# CITY OF LODI

# COUNCIL COMMUNICATION

AGENDA TITLE: Resolution authorizing the Parks and Recreation staff, in conjunction with Woodbridge Irrigation District to apply for a Sonar Fish Monitoring Project and Program Grant

MEETING DATE: September 1, 1999

PREPARED BY: Parks and Recreation Director

---

RECOMMENDED ACTION: That City Council approve the resolution authorizing the Parks and Recreation Staff in conjunction with Woodbridge Irrigation District to apply for a Sonar Fish Monitoring Project and Grant and further authorize the City Manager to execute the grant documents.

BACKGROUND INFORMATION: The City of Lodi and Woodbridge Irrigation District have been asked by Fish and Wildlife Service (U.S.F.W.S.) to submit a grant to their agency for funding a sonar-based fish counting system (mainly Chinook Salmon and Steelhead Trout). The grant includes equipment, installation, training, testing and monitoring. This is a two-year grant project that, if successful, will be administered by East Bay Municipal Utility District (E.B.M.U.D.) on a long-term basis. There is no cost or obligation to the City. The grant is in the amount of $361,000.00 and will initially be administered by W.I.D. The project dovetails our Cal/Fed Project to build the new dam at Woodbridge.

FUNDING: No funding is required.

Ron Williamson
Parks and Recreation Director

Prepared by: Dwight Dauber, Parks Superintendent

RW

cc: City Attorney

APPROVED: _____
H. Dixon Flynn -- City Manager

08/24/99

# TRANSMITTAL MEMO

Date: August 4, 1999

To: Anders Christensen, WID
Dwight Dauber, City of Lodi

From: Craig Stevens

Re: U.S. Fish and Wildlife Proposal

I have been working with Erwin Van Nieuwenhuyse from the Anadromous Fish Restoration Program of the U.S. Fish and Wildlife Service (USFWS) to prepare the attached proposal for submittal to USFWS. This proposal requests funding for the installation and evaluation of sonar-based monitoring equipment near Woodbridge Dam. It overlaps the request included in our most recent proposal to CALFED, but USFWS has authority to fund projects beneficial to anadromous fish through the Central Valley Program Improvement Act (CVPIA) Restoration Fund, a separate funding source from CALFED.

I have given the proposal in draft form to Erwin for his initial evaluation, but in order to officially submit the proposal, it must come from WID and the City of Lodi. Please review the proposal and, if you agree, prepare and sign a joint letter of submittal.

There is no time limit on this proposal, but the sooner we submit it the better our chances. If there is anything I can do to assist you, or if I can answer any questions, please let me know.

From the desk of...

**CRAIG STEVENS**
PROJECT MANAGER
JONES & STOKES ASSOCIATES, INC.
2600 V STREET, SUITE 100
SACRAMENTO, CA 95818-1914

916-737-3000
Fax: 916-737-3030

e-mail address: craigs@jsanet.com

# Executive Summary

### Project Title and Applicant Name

**Project Title:** Mokelumne River Juvenile Chinook Salmon Sonar-Based Enumeration Project.
**Joint applicants:** Woodbridge Irrigation District (WID) and the City of Lodi.

### Project Description and Primary Biological/Ecological Objectives

The proposed project involves sonar-based counting of anadromous fish on the lower Mokelumne River in San Joaquin County, California. At present, juvenile fish are counted using screw traps. This project involves acquiring, installing, testing, and using sonar-based equipment near Woodbridge Dam to automatically count juvenile anadromous fish (mainly fall-run chinook salmon and steelhead trout). The sonar-based counts will be compared to existing counting methods and evaluated to determine if the system provides sufficient accuracy at a reasonable cost to substitute for existing methods.

### Approach/Tasks

This is a 2-year project. The first year involves acquiring, installing, and testing sonar-based monitoring equipment and training staff. Paul Skvorc, of Acoustic Research and Technology, is an expert in this field and he will assist in calibrating the equipment and training project staff in its use. The second year involves collecting a full season of data for evaluation. The tasks associated with each year of the study are provided below:

**Year One - Site Setup, System Configuration, and Statistical Design.** Tasks during the first year include acquiring equipment, selecting a site, quantifying the relationship between probability of detection (PoD) and gas bladder length for postemergent chinook fry, developing the project statistical design, training technicians, and preparing quarterly and annual reports.

**Year Two - First Year of Operations.** Tasks during the second year include testing the statistical results of year one data; corroborating the PoD curve from year one and corroborating year one statistical design with a corresponding statistical precision estimate; preparing quarterly and annual reports; and analyzing and reporting total project cost, cost per sample, and cost for various levels of precision or seasonal estimates of passage.

## Justification for Project Funding by the AFRP

This project is consistent with the Revised Draft Restoration Plan (Plan) for the Anadramous Fish Restoration Program (AFRP) and is necessary to evaluate the improvements recommended by the Plan. Specifically, the Plan calls for evaluating the effectiveness of restoration efforts on the Mokelumne River, including "evaluat[ing] the effectiveness of pulse flows to facilitate successful emigration of juvenile salmonids in the spring", and "evaluat[ing] and facilitat[ing] passage of spawning adult salmonids in the fall and juvenile salmonids in the spring" past Woodbridge Dam. These evaluations will be more accurate if sonar-based monitoring is successfully implemented on the lower Mokelumne River.

## Budget/Time Line

The project is estimated to cost $361,000 over 2 years: $75,000 for material and equipment costs, and $286,000 for service contracts. Equipment purchase and installation is scheduled to begin in October 1999. The project is expected to be completed in September 2001.

## Applicant Qualifications

The joint applicants for this project are WID and the City of Lodi, but the work will be undertaken by Jones & Stokes Associates and Acoustic Research & Technology, contractors to the joint applicants. The qualifications of these firms are presented below.

**Jones & Stokes Associates.** Jones & Stokes Associates has extensive experience with the anadromous fisheries analysis and management throughout the Central Valley. In addition, Jones & Stokes Associates has direct experience working on the Mokelumne River, including the preparation of an environmental impact report/environmental impact statement (EIR/EIS) on implementation of the lower Mokelumne River Restoration Program (LMRRP), which includes actions to improve passage and screening conditions for anadromous fish in the lower Mokelumne River.

**Acoustic Research & Technology (Paul Skvorc)** - Paul Skvorc was the first person to design, build and prove a sonar-based system capable of differentiating species of fish based on their frequency domain signature. Paul worked for the Alaska Department of Fish and Game for 11 years as the head of the Sonar and Technical Services Group in the Division of Commercial Fisheries. During that 11 year period, he pioneered several new fisheries acoustics techniques and developed the first statistical methods for determining the precision of riverine fisheries sonar.

## Monitoring and Data Evaluation

The project is a monitoring effort, so monitoring of the project is not necessary. Data collected by the sonar equipment will be processed and statistically analyzed to determine its accuracy in counting juvenile anadromous fish. Following completion of the data collection, the cost and accuracy of data acquisition will be analyzed and compared to existing data collection methods.

## Local Support/Coordination with other Programs/Compatibility with AFRP Objectives

This project was included in a grant proposal submitted to CALFED in April 1999. That proposal was supported by the co-sponsors WID and the City of Lodi, East Bay Municipal Utility District (EBMUD), San Joaquin Council of Governments, The Nature Conservancy, San Joaquin Resource Conservation District (RCD), South Sacramento RCD, Sloughhouse RCD, Florin RCD, Sacramento Area Flood Control Agency, California Cattleman's Association, and California Rangeland Trust.

# Mokelumne River Juvenile Chinook Salmon Sonar-Based Enumeration Project

**Joint Applicants:** Woodbridge Irrigation District and City of Lodi

**Technical and Financial Contact Person:**
Mr. Anders Christensen, Manager
Woodbridge Irrigation District
18777 North Lower Sacramento Road
Woodbridge, CA 95258
Telephone: 209/369-6808
Fax: 209/369-6823
E-mail: wid2000@softcom.net

**Participants/Collaborators in Implementation:**
Mokelumne River Technical Advisory Committee
East Bay Municipal Utility District
Jones & Stokes Associates
Acoustic Research & Technology (Paul Skvorc)

**Tax Identification No. and Contractor License No.:**
Woodbridge Irrigation District: Federal Tax ID No. 94-2645849
State Tax ID No. 698-14085
City of Lodi: Federal Tax ID No. 94-60000361

# Project Description

## Project Description and Approach

The proposed project involves sonar-based counting of juvenile anadromous fish on the lower Mokelumne River in San Joaquin County, California. At present, adult fish are counted by EBMUD using video equipment installed in the fish ladder at Woodbridge Dam. Juveniles are counted using screw traps. This project involves installing, testing, and using sonar-based equipment near Woodbridge Dam to automatically count juvenile anadromous fish (mainly fall-run chinook salmon and steelhead trout). The sonar-based counts will be compared to existing counting methods and will be evaluated to determine if the system provides sufficient accuracy at a reasonable cost to substitute for existing methods.

The sonar-based counting equipment will be located just below Woodbridge Dam near the current screw trapping site. The project's primary long-term goal is to provide a seasonal estimate of the cumulative downstream passage of out-migrating juveniles, including recently emerged fry and smolts. The first year's in-season goals will be directed toward identifying and ameliorating site-specific problems and establishing a well-defined daily routine of data acquisition, processing, analysis, and storage. Ultimately, the project will feature at least two transducers, one on each bank, insonifying the entire water column from bank to bank. The project will likely operate either manned or unmanned for — 24 hours per day 7 days per week — for the duration of the field season. Data will be collated and processed in 24 hour increments. A given day's passage with associated confidence intervals will be available the following day. Cumulative daily passage estimates will be accumulated to seasonal passage estimates and run-timing curves.

## Location or Geographic Boundaries of Project

The equipment will be located in the vicinity of Woodbridge Dam on the Mokelumne River near the town of Woodbridge, but the project allows for the counting of all migrating fish in the lower Mokelumne. The lower Mokelumne River is defined as the stretch of river between Camanche Dam and the Cosumnes River.

## AFRP Action/Evaluation Priority

The Revised Draft Restoration Plan for the AFRP (May 1997) includes recommendations for several evaluations related to restoration efforts on the lower Mokelumne River: "evaluat[ing] the effectiveness of pulse flows to facilitate successful emigration of juvenile salmonids in the

spring" and "evaluate and facilitate passage of spawning adult salmonids in the fall and juvenile salmonids in the spring" past Woodbridge Dam. These evaluations are authorized under CVPIA Section 3406(e)(3), "Measures to eliminate barriers to upstream and downstream migration of salmonids"; and Section 3406(e)(6), "Other measures to protect, restore, and enhance natural production of salmon and steelhead in tributary streams of the Sacramento and San Joaquin rivers."

CALFED has selected the lower Mokelumne River as a priority river for fish restoration under the Ecosystem Restoration Program. CALFED, EBMUD, the U.S. Army Corps of Engineers, and others are spending significant amounts of time and money studying ways to improve ecosystem functions in that section of river. The existing methods for counting juveniles may not be sufficiently accurate to allow firm conclusions regarding the effects on salmon and steelhead populations to be drawn from these evaluations. If successfully implemented, the sonar-based enumeration project will allow the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (DFG), National Marine Fisheries Service (NMFS), and others to evaluate the benefits or impacts of fishery restoration actions being undertaken in the lower Mokelumne River.

## Expected Benefits

The current method for counting juvenile anadromous fish, screw traps, counts only between 1% and 10% of the downstream migrants, and therefore provides an estimate of the number of migrating fish with an error margin of +/- 80%. This method makes the measurement of the expected effects on population of the various actions being undertaken on the river, including the improvements to fish passage and fish screening being proposed as part of the LMRRP, very difficult. The successful implementation of a sonar-based counting system can provide a much more accurate estimate of population size. By installing this system prior to implementing any of elements of the LMRRP, a baseline measure of population size can be obtained, against which the effects of the LMRRP can be measured. It also will provide a more accurate method for measuring the effects of other ecosystem improvements including AFRP and CALFED Ecosystem Restoration Program Plan (ERPP) actions.

## Background and Biological/Technical Justification

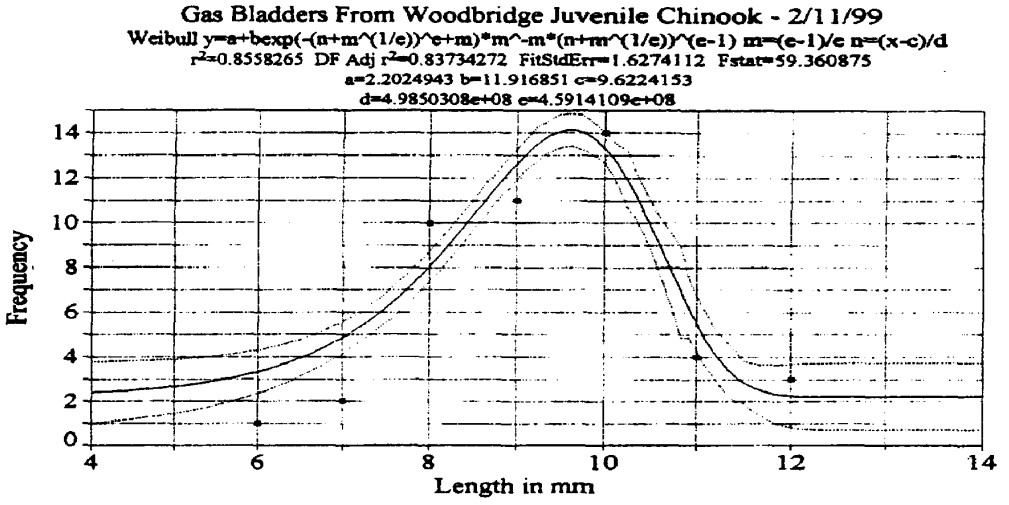
In the early developmental stages, the project design will be focused on determining those characteristics of the fish that reduce the PoD from one.

The theoretical minimum range resolution (which corresponds directly to the ability to detect individual targets) is equal to ½ the pulse width. The actual range resolution is slightly larger than ½ the pulse width; how much larger is primarily a function of the quality of the hardware producing the signal, the hardware receiving the signal, the techniques used to process the received signal, and,

to a lesser degree, the medium through which the sound propagates (in this case, the river). Postemergent fry are small. In order to maximize spatial resolution the pulse width needs to be short; however, sufficient power to effectively insonify the maximum cross section of the river is maintained by lengthening the pulse width. When dealing with acoustically small targets, it is best to determine at the site the pulse widths that will provide sufficient detection power and sufficient spatial resolution for individual target detection. Because fish density (fish per unit volume of river) will change as each season progresses, the PoD, as a function of pulse width, will change correspondingly.

In order to get an initial estimate of the PoD in the early stages of fry outmigration, fish were collected from the Woodbridge screw trap in mid-February and X-rayed to determine gas bladder lengths (the gas bladder is the primary acoustic reflector.) Fitting a Weibull distribution to the resulting data set suggests that there is a 90% chance that by February 11, 1999, approximately 75% of the fish present had gas bladder lengths greater than 8 millimeters (mm) (Table 1). If a frequency of 420 kilohertz per hour (kHz) is employed, it will have a corresponding ½ wavelength of approximately 1.8 mm. Theory dictates that under ideal conditions (other physical properties of the target and medium of propagation not withstanding), an object will reflect a pressure wave if the diameter of the object, normal to the incident wave, is equal to or greater than ½ the wavelength. (Actually it is the cross sectional area of the target normal to the incident wave, but in the case of targets having cross sections that are not needle-like, the largest diameter is a convenient measure.) In practice, the industry-recommended standard is that the object have a diameter, normal to the incident wave, at least 10 times the ½ wavelength. As the ratio of diameter to ½ wavelength decreases from 10:1, the PoD decreases correspondingly but not linearly. With a ½ wavelength of 1.8 mm for 420 kHz, the 10:1 ratio suggests that under ideal conditions, the minimum target size for a PoD of one is 18 mm. Table 1 illustrates that less than 1% of the fish in the February 11, 1999 sample have gas bladders in excess of 18 mm. However, the PoD does not plummet from 1 as the diameter to ½ wavelength ratio decreases from 10:1. In fact, it remains near 1 until the ratio falls below 5:1. (A prior exact probabilities are not obtainable because of the complexity of unknown site-specific physical characteristics.)

## Table 1. Gas Bladders of Woodbridge Juvenile Chinook Salmon




Rank 22 Eqn 8053 [Weibull] y=a+bexp(-(n+m^(1/e))^e+m)*m^-m*(n+m^(1/e))^(e-1) m=(e-1)/e n=(x-c)/d

| $r^2$ Coef Det | DF Adj $r^2$ | Fit Std Err | F-value |
|---|---|---|---|
| 0.8558265007 | 0.8373427187 | 1.6274111905 | 59.360874543 |

| Parm | Value | Std Error | t-value | 90% Confidence Limits | |
|---|---|---|---|---|---|
| a | 2.202494327 | 0.897313313 | 2.454543242 | 0.691467280 | 3.713521374 |
| b | 11.91685111 | 0.918546576 | 12.97359483 | 10.37006840 | 13.46363383 |
| c | 9.622415322 | 0.056127288 | 171.4391649 | 9.527900008 | 9.716930636 |
| d | 4.98503e+08 | 6.805e+14 | 7.32554e-07 | -1.1459e+15 | 1.14593e+15 |
| e | 4.59141e+08 | 6.26767e+14 | 7.32554e-07 | -1.0554e+15 | 1.05544e+15 |

| Date | Time | File Source |
|---|---|---|
| Mar 8, 1999 | 1:54:53 PM | CLIPBRD.WK3 |

At this point, one might be tempted to increase the operating frequency of the system; however, the higher the frequency the greater the attenuation of the projected pulse. Additionally, as frequencies exceed roughly 200 kHz, attenuation reaches a significant level and the sources of the attenuation increase. Attenuation increasingly fluctuates more severely with small changes in characteristics in the water, such as conductivity. The effect is a fluctuating insonified cross section. Attenuation is easily compensated for mathematically; however, as the sonar system becomes more sensitive to changes in the operating environment, the level of required onsite expertise increases. Additionally, the need for human supervision of the system increases.

The best solution is to choose an operating frequency that minimizes attenuation and maximizes the ratio of gas bladder length to wavelength for the fish of interest. Given the availability of hardware capable of generating and receiving 420 kHz and the relatively short range at the Mokelumne site, 20 kHz is a reasonable starting point. If compensating for 420 kHz attenuation turns out to be a data acquisition and processing problem (the cost of technical expertise exceeds budget constraints), other options can be explored. Those options include:

lowering the system frequency,

reducing statistical rigor (enlarging the confidence intervals around the passage estimate), and

postponing initiation of the sonar until the gas bladders are of sufficient size to provide the PoD value that is satisfactory for the level of precision required for the passage estimate.

## Proposed Scope of Work

This is a 2-year project. The first year involves obtaining, installing, and testing sonar-based monitoring equipment and training staff. We will use Paul Skvorc of Acoustic Research and Technology, an expert in the field, to calibrate the equipment and to train project staff in its use. The second year involves collecting a full season of data for evaluation. The tasks associated with each year of the study are provided below.

### Year One - Site Setup, System Configuration, and Statistical Design

1. Select the site. Selecting the specific location for installation of the sonar equipment includes determining the bottom profile and if bottom modification will be necessary, and constructing the structures necessary to house the sonar equipment.

2. Quantify relationship between PoD and gas bladder length for postemergent chinook fry.

3. Develop the project statistical design. This includes establishing a daily sampling schedule based on predetermined statistical precision criteria for the seasonal passage estimate, onsite personnel requirements, offsite data processing and analysis, and incorporation of the PoD curve established under Task 2.

4. Train technicians.

5. Prepare quarterly reports.

6. Prepare annual report.

## Year Two - First Year of Operations

1. Test statistical results of year one. Given the statistical design of year one, collect data to determine if the established procedures yield consistent results with current season environmental and biological conditions. If not, collect data for adjustment.

2. Corroborate PoD curve from year one.

3. Corroborate year one statistical design with corresponding statistical precision estimate.

4. Prepare quarterly reports.

5. Prepare annual report.

6. Analyze and report total project cost, cost per sample, and cost for various levels of precision or seasonal estimate of passage.

It is likely that the project will ultimately be staffed with three technicians whose primary function is to collect and preserve data acquired by the sonar system. In addition, they will perform upkeep and preventive maintenance on the sonar system and associated support equipment. The project leader will be responsible for routine daily data processing, analysis, dissemination, and archiving. The project leader also will supervise the technicians and troubleshoot system problems directly observed or identified by the technicians. The project leader will be responsible for the technical integrity and statistical evaluation of the data at all levels. The leader will also be responsible for maintaining the operational capabilities of the sonar system and the support equipment and facilities. In the initial phases of the project, the project leader will conduct or supervise data processing and analysis. The project leader will be responsible for developing site specific operational protocols, writing required periodic reports, and conducting presentations when necessary.

## Monitoring and Data Evaluation

During the first year, the project will be operated on a normal 8-hour work day. This day may start just prior to sundown in order to be operational at the time of day of maximum passage. Sonar sampling will commence at the start of the hour and continue for 20 minutes on one bank, followed by a 5-minute break to prepare for sampling on the opposite bank. Sampling on the opposite bank will commence at 25 minutes past the hour and continue for 20 minutes. This will be followed by a 15-minute period of quiescence, after which the sampling sequence will commence

again at the top of the hour. This cycle will continue for the full 8 hours, after which the data will be stored and prepared for transport back to the office for analysis.

The sonar system will be transmitting at eight pings per second for 40 minutes per hour, at least 8 hours per day. Each ping will have a range resolution of approximately 8 centimeters (cm). If the total range per bank is 15 meters, the total number of target acquisitions possible per ping is approximately 190. Each valid echo will provide no less than 9 and as many as 15 separate parameters to be recorded. Each target should provide at least eight echoes. Therefore, in one 8-hour sampling period, there is the potential for $2.1 \times 10^9$ data bits (8 x 60 x 40 x 8 x 190 x 9 x 8) that have to be filtered, stored, and processed. The following references provide thorough detail on the procedures that will be employed on this project:

1. Kuskokwim River Sonar Progress Report, 1989 - 1990. Regional Information Report No. 3A94-12, Alaska Department of Fish and Game.

2. Kuskokwim River Sonar Progress Report, 1991. Regional Information Report No. 3A96-24, Alaska Department of Fish and Game.

3. Kuskokwim River Sonar Project Abundance Estimates of Salmon Species, 1993. Regional Information Report No. 3A95-05, Alaska Department of Fish and Game.

4. Kvichak River Side-Looking Sonar Smolt Abundance Estimation - Regional Information Report No. 5J92-07, Alaska Department of Fish and Game.

5. Lower Yukon River Sonar Project Report, 1993. Regional Information Report No. 3A95-33, Alaska Department of Fish and Game.

6. Noatak River Sonar Escapement Estimate, 1992. Regional Information Report No. 3C93-06, Alaska Department of Fish and Game.

## Implementability

This technology has been successfully implemented by Paul Skvorc in numerous locations in Alaska, as listed above. Initial measurements of juvenile gas bladder size taken in February 1999 indicate that they are at the edge of the range where detection is possible.

# Cost and Schedule

### Budget Costs

Table 2 provides information regarding the costs associated with each year of operation of this project, broken down by cost type.

**Table 2. Total Budget by Year and Cost Type**

| Year | Direct Labor Hours | Direct Salary and Benefits | Service Contracts | Material and Acquisition Costs | Misc. and Other Direct Costs | Overhead and Indirect Costs | Total Cost |
|---|---|---|---|---|---|---|---|
| 1 | $0 | $0 | $149,000 | $75,000 | $0 | $0 | $224,000 |
| 2 | $0 | $0 | $137,000 | $0 | $0 | $0 | $137,000 |
| Total | $0 | $0 | $286,000 | $75,000 | $0 | $0 | $361,000 |

### Schedule Milestones

The project would proceed on the following schedule:

| | |
|---|---|
| Acquire and install equipment | December 1999 |
| Complete initial equipment testing | June 2000 |
| Complete first full year of data collection | June 2001 |
| Complete analysis of first year of data and final report | September 2001 |

### Third-Party Impacts

Because this project will not physically affect any of the parameters of the river, it is not anticipated that any third-party impacts will occur.

# Applicant Qualifications

The joint applicants for this project are WID and the City of Lodi, but the work will be undertaken by Jones & Stokes Associates and Acoustic Research & Technology, contractors to the joint applicants. Qualifications of these firms are presented below.

### Jones & Stokes Associates

Jones & Stokes Associates has extensive experience with the anadromous fisheries analysis and management throughout the Central Valley of California. Jones & Stokes Associates has conducted large-scale systemwide analyses of impacts on fisheries of implementation of both the CVPIA and the CALFED Bay-Delta Program. In addition, Jones & Stokes has direct experience working on the Mokelumne River, including the preparation of an EIR/EIS on implementation of the LMRRP, which includes actions to improve passage and screen conditions for fish in the lower Mokelumne River. This sonar-based monitoring project is related to the LMRRP work, as both will occur at or near Woodbridge Dam.

### Acoustic Research & Technology (Paul Skvorc)

Paul Skvorc's sonar experience dates back to 1970 when he was a US Navy Sonarman aboard nuclear submarines. Paul received a B.S. in zoology in 1978 and an M.S. in ecology in 1980. Throughout his undergraduate and graduate work, Paul was involved in fisheries sonar ranging from crappie, shad, and largemouth bass in Kansas reservoirs to arctic grayling, lake trout, and arctic char in alpine lakes on the arctic coastal plain in Alaska. Paul pursued an interdisciplinary doctorate in electrical engineering, physics, and fisheries science at the University of Alaska. His thesis title is "The Use of Broadband Sonar for Fish Species Differentiation." Paul was the first person to design, build, and prove a sonar system that was capable of differentiating species of fish based on their frequency domain signature. Paul started to work for the Alaska Department of Fish and Game (ADFG) prior to defending his thesis. Paul worked for the ADFG for 11 years as the head of the Sonar and Technical Services Group in the Division of Commercial Fisheries. During that 11-year period, he pioneered several new fisheries acoustics techniques and developed the first statistical methods for determining the precision of riverine fisheries sonar. Paul was also the State of Alaska's expert in hydroacoustics on the Joint Technical Committee of the US/Canada Salmon Treaty negotiations, and has assisted the Canadian Government in starting three separate fisheries projects; one on the Yukon River in the Northwest Territory for chinook salmon, one on the Arctic Red River in the Northwest Territory for broad white fish, and one in the Fraser River in British Columbia for

pink and sockeye salmon. Paul currently resides in Wasilla, Alaska, where he operates his fisheries acoustics consulting business, Acoustic Research & Technology.

RESOLUTION NO. 99-135

A RESOLUTION OF THE LODI CITY COUNCIL AUTHORIZING THE PARKS AND RECREATION STAFF IN CONJUNCTION WITH WOODBRIDGE IRRIGATION DISTRICT (WID) TO APPLY FOR A SONAR FISH MONITORING PROJECT AND PROGRAMS GRANT

==========

RESOLVED, that the City Council of the City of Lodi does hereby authorize the Parks and Recreation staff, in conjunction with Woodbridge Irrigation District (WID), to apply for a Sonar Fish Monitoring Project and Programs Grant; and

BE IT FURTHER RESOLVED, that the City Council of the City of Lodi does hereby authorize the City Manager to execute said grant documents on behalf of the City of Lodi.

Dated: September 1, 1999

==========

I hereby certify that Resolution No. 99-135 was passed and adopted by the City Council of the City of Lodi in a regular meeting held September 1, 1999, by the following vote:

AYES: COUNCIL MEMBERS – Hitchcock, Mann, Nakanishi, Pennino and Land (Mayor)

NOES: COUNCIL MEMBERS – None

ABSENT: COUNCIL MEMBERS – None

ABSTAIN: COUNCIL MEMBERS – None

Alice M. Reimche

ALICE M. REIMCHE
City Clerk