts:
Family Water Alliance is asking for $285,697.98 to fund a three year monitoring project. The total yearly costs will be predicated on the number of installations in the previous year. CalFed will fund the entire cost of the monitor component, while funding for the screening component will come from multiple sources including, but not limited to: National Fish and Wildlife Foundation ($214,535),

California Department of Fish & Game ($169,900), CalFed ($900,000), FishAmerica ($10,000), and Mary A. Crocker Trust ($10,000). The diversion owners will contribute to the installation, and bear the entire cost of continued operation and maintenance. The expected third party impacts of this program component will be positive. The monitoring of screens will assure that taxpayer investments in fish restoration is secure, and viable; while insure the farmers that they will receive water and continue to support this program. The increase in fish population will increase sport fishing opportunities, and benefit the general public by helping to assure a healthy, balanced river system.

Applicant Qualifications:
Family Water Alliance recently facilitated the installation of screens on four diversions (five pumps) in the Sacramento River. FWA's strength lies in our ability to assemble teams of qualified personnel, and coordinate the activities that keep projects moving forward. We have assembled a team of qualified personnel to structure and perform a monitoring component that will increase the data available to make educated decisions about future installations of positive fish barriers in the Sacramento River. This team includes: Davis Machine Shop, Inc., active in pump installation for over forty years, and currently participating in the installation of fish screens; North American Diving Company, active divers in the Sacramento River for over twenty years, and over twenty years experience in electrical and machine technology; farmers; National Marine Fisheries; Natural Resource Conservation Service; and the Department of Fish and Game.

Monitoring and Data Evaluation:
Information gathered during these monitoring sessions will be made available to vested agencies and landowners for evaluation. Yearly reports will be submitted to CalFed detailing the findings of the monitoring team. Suggested screen modification will be made with the cooperation, and consent of the landowner, NMFS, and CDF&G.

Local support/Coordination with other Programs/Compatibility with CALFED objectives:
The Sacramento River Small Diversion Fish Screen Program is supported by, and coordinated between multiple agencies, and currently has more willing participants than available funding. The addition of the monitoring component is supported by multiple agencies and landowners including but not limited to: Natural Resource Conservation Service, California Department of Fish and Game, and National Marine Fisheries Service.

This proposal meets CALFED objectives in that it:
1.) Allows for operational research to improve fish screen design and efficiency an approach currently supported by CalFed EERP, Vision for Reducing or Eliminating Stressor, Volume 1, page 277.
2.) Focuses on high risk species.
3.) Assures the mechanical performance of fish screen installations, and works toward developing a database for prioritizing future screen installations.
4.) Supports CalFed's Adaptive Management Philosophy.
5.) Consistant with indentified stressor reduction, and priority species protection project funding.

SACRAMENTO RIVER SMALL DIVERSION FISH SCREEN PROGRAM
EVALUATION COMPONENT

Applicant: Family Water Alliance
37 Oak Street
Maxwell, CA 95955

Type of Organization: 501(C)3 Educational Organization

Tax Identification Number: 68-0262939

Technical and Financial Contact Person:
Susan A. Sutton, Project Manager
Rita M. Trainer, Project Coordinator
P.O. Box 365
37 Oak Street
Maxwell, CA 95955
Phone: (530) 438-2026
Fax: (530) 438-2940
E-mail: fwa@mako.com

Participants/Collaborators in Implementation:
Water diversion owners and operators
Natural Resource Conservation Service
National Marine Fisheries Service
California Department of Fish and Game
Davis Machine Shop, Inc.
North American Diving Company
Family Water Alliance

Project Type: Small Screen Evaluation

Project Description and Approach:
The Small Diversion Fish Screen Program began in the fall of 1997; however, the installation of positive fish barriers has been the only approved method of fisheries enhancement, and a number of screens have been installed thoughout northern California, and into the Delta. To date a comprehensive monitoring program is not available. The monitoring that has been done is piecemeal, therefore unreliable as far as long-term, or relevant operational data. This project will allow for the development of information base on consistant variables.

This small screen monitoring component will enhance the existing small screen program in two separate areas. The monitoring to assure the mechanical performance will be performed once a year during the early spring. A boat along with a team of divers, and technical support personnel will travel to each screen location, and make a underwater inspection. The divers will have a background in machine technology, and electrical design. This inspection will cover: the condition of the screening material checking for damage or dents, assure that the cleaning mechanism is working properly, and measure algae growth.

The second component will monitor flow velocity, and relevant hydraulic conditions. This monitoring will also be performed once a year. The latest hydraulic measuring devices such as, the SonTek ADV (see attached) will be used by trained personnel. This will assure that the current design specifications are adequate for the protection of fish, and allow for practical research to help improve current screen designs to increase efficiency and affordability.

We are proposing a cooperative program involving agency personnel from the existing program, in particular, the National Marine Fisheries Service (NMFS), the California Department of Fish & Game (CDF&G), Natural Resource Conservation Service (NRCS), and private entities.

Proposed Scope of Work:
The monitoring will be scheduled in the early part of the spring, between March and June before or during the beginning stages of the irrigation season. Exact timing will depend on water levels and weather conditions. A boat will be dispatched with the aforementioned team to assess the screens that have been previously installed through the Small Diversion Fish Screening Program. The first year will entail the monitoring of nine screens. The implementation of Phase III, and the NRCS Small Screen Program will determine the exact number of screens that will require monitoring. It is expected by the third and final year there will be approximately twenty four screens in need of mechanical and hydraulic monitoring. There will be detailed reports generated from these dives supplied to CalFed, interested agencies, and the landowners. Any mechanical malfunctions detected will be corrected by either the screen manufacturers, or the screen owners.

The second task will involve measuring the uniform velocity of the screens to ensure that the screens are performing to the criteria as set out by NMFS, and CDF&G. Preventing entrainment is the primary function of the screen, yet it is equally as important to ensure that the screens are not causing impingement of fish. The first phase of screen installations took advantage of off-the-shelf manufacturing designs. It is generally accepted that these screens will perform as expected; however, these are hydro-mechanical devices with little practical experience in the conditions that are unique to the Sacramento River. These dives will help to ensure that this relatively new technology, and approach to protecting chinook salmon in the Sacramento River will be effective. It will also

provide a valuable learning tool for the engineering, and biological staffs within NMFS, NRCS, and CDF&G by providing relevant, performance-tested data.

The monitoring will be performed over a three year period. The first year up to nine installations will be assessed with the cooperation of NMFS Fish Passage Team. Technical support and peer review will be provided by NRCS Engineers and Biologists, CDF&G Fish Screen Specialists, and diversion owner/operators. The appropriate information will be developed based on the unanswered questions that have been gathered since the installation of screens began. This will create a foundation for the development of a data base that will prove most valuable to the improvement of the program. During the second and third year it is expected that monitoring will be performed on up to fourteen installations, and up to twenty-four installations, consecutively.

Location and/or Geographic Boundaries of the Project:
The initial stage of the project will focus on installations in Colusa and Sutter counties. The remaining stages will be determined by the location of future installation. The Small Diversion Screen Program is expected to cover Glenn, Colusa, Sutter, Yuba, Yolo, and Sacramento counties, depending on participation in these counties.

Expected Benefits:
The Small Diversion Screening Program is expected to assist in the restoration of anadromous fish populations, especially the winter, spring and late-fall runs of chinook salmon. This monitoring program will enhance the existing program by assuring the correct operation of the screens, consistant with current screening criteria. With the data that is acquired from this monitoring it is expected that engineers, and screen manufactures will be able to move towards designing a more efficient and economical screen. Although there have been some improvements in methods other than screening for fisheries protection, i.e. sonic and light or electrical barriers, the practical application of these methods has been met with scepticism by biologists, and fishery agencies. To date the positive fish barrier is the only approved method of fisheries protection. Refinement of the positive fish barrier to improve reliability, increase efficiency and lower the over all costs of these devices will benefit restoration goals, taxpayers, and the screen operators.

Background and Ecological /Biological/Technical Justification:
The Sacramento River is unique because it supports four runs of chinook salmon. The CalFed EERP identifies diversions as a major stressor to fish populations (154). The elimination of unscreened diversions is part of the strategic plan to restore winter-run chinook to the point where it can be removed from the endangered species list (151), and restore the Sacramento fall-run chinook, spring-run chinook, and late-fall run chinook to support sustainable sport and commercial fisheries (153), and continue research on fish screening and related facilities design and operations (277).

In the fall of 1997, Family Water Alliance assisted in the installation of four small diversion fish screens with the cooperation of Farm Services Agency, Natural Resource Conservation Service, California Department of Fish and Game, US Fish and Wildlife Service, National Marine Fisheries Service, and National Fish and Wildlife Foundation. To date over $111,000 has been invested in the screening of small diversions, and this program will continue with the installation of up to five screens in 1998, and FWA is currently working on the funding for screen installations in 1999. In addition, FWA will be an active participant in the NRCS small diversion screening program funded

by CalFed, and continuing for up to three years. The aforementioned participants are expected to continue their existing roles in the program, and FWA continues to seek new participants in the program.

The CalFed EERP stresses that cooperative efforts, and integration of existing restoration programs are key components in the success of restoration activities (152, 276). The Small Diversion Fish Screening Program along with the integration of this monitoring component is in line with the CalFed philosophy. To further enhance the screening program, FWA is in the process of developing a team to begin biological monitoring to assist in the development of a system of prioritization for further screening, and will be seeking funding to implement this phase, either through private, or government sources.

In the spring of 1998, Family Water Alliance received a call from a landowner that had participated in the fall screening program. The screen was malfunctioning, and was affecting his water delivery. He explained that he would need to begin irrigation soon to ensure the survival of his newly planted crop. A start-up check on the screen of a second participant reveal another mechanical error. Fortunately, FWA was able to secure a diving team from NMFS who came immediately, and found a malfunction in the screen cleaning mechanism. The first mechanical problem was small (an overloaded silt filter), and was corrected that day. The second screen will be repaired as soon as the water levels, and river turbidity drop sufficiently to allow a dive team into the river to complete repairs.

This experience demonstrates the necessity of a operational monitoring plan. A screen that is malfunctioning will not protect fish, nor will it generate support for a voluntary screening program. Word of mouth spreads quickly in the farming community, and we have already had one farmer drop out of the program until he is satisfied that a screen can be developed that will be reliable under Sacramento River conditions.

In recent years farmers have become very interested in supporting a voluntary effort to protect salmon populations in the Sacramento River. These small family farmers have agreed to put out initial investments in the installation of fish screens that can amount to as much as twenty thousand dollars in personal funds. On top of their initial investment, they agree to bear the added costs for yearly operation of their pump, which is estimated at a minimum of an addition 10% per year, and they agree to keep the screens mechanically sound for the life of the screen (10 years). Yearly river diving is beyond the scope of normal maintenance for farmers. This technology is still relatively new in its application in the Sacramento River. Because positive fish barriers still need refinement it is unreasonable to ask landowners to go beyond the commitment that they have already invested in this program. To allow for this, or any fish screening program to go forward on a voluntary basis it is imperative that cooperation continue to be prevailing ideology.

Monitoring and Data Evaluation:

The results of the information gathered at the dive sites will be disseminated to all interested agencies, to the screen operators, and the screen manufactures. The information will then be used to make design improvements, assess the relevant application of screens in the Sacramento River, allow for the examination of screening criteria, and address some of the issues and questions that have arisen since the screen program began. These question include, but are not limited to:

1) Do automatic screen cleaning systems work under all conditions? What is the timing that is most beneficial to screen proficiency and aquatic organisms?
2) Can screens remain submerged underwater indefinitely without running the cleaning system? Is it necessary to occasionally purge the screen during the off-season? Must the screens be removed from the river occasionally, if so, how often? How can this be done as easily and as inexpensively as possible?
3) Is the hydraulic flow field surrounding the fish screen within the standards that will protect immature fish from impingement?
4) Are certain screen designs more suited to particular site conditions than other screen options?
5) Is current technology the best available solution to the fish protection problem? How can we improve on designs to increase efficiency, and reduce costs?
6) Are fish screen components and systems working correctly and consistently?
7) Are subsurface screen components subject to damage by large debris, clogging by fine sediment, and alea growth on screen surface? If so, how can be these problem be dealt with economically and efficiently?

Implementability:
Preliminary investigation has found wide-spread support for this project among participating landowners, and agency personnel. There are no expected permits that will be needed for this project. Skilled personnel will be hired, and consultation with agencies and landowners will take place before the dives take begin.

Costs and Schedule:

Operation Monitoring	Direct Labor Hours	Direct Salary and Benefits	Overhead Labor (General Admin & Fees)	Service Contracts	Material and Acquisition Contracts	Misc. And Other Direct Costs	Total Costs
Mechanical Inspection							
Year 1	72	$16,200.00	$1,548.75	$10,200.24			$27,948.99
Year 2	112	$25,200.00	$1,700.00	$15,400.00			$42,300.00
Year 3	192	$43,200.00	$3,000.00	$26,400.00			$72,600.00
Hydraulic Inspection							
Year 1	72	$16,200.00	$1,548.75	$10,200.24			$27,948.99
Year 2	112	$25,200.00	$1,700.00	$15,400.00			$42,300.00
Year 3	192	$43,200.00	$3,000.00	$26,400.00			$72,600.00

This is a three year program. This will allow for the development of a comprehensive base for the evaluation of screens in the Sacramento River. As the program expands it is expected to encompass a variety of new circumstances, and will allow developing a criteria for screen applications. The three year staging will allow for multiple year funding.

All worker's compensation, and liability insurance will be supplied by sub-contractors.

Sacramento River Small Diversion Fish Screen Evaluation Project
July 2, 1998

	Year One	Year Two	Year Three
Boat rental	$ 5,400.00	$ 8,400.00	$ 14,400.00
Diver 1	$ 16,200.00	$ 25,200.00	$ 43,200.00
Diver 2 (Specially trained by NMFS)	$ 16,200.00	$ 25,200.00	$ 43,200.00
Equipment Rental (SonTek ADV Sonic Device - Includes Technical Support)	$ 15,000.48	$ 22,400.00	$ 38,400.00
Travel	$ 697.50		
Total Direct Costs	$ 53,497.98	$ 81,200.00	$139,200.00
General Administration			
Salaries (includes SSI, workers comp. & benefits)	$ 2,400.00	$ 3,400.00	$ 6,000.00
Total Indirect costs	$ 2,400.00	$ 3,400.00	$ 6,000.00
Total Project cost	$ 55,897.98	$ 84,600.00	$145,200.00

***All telephone, paper, and postage will be in-kind contributions, or covered under the supporting contributions.**

I-008251

Schedule Milestones:
The work on this project will begin between April and June of each year, depending on water, and weather conditions. It is expected to be completed by the end of June. After each testing period, the data will be disseminated to all interested agency personnel for complete analysis. A long term data base will be kept in the FWA office for additional inspection. Payments will be due upon the completion of the project in June.

Third Party Impacts:
Third party impacts are expected to include:
Increased fishing opportunities along the river.
Guaranteed water supply for farmers.
Increased support from the farming community for the screening program, and increased knowledge about small fish screens and their application.

Applicant Qualifications:
Family Water Alliance
Project Coordinator
As the program coordinator for the Small Diversion Fish Screen Program, Family Water Alliance is aware of the intricacies of the fish screen process, and has already established a working relationship with the agency personnel and the diversion owners.

Family Water Alliance will be responsible for coordinating dive team, notifying landowners, and disseminating information. Family Water Alliance also anticipates active role in the development of database, and evaluation criteria.

Davis Machine Shop, Inc.
Marshall, Clifton and Tom Davis
Owners, and Operators
Over 40 years experience in irrigation pump installation.
Installed two fish screens in fall of 1997
Graduate: Cal Poly, Ag-Engineer
Davis Machine will be responsible for the hydraulic readings, equipment rental, and river navigation. Their experience with irrigation pumps and fish screen installation will contribute to the development of this monitoring project.

Technical support, and a portion of the equipment rental will be supplied by an employee of Family Water Alliance.

North American Diving Company
Dave C. Maze, Owner
Mr. Maze has over twenty years experience diving the Sacramento River. He also is an electrical contractor, Lic.#522273, and has a background in machine technology, which adds to his expertise in the practical application of hydro-mechanical devices.

The second diver will also be coming from North American Diving Company. The second diver has over eighteen years of diving experience in the Sacramento River, and has worked with Mr. Maze on

mechanical maintenance jobs.

Technical Support & Peer Review:

National Marine Fisheries Service: Richard Wantuck, Hydraulic Engineer, Team Leader, NMFS Regional Fish Passage Team

Natural Resources Conservation Service: Loren Schilder, Engineer & Tim Viel, Fisheries Biologist

California Department of Fish & Game, Phil Warner, Region 1 CDF&G.

California Department of Fish and Game, Fish Screen Review Panel

Works Cited

Ecosystem Restoration Program Plan, Volume 1, (March 1998) Programmatic EIS/EIR Technical Appendix

ADV SPECIFICATION

To Print this page from your browser, click

●ADV Applications **●ADV Principles of Op**

Physical Parameters

- Acoustic frequency: 10MHz
- Velocity range: Programmable to ±3, 10, 30, 100 or 250cm/s
- Velocity resolution: 0.1mm/s
- Velocity bias: ±1%,±0.25cm/s *
- Random noise: Approximately 1% of velocity range at 25Hz*
- Sampling rate: Selectable from 0.1 to 25Hz
- Sampling volume: less than $0.2cm^3$
- Distance to sampling volume: 5 or 10cm
- Minimum water depth: 2-3cm for side-looking 5cm 2-D probe, 6cm for 5cm 3-D probes. 12cm for 10cm probes.
- Minimum distance from sampling volume to boundary: 1mm
- Maximum deployment depth: 30m

Environmental

Operating Temperature:

- Probe: -2° to 40° C
  Electronics: -5° to 45°C

Storage Temperature:

- Probe: -10° to 50° C

Stan

Lab Model:

- Uses a desktop F
- Sensor is mount
- Standard cable l

Field Model:

- Uses a self-cont
  splash-proof or u
- Sensor is mount
- Standard cable l

- Analog outputs
- Saltwater deploy
- Internal recorder
- Integral batteries
- Pressure sensor f
- Temperature sen
  compensation
- Compass/tilt sen
  (East-North-Up)
- A variety of prob

Electronics: -20° to 60°C

Operating Pressure:

- 30m

Power (Field System)

Power Supply:

- 12-24 Volt DC

Power Consumption:

- Approximately 2.5-4W operating, less than 1mW in sleep mode.

Serial Comm for F

- RS232 – Single : cables (to 100m)
- RS422 – Single : (to 1500m)
- RS485 – Multipl single power anc cable lengths to

*Velocity specification laboratory simulations meters. Test results are

(SonTek Home) (Products) (What's New) (Software) (Jobs) (Re

Back to Top

ADV PRINCIPLES OF OPERATION

ADV Applications ADV Specifications Back to Products

Contents:

1 – Introduction

The SonTek ADV is a single point, high resolution, 3D Doppler current meter. ADV Doppler processing techniques provide a number of important advantages: 3D velocity measurements in a remote sampling volume; invariant factory calibration (no periodic re-calibration required); simple operation; direct calculation of turbulent parameters such as Reynolds stress; and excellent low flow performance. This document presents the basic operating principles of the SonTek ADV. To learn more about specific ADV configurations and applications, please contact SonTek directly.

2 – The Doppler Shift and Bistatic Current Meters

The ADV measures the velocity of water using a physical principle called the Doppler effect. If a source of sound is moving relative to the receiver, the frequency of the sound at the receiver is shifted from the transmit frequency.

$F_{doppler} = -F_{source} (V / C)$

In this equation, V is the relative velocity between source and receiver, C is the speed

of sound, $F_{doppler}$ is the change in frequency at the receiver, and F_{source} is the transmitted frequency.

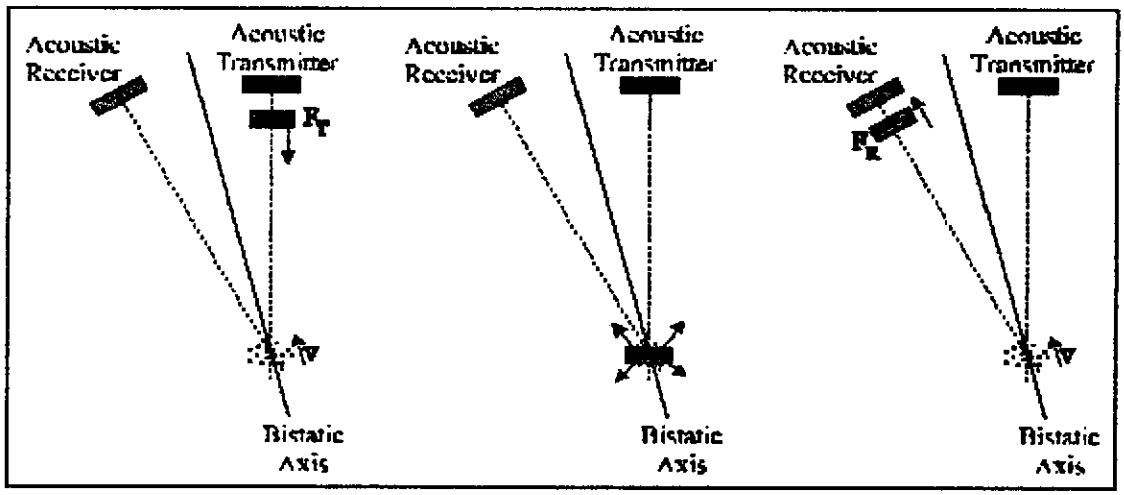

Figure 1 - Bistatic Doppler Current Meter

Figure 1 illustrates the operation of a bistatic Doppler current meter such as the ADV (bistatic systems use separate acoustic transducers for transmitter and receiver). Both transmitter and receiver are constructed to generate very narrow beam patterns; the transmitter generates sound with the majority of the energy concentrated in a narrow cone and the receiver is sensitive to sound coming from a narrow angular range. The transducers are mounted such that their beams intersect at a volume of water located some distance away; the beam intersection determines the location of the sampling volume (the volume of water in which measurements are made).

The transmitter generates a short pulse of sound at a known frequency, which propagates through the water along the axis of its beam. As the pulse passes through the sampling volume, the acoustic energy is reflected in all directions by particulate matter (sediment, small organisms, bubbles, etc.). Some portion of the reflected energy travels back along the receiver axis, where it is sampled by the ADV and the processing electronics measure the change in frequency. The Doppler shift measured by one receiver is proportional to the velocity of the particles along the bistatic axis of the receiver and transmitter. The bistatic axis is located halfway between the center axes of the transmit and receive beams.

3 – Beam Geometry and 3D Velocity Measurements

Each transmitter/receiver pair measures the projection of the water velocity onto its bistatic axis. The ADV uses one transmitter and two or three acoustic receivers (for 2D or 3D probes); the receivers are aligned to intersect with the transmit beam pattern at a common sampling volume. The velocity measured by each receiver is referred to as the bistatic velocity, and is the projection of the 3D velocity vector onto the bistatic axis of

the acoustic receiver. Bistatic velocities are converted by the ADV to XYZ (Cartesian) velocities using the probe geometry. XYZ velocities give the 3D velocity field relative to the orientation of the ADV probe. As it is not always possible to control instrument orientation, the ADV can be equipped with an internal compass and tilt sensor. The compass/tilt sensor allows the ADV to report velocity data in an Earth (East-North-Up or ENU) coordinate system, independent of probe orientation.

4 – Sampling Volume Definition

The location of the sampling volume is determined by the physical construction of the probe, and can be either 5 or 10 cm from the tip of the probe. The size of the ADV sampling volume is determined by the sampling configuration used. The standard sampling volume is a cylinder with a diameter of 6 mm and a height of 9 mm. For specialized high resolution applications, the height of the sampling volume can be reduced to as little as 1.2 mm with only software modifications.

5 - ADV Data

The ADV records nine values with each sample: three velocity values (one for each component), three signal strength values (one for each receiver), and three correlation values (one for each receiver). Naturally, the velocity data are of foremost interest; signal strength and correlation are used primarily to determine the quality and accuracy of ADV velocity data.

5.1 – Velocity

ADV velocity data can be reported in XYZ (Cartesian) coordinates relative to probe orientation or Earth (East-North-Up or ENU) coordinates for systems using the optional compass/tilt sensor. The velocity data output by the ADV can be used directly without post processing; the calibration will not change unless the probe has been physically damaged.

One of the most important ADV operating parameters is the velocity range setting. This determines the maximum velocity that can be measured by the instrument; standard settings are ± 3, ± 10, ± 30, ± 100, and ± 250 cm/s. The user should select the lowest velocity range setting that will cover the maximum velocity expected in a given experiment. Instrument noise in velocity data is proportional to the velocity range setting; higher velocity ranges have higher noise levels. The typical noise level in good operating conditions is 1% of the velocity range when outputting data at 25 Hz (i.e. each sample is ± 1 cm/s when using the ± 100 cm/s velocity range and a sampling rate of 25 Hz).

The ADV is designed to measure velocity as rapidly as possible. A single estimate of

I-008259

the 3D velocity field is referred to as a ping; the ADV pings 200-250 times per second. The noise in a single ping is too high for practical use, so the ADV averages a number of pings before outputting a velocity sample. The number of pings averaged is set to meet the user specified sampling rate within the range of 0.1 to 25 Hz. For example, when sampling at 25 Hz the ADV will collect as many pings as possible over a 40 ms period and output the average as one sample. An important result of the ADV sampling scheme is that reducing the sampling rate decreases the noise in each sample (by increasing the number of pings averaged per sample).

5.2 Signal Strength

Signal strength, recorded for each ADV receiver, is a measure of the intensity of the reflected acoustic signal. The primary function of signal strength data is to verify that there is sufficient particulate matter in the water. If the water is too clear, the return signal may not be stronger than the ambient electronics noise level. Without sufficient signal strength, the ADV is unable to make accurate velocity measurements. In general, the ADV requires a minimal amount of scattering material (typically 10 mg/L) for excellent operation.

Since the return signal is a function of the amount and type of particulate matter in the water, signal strength values can be used as an indicator of sediment concentration. While ADV signal strength data cannot be directly converted to sediment concentration, it does provide an excellent qualitative picture of sediment fluctuations. With proper calibration, signal strength data can be used for reasonably accurate estimates of sediment concentration.

5.3 Correlation Coefficient

The ADV correlation coefficient is a data quality parameter that is a direct output of the Doppler velocity calculations. The ADV computes three correlation values (one for each acoustic receiver). Correlation is expressed as a percentage: perfect correlation of 100% indicates reliable, low noise velocity measurements; 0% correlation indicates that the output velocity value is dominated by noise (no coherent signal).

Ideally, correlation should be between 70 and 100%. Values below 70% indicate that the ADV is operating in a difficult measurement regime, the probe is out of the water, the SNR is too low, or that something may be wrong with the ADV. In some environments (highly turbulent flow, highly aerated water), it may not be possible to achieve high correlation values. Low correlation values will affect the short-term variability in velocity data (i.e. increase the noise), but will not bias the mean velocity measurements. For mean velocity measurements, correlation values as low as 40% can be used.

6 – ADV Probe Configurations

The ADV probe is available in several configurations for different measurement needs. These variations are divided into four areas: location of the sampling volume, acoustic sensor mounting, sensor orientation, and coordinate resolution. Probes can be constructed with almost any combination of these configurations.

1. Sampling volume location The sampling volume can be located either 5 or 10 cm from the tip of the acoustic sensor. The 5 cm sensor can be used in shallower water, and gives a stronger return signal by about 6 dB; the 10 cm sensor has less potential for flow interference.
2. Sensor mounting The sensor can be mounted on a 25 or 40 cm long stainless steel stem, or a 100 cm flexible cable. The 40 cm stem is used in laboratory applications to reduce the amount of equipment in the water. The 25 cm stem is used in field applications where a more rugged stem is required. The 100 cm cable allows increased flexibility in the sensor orientation, but requires more complicated mounting arrangements.
3. Sensor orientation The ADV acoustic sensor can be oriented looking down, to the side, or up. Down is most common as it allows for easy mounting and measurements close to the bottom boundary. Side looking is typically used in wave tanks with the sensor mounted looking across the direction of propagation, reducing the chance of flow interference. Up looking is typically used for measurements near the surface, under a layer of ice, or near the bottom of a vessel or structure.
4. Coordinate resolution The ADV can be built to measure either 2D or 3D fluid flow, using 2 or 3 acoustic receivers respectively. 3D is the most common configuration; 2D is most commonly used for very shallow water (minimum 3 cm) with a side looking sensor, or very narrow channels using a down looking sensor.

7 – Near Boundary Measurements

Because of the remote 3D velocity measurements, the ADV is extremely well suited to flow studies in boundary layers. The ADV can be used for detailed boundary layer studies and direct measurement of turbulent parameters such as Reynolds stress. Additionally, the ADV automatically measures and records the distance to the boundary at the start of each data collection cycle (the boundary measurement can be made when the sampling volume is between 2 and 25 cm from the boundary).

Under good operating conditions, the leading edge of the sampling volume can be placed within about 0.5 mm of a boundary. The vertical extent of the sampling volume is precisely defined; thus this leading edge can be placed very close to a boundary

without interference. Using the reduced sampling volume size mentioned earlier, with a minimum height of 1.2 mm, allows the user to make detailed flow measurements within a few millimeters of a boundary.

8 – Low Flow Measurements

One significant advantage of the ADV is that there is no minimum measurable velocity, with no potential for a zero offset or zero drift. The lowest ADV velocity range, ± 3 cm/s, will yield good results for flows down to about 0.1 cm/s. If working in an environment with extremely low flows, the ADV software can be modified to use lower velocity ranges to further improve performance. The ADV has been used to measure calibrated flows as low as 0.04 cm/s and has shown excellent performance at even lower levels where no reference is available.

(SonTek Home) (Products) (What's New) (Software) (Jobs) (Reps) (Info Request)

Back to Top

NONDISCRIMINATION COMPLIANCE STATEMENT

ITEM 7

COMPANY NAME

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
Susan A. Sutton

DATE EXECUTED
6/30/98

EXECUTED IN THE COUNTY OF
Colusa

PROSPECTIVE CONTRACTOR'S SIGNATURE
Susan A Sutton

PROSPECTIVE CONTRACTOR'S TITLE
Ex V.P.

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME
Family Water Alliance

I-008263

Agreement No. _____

Exhibit _____

STANDARD CLAUSES— SERVICE & CONSULTANT SERVICE CONTRACTS FOR $5,000 & OVER WITH NONPUBLIC ENTITIES

Workers' Compensation Clause. Contractor affirms that it is aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self insurance in accordance with the provisions of that Code, and Contractor affirms that it will comply with such provisions before commencing the performance of the work under this contract.

Claims Dispute Clause. Any claim that Contractor may have regarding the performance of this agreement including, but not limited to, claims for additional compensation or extension of time, shall be submitted to the Director, Department of Water Resources, within thirty days of its accrual. State and Contractor shall then attempt to negotiate a resolution of such claim and process an amendment to this agreement to implement the terms of any such resolution.

National Labor Relations Board Clause. In accordance with Public Contract Code Section 10296, Contractor declares under penalty of perjury that no more than one final, unappealable finding of contempt of court by a federal court has been issued against the Contractor within the immediately preceding two-year period because of Contractor's failure to comply with an order of a federal court which orders Contractor to comply with an order of the National Labor Relations Board.

Nondiscrimination Clause. During the performance of this contract, the recipient, contractor and its subcontractors shall not deny the contract's benefits to any person on the basis of religion, color, ethnic group identification, sex, age, physical or mental disability, nor shall they discriminate unlawfully against any employee or applicant for employment because of race, religion, color, national origin, ancestry, physical handicap, mental disability, medical condition, marital status, age (over 40), or sex. Contractor shall insure that the evaluation and treatment of employees and applicants for employment are free of such discrimination. Contractor shall comply with the provisions of the Fair Employment and Housing Act (Government Code Section 12900 et seq.), the regulations promulgated thereunder (*California Administrative Code, Title 2, Sections 7285.0 et seq.*), the provisions of Article 9.5, Chapter 1, Part 1, Division 3, Title 2 of the Government Code (Government Code Sections 11135 - 11139.5), and the regulations or standards adopted by the awarding State agency to implement such article. Contractor or recipient shall permit access by representatives of the Department of Fair Employment and Housing and the Awarding State agency upon reasonable notice at any time during the normal business hours, but in no case less than 24 hours notice, to such of its books, records, accounts, other sources of information and its facilities as said Department or Agency shall require to ascertain compliance with this clause. Recipient, contractor and its subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement. The Contractor shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under the contract.

Statement of Compliance. The contractor's signature affixed hereon and dated shall constitute a certification under penalty of perjury under the laws of the State of California that the Contractor has, unless exempted, complied with the nondiscrimination program requirements of Government Code Section 12990 and Title 2, California Code of Regulations, Section 8103.

Performance Evaluation. Contractor's performance under this contract will be evaluated after completion. The evaluation will be filed with the Department of General Services.

Availability of Funds. Work to be performed under this contract is subject to availability of funds through the State's normal budget process.

Audit Clause. The contracting parties shall be subject to the examination and audit of the Auditor General for a period of three years after final payment under the contract. (Government Code Section 10532).

Reimbursement Clause. If applicable, travel and per diem expenses to be reimbursed under this contract shall be at the same rates the State provides for unrepresented employees in accordance with the provisions of Title 2, Chapter 3, of the California Code of Regulations. Contractor's designated headquarters for the purpose of computing such expenses shall be: _____.

Drug-Free Workplace Certification. By signing this contract, the contractor or grantee hereby certifies under penalty of perjury under the laws of the State of California that the contractor or grantee will comply with the requirements of the Drug-Free Workplace Act of 1990 (Government Code Section 8350 et seq.) and will provide a drug free workplace by taking the following actions:

1. Publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited and specifying actions to be taken against employees for violations, as required by Government Code Section 8355(a).

2. Establish a Drug-Free Awareness Program as required by Government Code Section 8355(b), to inform employees of all of the following:

   (a) The dangers of drug abuse in the workplace,
   (b) The person's or organization's policy of maintaining a drug-free workplace,
   (c) Any available counseling, rehabilitation and employee assistance programs, and
   (d) Penalties that may be imposed upon employees for drug abuse violations.

3. Provide, as required by Government Code Section 8355(c), that every employee who works on the proposed contract or grant:

   (a) Will receive a copy of the company's drug-free policy statement, and
   (b) Will agree to abide by the terms of the company's statement as a condition of employment on the contract or grant.

Failure to comply with these requirements may result in suspension of payments under the contract or termination of the contract or both and the contractor or grantee may be ineligible for award of any future contracts if the department determines that any of the following has occurred: (1) the contractor or grantee has made false certification, or (2) violates the certification by failing to carry out the requirements as noted above.

Priority Hiring Considerations. For contracts in excess of $200,000, the contractor shall give priority consideration in filling vacancies in positions funded by the contract to qualified recipients of aid under Welfare and Institutions Code Section 11200. (Public Contract Code Section 10353).

ITEM 10

Agreement No. _____

Exhibit _____

NONCOLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID FOR PUBLIC WORKS

STATE OF CALIFORNIA)
)ss
COUNTY OF Colusa)

Susan A. Sutton (name), being first duly sworn, deposes and says that he or she is Ex. V.P. (position title) of Family Water Alliance (the bidder).

the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

DATED: 6/30/98

By Susan A. Sutton
(person signing for bidder)

MARY E. HARRISON
Commission # 1127230
Notary Public — California
Colusa County
My Comm. Expires Apr 3, 2001

(Notarial Seal)

Subscribed and sworn to before me on June 30, 1998

Mary E Harrison
(Notary Public)