2004 Water Use Efficiency Proposal Solicitation Package

APPENDIX A: Project Information Form

Applying for: ❑ Urban **X** Agricultural

1. (Section A) **Urban or Agricultural Water Use Efficiency Implementation Project**
   - ❑ (a) implementation of Urban Best Management Practice, #_____
   - ❑ (b) implementation of Agricultural Efficient Water Management Practice, #_____
   - ❑ (c) implementation of other projects to meet California Bay-Delta Program objectives, Targeted Benefit # or Quantifiable Objective #, if applicable _____
   - ❑ (d) Specify other: _____

2. (Section B) **Urban or Agricultural Research and Development; Feasibility Studies, Pilot, or Demonstration Projects; Training, Education or Public Information; Technical Assistance**
   - ❑ (e) research and development, feasibility studies, pilot, or demonstration projects
   - ■ (f) training, education or public information programs with statewide application
   - ■ (g) technical assistance
   - ❑ (h) other

3. Principal applicant (Organization or affiliation): Yolo County Resource Conservation District

4. Project Title: Yolo/Colusa Mobile Water Lab: *Integrating water quality into on-farm irrigation water management improvements*

5. Person authorized to sign and submit proposal and contract:

Name, title	Paul Robins, Executive Director
Mailing address	221 W. Court St., Suite 1 Woodland, CA 95695
Telephone	530-662-2037 ext. 116
Fax.	530-662-4876
E-mail	robins@yolorcd.org

6. Contact person (if different):	Name, title.	Barbara Fleck, Program Administrator
	Mailing address.	221 W Court St., Ste 1 Woodland, CA 95776
	Telephone	530-662-2037 ext. 117
	Fax.	530-662-4876
	E-mail	fleck@yolorcd.org
7. Grant funds requested (dollar amount): *(from Table C-1, column VI)*		**$414,085**
8. Applicant funds pledged (dollar amount):		$58,320
9. Total project costs (dollar amount): *(from Table C-1, column IV, row n)*		$472,405
10. Percent of State share requested (%) *(from Table C-1)*		87.8%
11. Percent of local share as match (%) *(from Table C-1)*		12.2%
12. Is your project locally cost effective? *Locally cost effective means that the benefits to an entity (in dollar terms) of implementing a program exceed the costs of that program within the boundaries of that entity.* *(If yes, provide information that the project in addition to Bay-Delta benefit meets one of the following conditions: broad transferable benefits, overcome implementation barriers, or accelerate implementation.)*		❑ (a) yes ■ (b) no

11. Is your project required by regulation, law or contract? If no, your project is eligible.

    If yes, your project may be eligible only if there will be accelerated implementation to fulfill a future requirement and is not currently required.

    Provide a description of the regulation, law or contract and an explanation of why the project is not currently required.

- ❑ (a) yes
- ■ (b) no

_____
_____
_____
_____
_____

12. Duration of project (month/year to month/year): **1/06 to 1/09**

13. State Assembly District where the project is to be conducted: **8th & 2nd**

14. State Senate District where the project is to be conducted: **5th & 4th**

15. Congressional district(s) where the project is to be conducted: **1st & 2nd**

16. County where the project is to be conducted: **Yolo and Colusa**

17. Location of project (longitude and latitude): Longitudes: 383242N (Yolo) and 39000N (Colusa) Lattitudes: 1214422W (yolo) & 122000W (Colusa)

18. How many service connections in your service area (urban)? n/A

19. How many acre-feet of water per year does your agency serve? n/A

20. Type of applicant (select one):

- ❑ (a) City
- ❑ (b) County
- ❑ (c) City and County
- ❑ (d) Joint Powers Authority
- ❑ (e) Public Water District
- ❑ (f) Tribe
- ❑ (g) Non Profit Organization

- ❑ (h) University, College
- ❑ (i) State Agency
- ❑ (j) Federal Agency
- ■ (k) Other
  - ❑ (i) Investor-Owned Utility
  - ❑ (ii) Incorporated Mutual Water Co.
  - ■ (iii) Specify _Special District__

21. Is applicant a disadvantaged community? If 'yes' include annual median household income.

    (Provide supporting documentation.)

- ❑ (a) yes, _____ median household income
- ■ (b) no

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APPENDIX B: Signature Page

By signing below, the official declares the following:

The truthfulness of all representations in the proposal;

The individual signing the form has the legal authority to submit the proposal on behalf of the applicant;

There is no pending litigation that may impact the financial condition of the applicant or its ability to complete the proposed project;

The individual signing the form read and understood the conflict of interest and confidentiality section and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant;

The applicant will comply with all terms and conditions identified in this PSP if selected for funding; and

The applicant has legal authority to enter into a contract with the State.

_____	Paul Robins, Executive Dir.	_____
Signature	Name and title	Date

Statement of Work

Yolo/Colusa Mobile Water Lab:

Incorporating water quality management into on-farm irrigation water management improvements.

Section 1: Relevance and importance

Ongoing changes in water quality regulations and costs affect how farmers manage their drainage waters and irrigation systems. California farmers and water providers need more information about the actual effectiveness of water conservation (quality and quantity) techniques to be able to demonstrate the degree of their compliance with water use efficiency goals and water quality regulations. At the same time they need more information about what potential pollutants (sediment, nutrients and agrochemicals) are present in their drains and the techniques for managing them.

During its first year of operations (2004) the Yolo/Colusa Mobile Water Lab provided a unique service for just such information for agricultural water users requesting irrigation evaluations, runoff monitoring and recommendations. Positive response from the 18 farmers who received irrigation evaluations in 2004, requests for collaboration with local irrigation districts, and requests for support to the Yolo County Farm Bureau's Agricultural Water Quality Coalition are significant indicators of the value of the Mobile Water Lab in Yolo and Colusa counties. We are requesting funding to continue this service and to assess how independent water conservation evaluations can best assist growers to improve their overall water management systems in light of the growing pressure for further increases in water use efficiency and new state ag water quality requirements.

The Mobile Water Lab builds on the 'traditional' irrigation system evaluation Mobile Lab model to include tail and source water sampling and drainage system assessment along with recommendations and technical support for water quality management improvement techniques. Under this proposal we will also collaborate with the local irrigation district to survey participating growers regarding source and drainwater usage and water quality concerns. Combined with the irrigation district's information gathering efforts, the site monitoring and survey data will support refining water management techniques and provide a better understanding of overall watershed flow patterns to improve management of waters flowing to the Delta and support farmers' efforts to comply with public water conservation concerns.

Proposal Objectives & Water Use Efficiency Program Goals

Under this proposal, the Yolo-Colusa Mobile Water Lab will:

1. Provide free irrigation water management analyses and technical assistance to farmers in Yolo and Colusa counties.
2. Lead a local grower outreach program regarding water use efficiency techniques and project results using press, field demonstrations and other communications.
3. Conduct a slough water use and quality survey with cooperating growers.
4. Evaluate and assess the project and Mobile Water Lab effectiveness for service in Yolo County and extension to other regions lacking holistic water use efficiency evaluation services.

Goals 1 and 3 address the California Bay Delta Authority (CBDA) Water Use Efficiency Program (WUEP) Targeted Benefits (TB) #20, 25 and 26 (*Provide flow to improve ecosystem conditions, decrease nonproductive evaporation and transpiration to increase the quantity of water for beneficial uses and provide long-term water management flexibility to increase the water supply for beneficial uses*) and address the CBDA WUEP goal of "improving the flow between the point of diversion and the point of reentry" (Final 2004 Water Use efficiency PSP, page 5) through facilitating improved irrigation efficiency in Yolo & Colusa counties by:

- Providing farmers and water suppliers with independent water conservation evaluations that include components of irrigation system evaluation, tail and source water sampling and drainage system assessment as requested.
- Demonstrating water conservation and water quality management techniques on selected farms in the region through conservation practice installations, field meetings, small articles and partner district mailings.
- Providing technical assistance for on-farm and partner district canal water quality management projects such as tailwater recovery systems, sediment traps and canal bank stabilization with native/non-weedy vegetation.
- Conducting slough water surveys to better understand the use of tailwater.

Goal 2 indirectly meets CBDA WUEP TB #81 (*Reduce nutrients to enhance and maintain beneficial uses of water*) by:

- Educating growers about sediment traps and canal bank stabilization with native/non-weedy vegetation.
- Promoting on-farm water quality management which would minimize nutrient losses in tailwater, reduce production costs by identifying more accurate water and nutrient applications and reduce ground or surface water contamination by reducing nutrient applications and developing sediment traps.
- Supporting and implementing these practices on cooperating farms.

Goal 4 addresses CBDA WUEP TB#26 (*provide long-term water management flexibility to increase the water supply for beneficial uses*) and the CBDA WUEP goal to "build on existing water use efficiency programs and introduce new practices" (Final 2004 Water Use Efficiency PSP, page 5).

This program would build on the format of a traditional Water Mobile Lab, using evaluation methodologies developed by Irrigation Training and Research Center (ITRC) at Cal Poly San Luis Obispo and supported by the Department of Water Resources. In addition to the traditional Mobile Water Lab services which emphasize Distribution Uniformity as the primary measure of irrigation efficiency, this project would document the need for additional services, resulting in more collected data for more informed water management decisions on farms. It would also allow better local decision-making and action based on local data. Table 1a below outlines the additional services provided by the Yolo-Colusa Mobile Water Lab as compared to standard Irrigation Mobile Lab services.

Table 1a **Current and proposed practices of the Mobile Water Lab**

Traditional Mobile Lab Practices	Explanation
Distribution Uniformity (DU)	Provides an estimate of how uniformly water is being applied to the field
Reasons for non-uniformity	ITRC software estimates reasons for a low Global DU
Estimated Gross and Net water application rates	ITRC software estimates the gross and net application rates taking into account evapotranspiration and holding capacity
Recommend duration of irrigation sets	ITRC software recommends time length for water application to adequately irrigate crops
General recommendations	ITRC software gives general recommendations based on the preliminary interview with grower (i.e. chemical injections and hose flushing)

New and Expanded Practices	Explanation
Water Quality Testing	Lab and in-house tests of water samples to assess nutrient levels in irrigation water
Nitrogen Budgeting Calculations	Calculate the amount of NO3 already in the water to possibly reduce excess fertilizer application and nutrient run-off (see Nitrogen Budgeting Worksheet in Appendix G)
Aerial photos and acreage calcs	Use GIS aerial photos to calculate actual acreage of crop in order to increase management efficiency (see App. D, Table 1b)
CIMIS Evapotranspiration (ET) values and comparison	Compare water application to demand based on the daily and weekly ET values published by CIMIS (see App. D, Table 1c)
Flow meter Comparison	Compare flow values from the pump flow meter with calculated flow from catch cups and emitter specs (see App. D, Table 1d)
Slough water use survey	Characterize the flow of tailwater return systems by conducting interviews about slough water use in conjunction with YCFCWD

Anticipated Water savings: Initial water lab evaluations in 2004 resulted in an average of 31% estimated potential on-farm total water savings (see App. D, Table 1c). Allowing for unavoidable inefficiencies and externalities, for this proposal we anticipate a total water savings of up to 15% on farms implementing recommended improvements.

Consistency with local plans: This project is consistent with the following plans:

- Willow Slough Watershed Integrated Resources Management Plan (1996): identifies tailwater return systems, sediment traps and native vegetation bank stabilization systems as means of improving local water management and water quality.
- Yolo/Solano and Colusa Basin Subwatersheds Water Quality Coalitions: provides tools and information to farmers for managing runoff water quality.
- Yolo County Integrated Water Management Plan (under development): Includes the Yolo County Flood Control and Water Conservation District Water Management Plan Update which supports mobile water labs through its demand management outreach and goals.

Section 2: Technical/Scientific Merit, Feasibility:

The proposed work is based on established, successful models for irrigation evaluation (ITRC, described above) and RCD-Water District collaboration successfully demonstrated in several regions throughout California. Notable examples include Kern County, Imperial County, Merced County and most recently Glenn County. The expanded services are based on standard procedures for nutrient budgeting, simple water quality assessment, GIS analysis and survey design and administration, all of which have been successfully employed by YCRCD staff in the past and all but the survey employed in the context of the first year of Yolo-Colusa Mobile Lab operation. The Mobile Water Lab methods, equipment and facilities are described below (see appendix I for sample Evaluation Report):

Methods and Procedure

Mobile Lab System Evaluations

1. Set up evaluation and meet with irrigation manager. Conduct interview questions from the ITRC Software and slough water-use survey before irrigation begins.
2. Once irrigation has begun, measure and record the information required for the ITRC software as listed in the software manual (1999). For example, in a micro-drip system evaluation:
    a. Measure several pressures at specified regions of irrigation system.
    b. Measure flows at specified regions of the system.
    c. Check for emitter plugging.
    d. Flush irrigation line ends.
    e. Remove filter screens at few selected risers and re-check pressures.
3. Water quality Sample/Results.
    a. Take irrigation water samples as requested and provide analysis in-house or via certified lab, depending on constituents of interest. Methodologies used and data collected will include but are not necessarily limited to the following procedures:
        1. Grab samples, parameter-specific bottles, iced or frozen as necessary.
        2. Temperature, pH, total dissolved solids (tds), electrical conductivity (ec); (Hanna Instruments 98129 portable multi-meter)
        3. Turbidity (Hach Portable Turbidimeter 2100 P)
        4. Nutrients: nitrogen, phosphorus (Hach Portable Datalogging Colorimeter DR890).
4. Comparison of water actually applied and water management recommendations based on the California Irrigation Management Information System (CIMIS).
    a. Calculate applied water from flows measured by flow meter, measurements of system in operation, and system specs. (Sigma 910 Area Velocity Flow Meter, Global Water FP 201 pole-mounted flow meter).
    b. Compare to CIMIS recommended values (based on posted evapo-transpiration values).
5. Willow Slough water-use survey (in Willow Slough Watershed only).
    a. Conduct survey about slough water-use based on questions developed in conjunction with Yolo County Flood Control and Water Conservation District.
6. Aerial Photos and Acreage.

   a. Use ortho-rectified aerial photos from USDA-NRCS ArcView GIS database to estimate irrigated area and calculate acreage.
7. Recommendations and Assistance.
   a. Enter data from site evaluation to run ITRC software analysis
   b. Based on evaluation results, make recommendations about irrigation and water management practices.

Based on the recommendations given, Mobile Water Lab staff will assist motivated farmers with technical assistance and locating financial assistance as needed to implement recommended changes. Where changes are made, the Mobile Water Lab staff will document relevant post-implementation factors contrasted with the initial system evaluation as a baseline to evaluate effectiveness of the conservation practices. Depending on the practice these further measurements could be water quality or quantity or distribution factors taken in the same manner as during the original system evaluation.

Outreach and Evaluation methods are described in detail under Section 4 of this proposal, below.

Equipment

The Mobile Water lab will employ the following tools in undertaking site evaluations. All equipment listed was acquired or used by the Yolo/Colusa Mobile Water Lab in 2004. Additional small items, replacements and parts may be acquired during the project as needed:

- Standard tool box for ITRC irrigation system evaluations. (see Appendix H)
- Honda “Rancher” ATV
- Ford F-350 truck
- Sigma 910AV Doppler open channel Flow meter
- Hanna Instruments HI98129 pH/EC/TDS portable meter
- Hach Portable Datalogging Colorimeter DR890
- Hach Portable Turbidimenter 2100 P
- Greyline PDFM-IV closed pipe flow meter
- Dell Desktop Computer
- ITRC Irrigation Evaluation Software
- America Sigma instrument software (Insight)
- Greyline Flow Meter/Logger software
- Sigma 910 Area Velocity Flow Meter, Global Water FP 201 pole-mounted flow meter
- ArcView GIS software
- Nasco WHIRL-PAK 18 oz stand-up bags for water sample collection and shipping
- Soil Probe
- Catch cups

Facilities

Main office is shared with USDA NRCS Woodland Field Office. ATV and other equipment are stored at a local cooperating farm. An off-site certified water quality testing laboratory will be contracted for 2005-1007.

Task List

Objective 1. *Provide free farm water system evaluations and technical assistance to local users.* Provide farmers and water suppliers with independent water conservation evaluations that include components of irrigation system evaluation, tail and source water sampling, and drainage system assessment, as requested. A minimum target of 25 farms will be evaluated each year of the grant period.

Task 1.1: Establish priorities and announce availability of Mobile Water Lab for 2006 irrigation season (April 2006, 2007, 2008)

1. Convene steering committee (see Task 4: Evaluation) to review and establish/affirm priorities for each year of grant prior to the growing season.
2. Send mailer to Yolo and Colusa county farmers, submit article to local and agricultural press, make presentation to local Farm Bureaus and commodity groups

Task 1.2: Perform evaluations upon request including additional services not provided in the traditional Mobile Irrigation Lab (April-October 2006, 2007, 2008)

1. Evaluations conducted according to Methods and Procedures (described above).
2. Nitrogen budgeting calculations using worksheet (Appendix G)
3. Acreage calculations using GIS ortho-rectified aerial photos from USDA database.
4. Take water samples to be analyzed in-house or by an off-site lab. Provide assessments

Task 1.3: Recommendations and assistance provided to improve analyzed irrigation and water management systems (May-December 2006, 2007, 2008)

1. Comparison with regional, UC, NRCS, and EPA standards for water management and quality.
2. Written reports submitted to farmer with recommendations based on ITRC software and NRCS standards and specifications.
3. Aerial photos and soil surveys submitted to farmer.
4. Technical assistance to implement recommendations as requested.

Objective 2. *Lead a local grower outreach program regarding water use efficiency techniques and project results.* Through field demonstrations, publications and presentations, communicate to farmers and the public methods for improved on-farm water management and project results. Provide individual consultations, technical assistance, and guidance for financial assistance for improved on-farm management practices as requested.

Task 2.1: Present a demonstration/workshop in each county each year of grant, beginning October 2006.

1. Advertise workshops through District mailer and articles in local and ag press.
2. Conduct workshop on farms featuring installed improved water management practices
3. Evaluate meetings based on attendee responses to questionnaire and follow-up contacts from participants.

Task 2.2 Communicate to growers about water management improvement practices through individual consultation, media and District publications.

1. Provide individual on-farm consultation for conservation practice planning and installation upon request.
2. Develop and disseminate self-assessment and practice installation brochures and articles based on project results.
3. Maintain program webpage with up-to-date management practice information on the YCRCD website (www.yolorcd.org).

Objective 3. *Conduct a slough water use and quality survey with cooperating growers*
Conduct slough water usage survey in conjunction with Yolo County Flood Control and Water Conservation District (YCFCWCD) WUE proposal to enable better characterization and future management improvements of slough system.

Task 3.1: Develop survey tool with YCFCWCD (April 2006).
Task 3.2: Conduct survey with growers in Willow Slough Watershed receiving farm water system evaluations (ongoing between April 2006 – October 2008)
Task 3.3: Process survey results with YCFCWCD staff to develop initial characterization of slough drainage and water quality issues.

Objective 4. *Project and Mobile Water Lab evaluation.* Evaluate and assess the project and Mobile Water Lab effectiveness for service in Yolo County and extension to other regions lacking holistic water use efficiency evaluation services.
Task 4.1: Program Steering Committee and Evaluation Plan

1. Convene Steering Committee (to consist of participating RCD and water district staff, technical experts such as USDA NRCS and UC Cooperative Extension personnel, and at least one area farmer) to meet semiannually for program review
2. Develop and implement project assessment and evaluation plan to include regular assessment of assumptions and progress in each task area on a semi-annual basis, promoting timely opportunities for adaptive program management to improve project outcome. The evaluation process will be managed by YCRCD staff and the Steering Committee.

Task 4.2: Ongoing monitoring and refinement of implemented practices (ongoing after May 2006)

1. Use initial system evaluations as benchmark conditions
2. Monitor resource quality/management changes associated with system improvements
3. Review data with Steering Committee for possible practice modifications

Task 4.3: Document the need for additional services and effectiveness of current services (Ongoing after May 2006)

1. Document results and feedback in order to shape a new Mobile Water Lab model.
2. Note any services requested by farmers and assess feasibility
3. Solicit participating grower and demonstration meeting attendee critiques of program and review with Steering Committee.
4. Contact other Mobile Water Labs to document their experiences/services and farmer responses.

Objective 5. *Project Administration and Reporting*

Task 5.1: Reports.

1. Quarterly reports documenting results and changes will be submitted beginning three months after initialization of the project, approximately January 2006.
2. Annual reports will be submitted at the end of each project year: December 2006, December 2007 and February 2009 (included in Final Report under 5.4, below).
3. Special reports: Should major changes be recommended by the steering committee, special reports will be submitted within a reasonable timeframe to justify changes and seek appropriate approval by funder.

Task 5.2: Invoices.

1. Invoices for work conducted will be submitted on a monthly or quarterly basis to the grantor for reimbursement dependent upon the terms of the grant agreement.

Task 5.3: Final report

1. At the end of the project a final report documenting recommendations and describing recommended models for Mobile Water Labs and for canal/slough characterization will be submitted. This is anticipated to be approximately February 2009.
2. Assessment of assumptions, progress toward performance measures and opportunities for adapting project management in each task area will be provided for on a quarterly and yearly basis. The evaluation process will be managed by the steering committee.
3. Documentation of collected data, funding spent and cooperators will be submitted at the end of the project: approximately February 2009.

Schedule of Deliverables and Task Costs (including local match)

Task	Deliverable	Term	Estimated Cost
1: Mobile Lab			$ 280,000
1.1	Document of priorities and service announcement	1/06-5/06	
1.2	Perform irrigation evaluations	4/06-10/06, 4/07-10/07, 4/08-10/08	
1.3	Reporting, recommendations and assistance	5/06-12/06, 5/07-12/07, 5/08-12/08	
2: Outreach			$ 55,000
2.1	Educational Workshops	2/06, 2/07, 2/08	
2.2	Communication with growers through on-site consultation etc.	04/06-12/08	
3: Survey			$ 30,000
3.1	Development with YCFCWCD	04/06	

3.2	Conduct survey with area growers	Ongoing 04/06 to 01/08	
3.3	Process results with YCFCWCD	Ongoing 04/06 to 01/08	
4: Evaluation			$ 44,000
4.1	Convene Steering Committee	Semi-annual for 06, 07, 08	
4.2	Ongoing evaluation	Ongoing from 05/06	
4.3	Documentation of additional services	Ongoing from 05/06	
5: Admin/Reporting			$ 63,405
5.1	Quarterly, Annual, and Special Reports	Beginning approx. 01/06	
5.2	Invoicing	Monthly or quarterly beginning 01/06	
5.3	Project documentation, Final Report	Approx. 02/09	
Program Total			**$472,405**

Environmental Documentation: This is not a "project" according to CEQA. NEPA requirements do not apply to the proposed work.

Section 3: Monitoring and Assessment: A small steering committee consisting of staff from the Yolo County Flood Control and Water Conservation District, USDA Natural Resources Conservation Services, Reclamation District 108, Colusa County Resource Conservation District and cooperating growers will provide monitoring and assessment of the project's progression**.** Progress assessment will be based on:

1. The number of farmers served
2. The percentage of those applying recommendations
3. Analysis of improvements resulting from application of recommendations.
    a. These improvements will be measured in terms of per acre and per liter water quality or water use efficiency improvements and costs and/or savings of the specific practices contrasted with "no changes."
4. Progress assessment for outreach and demonstration efforts will be determined through surveys of participants and the number of evaluation requests made by field meetings and presentation attendees.
5. Practice effectiveness monitoring will be conducted using similar techniques to those used during the initial system evaluations.
    a. System conditions identified during initial system evaluations will serve as baseline conditions for assessing relative changes.
    b. Relevant data will be collected after recommended changes are made to evaluate project and practice success in relation to site objectives (i.e. improved water quality, water conservation, cost-benefits).

Consideration of external factors: Changeable external factors such as weather, irrigation or cropping programs and sampling location access (all coordinated and approved by landowner in advance) will be adapted to as they occur through rescheduling.

Data handling, storage, reporting and accessibility to DWR and others: Hand-written data from standardized field data sheets will be entered into Excel-based spreadsheets on the dedicated Mobile Water Lab computer. Datalogger-derived information will be downloaded onto the lab computer for analysis with the appropriate proprietary software and converted to Excel

format as needed for further analysis. All YCRCD digital information is backed up on two separate drives to be stored in-house and off-site for security.
Aggregated results of documented water use efficiency improvements will be included in reports to the grantor (DWR) and publicized as appropriate through Yolo and Colusa County Resource Conservation District publications (including the YCRCD Mobile Water Lab webpage), papers, presentations and field meetings. The final report will include a re-evaluation of project costs and a benefit analysis for five years after project completion.

Qualification of the Applicants and Cooperators:

Resumes for the project leader and project engineer are attached (see Appendix F).

Applicant: Yolo County Resource Conservation District

Yolo County Resource Conservation District has been a leader and active participant in on-farm resource conservation and enhancement since 1977, successfully developing, managing and completing large grant-funded programs since 1993. The District has attracted a wide diversity of cooperators to its projects and enjoys regional buy-in and support for its projects and vision. District staff includes three resource specialists, an agriculture engineer, a water quality specialist, a program administrator and an administrative assistant. The District shares space and technical expertise with the Woodland Field Office of the Natural Resources Conservation Service (NRCS), which provides to all RCD programs specialists in range management, engineering and soil conservation. YCRCD successfully operated the Mobile Water Lab the summer of 2004 with funding from NRCS, US Bureau of Reclamation and Unilever Corporation. Twenty-one evaluations were completed resulting in data that supports the use of nitrogen budget calculations, comparisons of flow rates from pump flow meter, catch-can calculations, and emitter specs and acreage comparisons. In 2001 YCRCD completed a one-year CALFED Water Use Efficiency Pilot Program in which winter cover cropping, sediment traps, tailwater ponds and irrigation management techniques were evaluated for runoff water quality impacts. This study was continued through 2004 in YCRCD's "Lower Union School Slough Watershed Improvement Program," funded by CALFED Ecosystem Restoration Program. Preliminary Results confirm the reduction in sediment content in runoff and improved runoff management associated with the practices mentioned above.

Primary Project Personnel

Paul Robins, Project Leader, has served as Executive Director of Yolo County Resource Conservation District since 2000. Mr. Robins served the YCRCD as Program Manager from 1995-2000 overseeing two USBR funded projects: Total Resource Management Outreach Challenge Grant (through the California Association of RCDs) and a Filter Strip project with Reclamation District 108. Mr. Robins developed and teaches a biannual "Farmscape Architecture" 10-week landscape architecture studio course at UC Davis since 2004 (to repeat in 2006). The focus of his work with the RCD has been on the interactions between agriculture, water management, and wildlife habitat in Yolo County, with emphasis on the use of tailwater management and native vegetation systems. Prior work includes that of Certified Nurseryman and farmland conservation research. Education includes MS in Community Development and BS degrees in International Agricultural Development and Landscape Architecture from UC Davis.

Kyle Wooldridge, project engineer: Mr. Wooldridge holds a B.S. in Biological Systems Engineering from University of California Davis (2004). He has served on the Mobile Water Lab team since May 2004 as the engineering technician. In 2004 he assisted on and administered more than 15 irrigation system evaluations including micro-drip, micro-spray, and furrow systems.

Cooperator: Colusa County Resource Conservation District

The mission of the Colusa County Resource Conservation District (CCRCD) is to assist local landowners to protect, conserve and restore their natural resources through information, education and access to technical assistance programs. The CCRCD is currently staffed by a District Manager and a Project Manager.

Since 1995 the CCRCD has received over $2 million in grants from a wide array of funding sources including CalFed/CBDA, Department of Conservation, Wildlife Conservation Board, California Department of Forestry and others. Project components have included streambank stabilization, stream health, sediment reduction, planting of native grasses, shrubs and trees, solar pump systems, range improvement and alternative water systems for cattle. As YCRCD does in Yolo County, the CCRCD has a close relationship with the Colusa office of NRCS with access to that agency's technical resources. The CCRCD recognizes its role within the larger Colusa Basin Watershed and works across the county's political boundaries with the Yolo and Glenn County Resource Conservation Districts, the Colusa Basin Drainage District, Glenn-Colusa Irrigation District, the Colusa Basin Sub-watershed Program (Coalition) and others.

Cooperator: Yolo County Flood Control & Water Conservation District

In 1951, at the request of the Yolo County Supervisors, the Yolo County Flood Control and Water Conservation District was created by the California Legislature as an independent Special District. The primary purpose of the District was to seek new water sources and manage them efficiently.

Initially, the District had no water rights and operated on a very small budget generated by property taxes. Today, the District manages two small hydroelectric plants, two reservoirs, more than 150 miles of canals and laterals, and three dams including the world's longest inflatable rubber dam.

The District's boundaries cover 195,000 acres of Yolo County, including the cities of Woodland, Davis and Winters, and the towns of Capay, Esparto, Madison and other small communities within the Capay Valley (see resume for Max Stevenson, Water Quality Associate in Appendix F).

Role of external cooperators: Reclamation District 108 and the Dunnigan Water District will provide logistical support in contacting agricultural producers within their districts and assist with system evaluation, reporting, education and outreach under the direction of YCRCD. Cooperating farms will allow access on their property, provide equipment as needed and participate in the final evaluation and analysis of the project's success.

Outreach, Community Involvement and Acceptance:

The positive farmer response and support from local water districts during the first year of operation, indicates this service is needed and desired by the local agricultural community. The Yolo/Colusa Mobile Water Lab received support from RD108, NRCS Woodland Field office, the Yolo County Flood Control and Water Conservation District and had 18 cooperating farmers in its first year of existence. Additionally, services of the Yolo/Colusa Mobile Water Lab have been requested by the Yolo-Solano Water Quality Coalition to assist area farmers in meeting the requirements of the Ag Waiver. Community involvement is evidenced by the attached letters of support (Appendix E). The potential reduction of management costs resulting from irrigation efficiency evaluations, acreage comparisons and nitrogen budget calculations lend an economic incentive for area growers to make use of the expanded services of the Mobile Water Lab.

Outreach (Proposal Objective 2) to growers will include mailers, word of mouth and articles for media. Outreach deliverables will include:

- Project sites used for field demonstrations.
- Individual farmer consultations by project staff.
- Project presentations to commodity groups each year.
- Articles in participating districts' newsletters.
- Printed educational materials to support the Mobile Water Lab's free technical service and recommended conservation practices.
- Project staff will participate in regional and state-wide ag water management conferences and meetings to share the results of the Mobile Water Lab efforts with other entities working on similar issues, to gain information and insight from the results and efforts of others' work on improving agricultural water use efficiency and leverage that information to enhance the project.

We will evaluate each outreach activity for efficacy and relevance to the target audience, ensuring effective, broad-scale distribution of information on local and watershed-wide water use efficiency management practices.

Potential third party impacts: none

Number of people/organizations to receive training, employment or social benefit: We estimate that at least 120 people will attend the trainings. A targeted minimum of 75 farmers will receive water evaluations during the three-year project.

Opposition to project: None

How information will be disseminated once it's finished: Documented results of the project will be publicized in local media and grower commodity publications. Reports, presentations to agricultural meeting sand industry conference and publication on the RCD website will facilitate dissemination of the final results.

Innovation

The Expanded Mobile Water Lab

While demand for irrigation evaluations is enhanced in other regions by high water prices and limited supplies, demand for the Yolo-Colusa lab focuses on water quality assessments associated with irrigation and winter runoff management and efficiency of water use. We anticipate the innovative techniques tested in this project (see Table 1a page 3 of this proposal) will become a model for future Mobile Water Labs throughout the state.

Because water evaluations will give growers information that will allow them to make irrigation and fertilizer applications with more precision, and water districts will have a better understanding of their slough/canal tail water return systems, the state will realize benefits of increased water flow and water quality. These new techniques were described in detail on page three.

Local waterway flow and quality characterization

As in other agriculturally-dominated regions of California, the lowland waterways of the Willow Slough Watershed serve farmers and the Yolo County Flood Control and Water Conservation District (YCFCWCD) both as irrigation delivery and drainage conveyance. While some of these channels include YCFCWCD turnouts and other structures, the management of these waterways and the diversions and tailwater influx are not fully managed. While this fairly informal system has likely allowed considerable reuse of the same waters (drained from one farm to be picked up by the next and drained and then picked up by another and drained, and so on) there are also significant irrigation season 'losses' at the bottom of the watershed where Willow Slough drains to the Yolo Bypass.

This situation presents considerable opportunity for water use efficiency improvement in terms of both quality and quantity of water effectively managed by farmers and 'delivered' to the Bypass and Delta for wildlife use. In cooperation with the YCFCWCD, we will systematically survey Mobile Lab client farmers regarding their slough water use and drainage practices in order to properly characterize the slough network and enable appropriate management changes for improved agricultural water use efficiency in the watershed. The survey would also elicit grower assessment of slough source water quality and any quality-related effects on their equipment or crops. This survey and the associated analysis process could be used as a model for other canal and slough systems that similarly lack characterization.

Program Costs and Benefits:

This program is estimated to cost $414,085 over a three-year period. While match is not required for this funding, we anticipate matching contributions of $58,320 from partner organizations and other funding sources (see table below).

Program Matching Expenses

Item	Match
Personnel	
Lab Intern	$30,000
YCFCWCD Staff	$18,720
Farmer cooperators	$3,600
Equipment and Supplies	
Office expenses	$6,000
Total Match	$58,320

Explanation of Direct Costs

YCRCD Personnel contributing directly to project (all receive 30% fringe benefits—unemployment insurance, health, retirement, workers comp, etc.—and annual cost of living and merit increases based on performance):

- Mobile Water Lab Manager: 0.5 FTE at average pay rate of $24.65
- Engineering Technician: 0.5 FTE at average pay of $19.30/ hour
- Program Administrator: 0.1 FTE at avg. pay of $24/ hour
- Exec. Director: 0.1 FTE at avg. pay of $36/ hour
- Administrative Assistant: 0.1 FTE at avg. pay of $18/ hour

Personnel line total: $190,579+ $57,174 benefits total for three years

Field Supplies: This category includes incidental small tools and supplies needed for monitoring and evaluations through the term of the grant-funded program. These will include disposable and specialty sampling supplies, reagents for the colorimeter, tool repairs and replacement parts.

Field supplies line total: $9,000

Office Expenses: This category includes cell phone; printing and mailing expenses; software and memory; computer maintenance; and small office supplies for in-office data management, analysis, workshops, outreach communications, and project management.

Office expenses line total: $10,500

Equipment Maintenance and Use: This category includes System evaluation vehicle and equipment use, maintenance and fuel costs. All equipment (ATV and automated samplers) is already acquired.

Equipment maintenance and use line total: $7,560

Consulting Services:

- Colusa County Resource Conservation District staff direction of Colusa County system evaluations, outreach and program guidance: 1200 hours = $57,000
- Certified Lab analysis as needed: $15,000
- Macias, Gini & Co. Independent Project Financial Review: $1,500

Consulting services line total: $73,500

Travel: This includes vehicle use, maintenance and fuel costs for the Mobile Water Lab truck (F-350 already on-hand) and personal vehicle use reimbursement at $0.405/mile for travel to farm sites, meetings, and special events.

Travel line item total: $21,348

Indirect Costs

Program overhead is estimated at a standard rate of 15% applied to YCRCD program expenses excluding Professional Services: $44,424

Potential benefits

In sum, the potential benefits of the proposed work as described within the above proposal include:

- A minimum of 75 farms to receive farm irrigation water management evaluations
- An average of 15% (potentially as high as 30%) water savings on farms implementing evaluation recommendations resulting in farmer cost savings and increased water available for other beneficial uses. Based on experience, this should apply to at least 30% of the sites evaluated.
- 30% average sediment concentration reductions in runoff from growers implementing changes on farms with identified sediment movement concerns.
- A minimum of 120 individuals to receive direct training in improved irrigation water management techniques.
- Educational materials distributed to members of RCD and water district mailing lists in Yolo and Colusa counties, an aggregated total of over 1,000 individuals
- A carefully scrutinized model for expanded Mobile Water Labs that would be extendable to other regions of California.

List of Appendices

Appendix C

Applicant:

THE TABLES ARE FORMATTED WITH FORMULAS: FILL IN THE SHADED AREAS ONLY

Section A projects must complete Life of investment, column VII and Capital Recovery Factor Column VIII. Do not use 0.

Table C-1: Project Costs (Budget) in Dollars)

	Category (I)	Project Costs $ (II)	Contingency % (ex. 5 or 10) (III)	Project Cost + Contingency $ (IV)	Applicant Share $ (V)	State Share Grant $ (VI)	Life of investment (years) (VII	Capital Recovery Factor (VIII)	Annualized Costs $ (IX)
	Project Costs								
	Salaries, wages	$220,579	0	$220,579	$30,000	$190,579			$0
	Fringe benefits	$57,174	0	$57,174	$0	$57,174			$0
	Field Supplies	$9,000	0	$9,000	$0	$9,000			$0
	Office Supplies	$16,500	0	$16,500	$6,000	$10,500			
	Equipment maintenance and use	$7,560	0	$7,560	$0	$7,560			$0
	Consulting services	$95,820	0	$95,820	$22,320	$73,500			$0
	Travel	$21,348	0	$21,348	$0	$21,348			$0
	Other (Overhead)	$44,424	0	$44,424	$0	$44,424			$0
(a)	Total Program Costs*	$472,405		$472,405	$58,320	$414,085			$0
(b)		$0	0	$0	$0	$0			$0
(c)	* includes Monitoring and Assessment and report preparation	$0	0	$0	$0	$0			$0
(m)		$0	0	$0	$0	$0			$0
(n)	**TOTAL**	$472,405		$472,405	$58,320	$414,085			$0
(o)	Cost Share -Percentage				12	88			

1- excludes administration O&M.

Applicant:

THE TABLES ARE FORMATTED WITH FORMULAS: FILL IN THE SHADED AREAS ONLY

Section A projects must complete Life of investment, column VII and Capital Recovery Factor Column VIII. Do not use 0.

Table C-1: Annual Project Costs (not including match)

	Category (I)	Year 1	Year 2	Year3	Total
	Project Costs				
	Salaries, wages	$59,280	63429.6	$67,870	$190,579
	Fringe benefits	$17,784	19028.88	$20,361	$57,174
	Field Supplies	$5,000	2000	$2,000	$9,000
	Office Supplies	$4,500	3000	$3,000	$10,500
	Equipment maintenance and use	$2,520	2520	$2,520	$7,560
	Consulting services	$23,500	24500	$25,500	$73,500
	Travel	$7,116	7116	$7,116	$21,348
	Other (Overhead)	$14,430	14564.172	$15,430	$44,424
(a)	Total Program Costs*	$134,130	$136,159	$143,797	$414,085
(b)					$0
(c)	* includes Monitoring and Assessment and report preparation				$0
(m)					$0
(n)	**TOTAL**	**$134,130**	**$136,159**	**$143,797**	**$414,085**
(o)	Cost Share -Percentage				$0

1- excludes administration O&M.

Applicant: **Yolo County Resource Conservation District**

THE TABLES ARE FORMATTED WITH FORMULAS: FILL IN THE SHADED AREAS ONLY

Table C-5 Project Annual Physical Benefits (Quantitative and Qualitative Description of Benefits)

	Qualitative Description - Required of all applicants[1]				**Quantitative Benefits - where data are available [2]**
	Description of physical benefits (in-stream flow and timing, water quantity and water quality) for:	Time pattern and Location of Benefit	Project Life: Duration of Benefits	State Why Project Bay Delta benefit is Direct[3] Indirect [4] or Both	Quantified Benefits (in-stream flow and timing, water quantity and water quality)
Bay Delta	Increasing irrigation efficiency will reduce water use and reduce runoff. The reduced runoff will increase the water quality in the Bay Delta System by lowering sediment and nutrients entering the sloughs and creeks that feed into the System.	Benefits will commence once recommended irrigation management practices are adopted by growers following evaluations. The benefits will affect the Bay Delta via the Sacramento River.	Irrigation management changes are indefinite, while sediment traps and tailwater return systems may have a lifespan of 20 yrs and vegitated ditches may last 10 to 20 yrs.	The project will have direct water quality and quantity benefits during its life including specific TB's 20, 24, 25, 26. It will also have indirect benefits through the long term use of sediment traps which will decrease sediment and nutrient levels in the system, and tailwater return systems which will reduce the amount of water drawn from the system.	Decreased volume of excess water used for irrigation by up to 15% (Table1c). A decrease of sediment and nutrient concentrations due to traps and ponds can also be measured.
Local	A reduction in irrigation runoff through tailwater return systems will benefit groundwater recharge in the area. Also an increase in efficiency will help with the conservation of water and resources for the area, and possibly save the growers money.	Benefits will commence once recommended irrigation management practices are adopted by growers following evaluations.	Irrigation management changes are indefinite, while sediment traps and tailwater return systems may have a lifespan of 20 yrs and vegetated ditches may last 10 to 20 yrs.	**Not applicable.**	Decreased volume of excess water used for irrigation by up to 15% (Table1c). A decrease of sediment and nutrient concentrations due to traps and ponds can also be measured.

[1] The qualitative benefits should be provided in a narrative description. Use additional sheet.

[2] Direct benefits are project outcomes that contribute to a CALFED objective within the Bay-Delta system during the life of the project.

[3] Indirect benefits are project outcomes that help to reduce dependency on the Bay-Delta system. Indirect benefits may be realized over time.

[4] The project benefits that can be quantified (i.e. volume of water saved or mass of constituents reduced) should be provided.

Appendix D

Table 1b	Acreage Comparisons from 2004 Yolo-Colusa			
	Mobile Water Lab site visits			
		Acreage		%
Evaluation	Date	Estimated	Actual	Difference
(names Removed)	7/27/2004	65	60.8	6.91
	10/14/2004	63	59	6.78
	7/14/2004	50	49.2	1.63
	6/30/2004	60	55.9	7.33
	7/21/2004	25	24.6	1.63
	8/17/2004	31.5	31.25	0.80
	8/4/2004	72	72	0.00
	9/2/2004	85	82.5	3.03
Average				3.51 over

Table 1c	Water application comparison			
		Water Usage (units vary)		%
Evaluation	Date	Applied (Flowmeter)	Needed (CIMIS)	Difference
(names Removed)	10/14/2004	2.146	1.174	82.79
	7/14/2004	11.5	9.1	26.37
	6/30/2004	0.37	0.324	14.20
	7/21/2004	2.95	2.73	8.06
	8/4/2004	2.062	1.768	16.63
	9/2/2004	1.795	1.286	39.58
Average				31.27

Table 1d	Comparison of Flowrates from pump flowmeter			
	catch-can calcs and emmitter specs			
		Flowrates (gpm)		
Evaluation	Date	Pump Flowmeter	Measured at Emmitters	Emmiter Specifications
(names removed)	7/1/2004	n/a	306	441
	10/14/2004	1592	1493	1947
	6/30/2004	483	469	579
	7/21/2004	n/a	779	860
	7/30/2004	576	559	476
	8/17/2004	389	389	347
	8/4/2004	800	728	686
	9/2/2004	1437	984	971

Appendix E

BV Farms
201 W. Southwood Dr.
Woodland, CA
95695

I have farmed in Yolo and Colusa Counties for the past 30 plus years and am writing you today in support of the Yolo/Colusa Mobile Water Lab proposal for extension and expansion of the mobile lab services as submitted to the SWRCB Water Efficiency Solicitation Proposal. I used the services of the lab last year for water analysis and will continue to utilize their services in the future for water sampling, irrigation system efficiencies and uniformities. Their services have saved me considerable money.

I am presently working with the Yolo County RCD on a vineyard tailwater pond, hedgerow planting and erosion control with filter strips and cover cropping. These practices are new to me but through the guidance and leadership of the RCD I will minimize runoff and improve the water quality flowing into the Colusa Basin Drain. The Mobile Water Lab helped me and other growers achieve these important water quality and saving measures that need to be expanded throughout the county and state.

The Yolo County RCD is on the cutting edge of water conservation, monitoring and farming practices to improve water quality through cover cropping, tailwater ponds and sediment trapping.

The proposed Mobile Water Lab program will serve cooperating growers in the Yolo/Colusa watersheds, which both contribute directly and indirectly to the California Bay Delta. Every acre in the drainage system that can be subjected to water quality improvement will enhance the flow into the Bay and the quality of drainage system upstream.

Based on their prior successes, the work proposed by the YCRCD and its partner will be a critical and beneficial service to the area farmers, and could serve as a model for other Mobile Water Labs as they strive to assist agricultural water users throughout the state. Please give this proposal your highest consideration.

Sincerely,

Blair Voelz

Andrew Scofield
Grower / Manager

P.O. BOX 329 • DUNNIGAN, CA 95937 • 530-724-3376 • 530-476-2331 SHOP

To Whom It May Concern:

I have farmed in Yolo and Colusa counties for the past 30 plus years and am writing you today in support of the Yolo/Colusa Mobile Water Lab proposal for extension and expansion of the Mobile Water Lab, as submitted to the SWRCB Water Efficiency Solicitation Proposal. I used the services of the lab last year for water analysis and will continue to utilize their services in the future for water sampling, irrigation system efficiencies and uniformities. Their services have saved me considerable money.

Through the guidance and leadership of the RCD I will minimize runoff and improve the water quality flowing into the Colusa Basin Drain. The Mobile Water Lab helped me and other growers achieve these important water quality and saving measures that need to be expanded throughout the county and state.

The Yolo County RCD is on the cutting edge of water conservation, monitoring and farming practices to improve water quality through cover cropping, tailwater ponds and sediment trapping.

The proposed Mobile Water Lab program will serve cooperating growers in the Yolo/Colusa watersheds, which both contribute directly and indirectly to the California Bay Delta. Every acre in the drainage system that can be subjected to water quality improvement will enhance the flow in the Bay and the quailty of the drainage system upstream.

Based on their prior successes, the work proposed by the YCRCD and its partner will be a critical and benefiical service to the area famers and could serve as a model for other Mobile Water Labs as they strive to assist agricultural water users throughout the state. Please give this proposal your highest consideration.

Sincerely,

Andrew B. Scofield

Gilbert Ramos
6766 Harrington Ave.
Arbuckle, CA 95912

January 6, 2005

To Whom it May Concern:

I have farmed in Colusa county for the past 35 years and am writing you today in support of the Yolo/Colusa Mobile Water Lab proposal for extension and expansion of the Mobile Water Lab, as submitted to the SWRCB Water Solicitation Proposal. I used the services of the lab last year for an irrigation system efficiency evaluation. It saved me time and money as it showed exactly where to make improvements.

Through the quidance and leadership of the RCD I will minimize runoff improve the water quality flowing into the Colusa Basin Drain. The lab helped me and other growers achieve these important water quality and saving measures that need to be expanded throughout the state.

The Yolo county RCD is working very hard to improve water quality through cover cropping, tail water ponds and sediment traps.

The proposed Mobile Water Lab program will serve cooperating growers in the Yolo/ Colusa watersheds, which both contribute directly and indirectly to the California Bay Delta. Every acre in the drainage system that can be improved will enhance the quality of the water in the bay.

Based on their prior successes, the work proposed by the YCRCD and its partner will be a critical and beneficial service to the area farmers and could serve as a model for other Mobile Water Labs to assist agriculture water users throughout the state. Please give this proposal your highest consideration.

Sincerely,

Gilbert Ramos

DUNNIGAN WATER DISTRICT
P.O. BOX 84
DUNNIGAN, CALIFORNIA 95937
TELEPHONE (530) 724-3271
FAX: (530) 724-3273

BOARD OF DIRECTORS
William L. Cotter
Tom Mumma
Pat McAravy
Garreth B. Schaad
Tim Doherty

SECRETARY/MANAGER
Donita Hendrix

January 10, 2005

California Department of Water Resources
Office of Water Use Efficiency
P.O. Box 942836
Sacramento, CA 94236-001

To Whom It May Concern:

The Yolo County Resource Conservation District (YCRCD) has taken a significant and very positive step in addressing water quality by establishing and operating the Yolo/Colusa Mobile Water Lab. The Mobile Water Lab has done work with the Dunnigan Water District and we support and commend its efforts with this innovative program.

The Dunnigan Water District acknowledges the value of cooperation between multiple stakeholders to address issues in watersheds that have boundaries overlapping district jurisdictions and understands the need to work together on watershed-wide solutions.

The Dunnigan Water District will continue to provide logistical support in contacting agricultural producers within our District. The District can also assist with system evaluation, reporting, education and outreach within Yolo and Colusa Counties under the direction of YCRCD.

Please give this application your highest consideration.

Sincerely,

Donita Hendrix

Donita Hendrix
Secretary/Manager
Dunnigan Water District

RECLAMATION
DISTRICT
108

975 Wilson Bend Road
P. O. Box 50
Grimes, CA 95950-0050
(530) 437-2221
Fax: (530) 437-2248

January 7, 2005

California Department of Water Resources
Office of Water Use Efficiency
P.O. Box 942836
Sacramento, CA 94236-001

To Whom It May Concern:

The Yolo County Resource Conservation District (YCRCD) has taken a significant and very positive step in addressing water quality by establishing and operating the Yolo/Colusa Mobile Water Lab. RD108 contributed to the development of the Lab and we commend YCRCD for its efforts through this innovative program.

RD108 acknowledges the value of cooperation between multiple stakeholders to address issues in watersheds that have boundaries overlapping district jurisdictions and understands the need to work together on watershed-wide solutions.

RD108 will continue to provide this program with logistical support in contacting agricultural producers within our District. RD108 will also assist with system evaluation, reporting, education and outreach within Yolo and Colusa Counties under the direction of the YCRCD.

Please give this application your highest consideration.

Very truly yours,

Luther P. Hintz

Luther P. Hintz
General Manager

Colusa County
RESOURCE CONSERVATION DISTRICT
100 Sunrise Blvd., Suite B, Colusa, CA 95932
Phone: (530) 458-5131 Ext. 3 • Fax: (530) 458-3683 • colusarcd@hotmail.com

January 5, 2005

California Department of Water Resources
Office of Water Use Efficiency
P.O. Box 942836
Sacramento, CA 94236-001

Dear Sir or Madam,

The Colusa County Resource Conservation District (CCRCD) is proud to continue their partnership with the Yolo County Resource Conservation District's (YCRCD) endeavors to address water quality utilizing the Yolo/Colusa Mobile Water Lab. The CCRCD fully supports the YCRCD's water use efficiency proposal submitted to the California Department of Water Resources. The CCRCD acknowledges the value of cooperation between multiple stakeholders to address issues in watersheds that have boundaries overlapping district jurisdictions.

Specifically the CCRCD will provide this project with facilitation and logistical support for contacting agricultural producers within our District. The CCRCD will also assist with system evaluation, reporting, education and outreach within our county, under the direction of the YCRCD.

The CCRCD will offer any other available support to the program to enhance a positive outcome and impact on our watersheds and communities as a whole.

Sincerely,

Chris O'Sullivan-Vice President
Colusa County RCD

Effective water resource management

YOLO COUNTY

FLOOD CONTROL & WATER CONSERVATION DISTRICT

January 10, 2004

RE: Support for Yolo County Resource Conservation District's Yolo/Colusa Mobile Water Lab Proposal

Dear Proposition 50 WUE Proposal Selection Committee:

We would like to express our support for the proposed Yolo/Colusa Mobile Water Lab.

The Yolo County Resource Conservation District has taken a significant and very positive step in addressing water use efficiency and water quality by establishing and operating the Yolo/Colusa Mobile Water Lab.

Yolo County Flood Control and Water conservation District commends YCRCD for its efforts through this innovative program and is committed to supporting expansion of the project to incorporate practices that go beyond distribution uniformity and support farmers' efforts to improve water use efficiency and water quality.

YCFCWCD acknowledges the RCD's efforts will expand our understanding of the overall slough/canal system while working with our water users to adopt best management practices that result in water use efficiency.

YCFCWCD will work with YCRCD to conduct surveys of landowners along the Willow Slough in an effort to characterize the flow and collect data that will guide decisions on future water distribution and use. We will continue to provide logistical support in contacting agricultural producers and assist with system evaluation, reporting, education and outreach within Yolo County, under the direction of RCD.

Please give this application your highest consideration.

Sincerely,

Max Stevenson
Water Resources Associate

34274 State Highway 16
Woodland, CA 95695-9371
(530) 662-0265
FAX (530) 662-4982

Tim O'Halloran
General Manager

Appendix F

Paul Robins

Yolo County Resource Conservation District

221 W. Court St. #1
Woodland, CA 95695
(530) 662-2037, ext. 116
Email: robins@yolorcd.org

Education

MS, *Community Development*, UC Davis, 1995
BS, *Landscape Architecture*, UC Davis, 1995
BS, *International Agricultural Development*, UC Davis, 1987

Experience

Executive Director, *Yolo County RCD*
November 2000 - present

Program Manager, *Yolo County RCD*
Model Farms Project, 1995 – 2000
RD 108 Levee Revegetation & Bank Stabilization Project, 1998 – 2000
CALFED Water Use Efficiency Pilot Program, 2000 - 2001

Research Assistant, *Department of Environmental Design, UC Davis*, 1992 -1995.
Putah-Cache Creeks Watershed Bioregion Project, 1994 - 95.
Family Community Leadership, 1993 - 94.
Rural Urban Edges Research Project, 1992.

Retail Nurseryman, *Davis, CA.,* 1990 - 1993.

Research Assistant & English Instructor, Department of Entomology, Research Institute of Pomology and Floriculture, Skierniewice, Poland. 1988 - 1989.

Publications

Miyao, Gene and Robins, Paul. "Fall Planted Cover Crops May Improve Yields." *Vegetable Grower*, September 1999.

Robins, Paul, editor. *Bring Farm Edges Back to Life! A Conservation Handbook for Landowners.* Yolo County Resource Conservation District. 1997, 1998, 1999, 2000.

Robins, Paul, et. al. "Managing and Analyzing Quality of Year-Round Runoff from Annual Cropping Systems in California." US Council on Irrigation and Drainage Conference Proceedings, 2002.

Instruction Experience

"Farmscape Architecture," 10-week UC Davis Landscape Architecture (LDA 191) studio, winter 2004.

"Bring Farm Edges Back to Life" Field Meetings on diverse conservation techniques. Directed towards farmers and land managers. Approximately four meetings/year. 1997-present.

Various (4-5) 'lunchbag' lectures for UCD Landscape Architecture courses between 1995-2003.

Teaching Assistance and Readerships for: History of Landscape Architecture, Introduction to Landscape Architecture, Landscape Ecology, and other courses. 1992-95.

Kyle Wooldridge
432 E Street Unit B.
Davis, Ca 95616
(530) 220-6580

Education

-1998-1999: Bioresource and Agricultural Engineering
California Polytechnic State University, San Luis Obispo

-2001-2004: Bachelor of Science in Biological Systems Engineering (Expected graduation June 2004)
University of California Davis, Davis, CA

-2004: California State University Sacramento Office of Water Programs

Major Courses

Water Sources and Treatment - Small Water Systems Operation and Maintenance
Properties of Materials in Biological Systems
Heat and Mass Transfer in Biological Systems
Modeling of Dynamic Processes in Biological Systems
Engineering Design and Professional Responsibilities
Unit Operations in Biological and Food Engineering

Related Courses

Electric Circuits and Systems
Introduction to Programming and Problem Solving
Business Reports and Technical Communication
Organic Chemistry for Health and Life Sciences

Experience

Yolo County Resource Conservation District (May 2004 – current)

Professional Skills

Mobile Water Lab: agricultural irrigation system evaluations

Lower Union School Slough Watershed Improvement Program: water quality sampling and data analysis

Computer Skills

Proficient in Microsoft Excel, Word, PowerPoint, and programming in C, Visual Basic, and Matlab

Additional Skills

Four Time NCAA All-American in Swimming, also played soccer; Two years participation in 4-H

References

References Available upon request.

Max Stevenson

Water Resources Associate
Yolo County Flood Control and Water Conservation District
34274 State Hwy 16
Woodland, CA 95695
530-662-0265

http://www.geocities.com/maxstevenson2001/maxcv.html

Skills

Water quality, flow, and ecological monitoring data analysis

Flow measurement and rating curve development. Hydrologic modeling with HEC-RAS. Hydrologic analysis for the SF Bay-Delta, San Joaquin and Sacramento River basins, toxic and conventional pollution monitoring, population biology monitoring design and tracking (fish, birds, inverts), urban land development pressure assessment, habitat restoration monitoring, irrigation monitoring and planning

Reports and grant writing

Legislative progress reports, annual project reports, annual monitoring reports. Grant proposals totaling $950,000+ and reports for over $2,500,000 in projects.

Computers and data management

Advanced statistics (summary, parametric and non-parametric, SAS programming), economic analysis (modified break-even), web design, simulation modeling, large scale data management, survey design and analysis (in-person, phone, mail), automated data collection (data logger expertise), computer skills training implementation, spreadsheet calculation tool development (user testing, refinement, instructional material development)

Education

Ph.D., Plant Biology, UC Davis. 1998.

B.A., Applied Ecology, UC Irvine. 1991.

Curso de Orientacion a la Universidad (COU), Spain 1985-86.

Publications

A list of 25 publications is available on my Web Based Resume at
http://www.geocities.com/maxstevenson2001/maxcv.html

Max Stevenson, PhD

Work Experience

Position	Dates
Water Resources Associate Manage a countywide groundwater monitoring program. Manage flow measurement component of system wide canal modernization.	October 2004 to present
Hydrologist Develop and implement a water quality monitoring program and water efficiency mobile laboratory. Create rating curves to measure flow at 12 sites.	July 2003 to October 2004
Staff Scientist Develop aquatic ecosystem health indicators	Jan. 2002 to May 2003
BIFS Coordinator Administration and technical support. Multi-million dollar budget.	Oct. 1999 -May 2001
BIOS Staff Scientist Technical support and data management of a watershed protection program spanning seven counties.	Dec. 1997-Oct. 1999
Assistant Pest Monitoring Information Coordinator Analyze data and write newsletter articles.	Aug. 1997 -Dec. 1997
Researcher and PhD student Award winning plant eco-physiology and irrigation research.	1994- 1997
Teaching assistant Biology and lab courses, 11 quarters UC Davis	1991-1995
Research Assistant – Fish and Bird Sample Analysis UC Irvine Dept. of Ecology and Evolutionary Biology	1987- 1991
Biological Aid/ Field Technician Bird population monitoring in Alaska. USFWS	1989-1991 (summers)
Costa Rica Tropical Biology "A Quarter of Tropical Biology" Student UC EAP	April- June 1990
Field Assistant Alaskan bird behavioral ecology and energetics. UC Irvine.	July 1987 & July 1988
Freshwater Marsh Monitoring Water quality and mosquitoes. UC Irvine	Oct. 1986 - May 1987

Appendix G

Nitrogen Budgeting Worksheet *for Almond & Walnut Orchards*

I. Background Information

A nitrogen budget accounts for all N inputs and outputs on the farm. Mostly, N is removed from the farm in the crop and comes back in the form of compost, irrigation water, cover crop, and fertilizer.

Nitrogen deficiency is rare in California orchards

In well managed orchards nitrogen deficiency is rare. Most farmers apply plenty of nitrogen fertilizer. Many farmers also have the opportunity to reduce costs, keep good yields, and increase tree health by reducing application rates of N fertilizer.

Post harvest applications of N are not used by the tree

In university experiments with deciduous nut trees, labeled N applied post harvest was not absorbed by the tree. Even the following spring, N applied the previous fall was gone and no N could be found in the tree's wood, roots, leaves, or nuts. Labeled N applied in spring and summer was found in the tree.

Every orchard is different in its nitrogen requirements

Some scientific studies in walnuts and pistachios have shown that even after five years without any applied fertilizer (0 lbs. N/acre), there was no difference in yield from trees fertilized up to 320 lbs. N/acre. However, this does not mean that fertilization can be skipped for 5 years in your orchard, although it is possible in some cases. Trees always need nitrogen every year, but trees can get nitrogen from other sources besides annually applied chemical fertilizer. These alternative sources of N include nitrate in well water, legume cover crops, composts, manures and natural soil fertility.

Table 1. If leaf N is in the low range, increase fertilizer rates. If leaf N is in the high range, decrease fertilizer application rates.

Crop	Low leaf N %	High Leaf N %
Walnuts	<2.3%	>2.7%
Almonds	<2.2%	>2.5%

Sources: *Walnut Production Manual,* p. 200. *Almond Production Manual,* p. 193.

As an extreme example, some BIOS growers have not applied any chemical nitrogen fertilizer for many years, yet still have good leaf tissue N levels and great yields. Their trees are receiving nitrogen from the well water (in some cases over 100 lbs. N/acre), a legume cover crop, a fertile soil with high organic matter content, and sometimes a small amount of additional applied compost.

In most orchards, applied chemical fertilizer will still be needed, but often at a reduced rate. Leaf tissue analysis and a nitrogen budget are two methods to scientifically determine the optimal rate of fertilizer application.

Leaf Tissue Analysis

Leaf tissue analysis, from leaf samples collected in July, can be used to guide nitrogen fertilizer decisions. Table 1 below gives guidelines for increasing or decreasing nitrogen fertilizer rates based of leaf tissue N concentration. Out of 50 walnut and almond BIOS orchards that submitted leaf samples in 1998, only one (2%) was in the low range, yet one half (50%) of the 1998 samples were in the high range. Fertilizer rates can be safely reduced when leaf N is in the high range.

The best information from leaf tissue analysis is gained when samples are collected at the same time in the growing season, year after year. If the trend is a higher and higher leaf tissue N, then fertilizer rates can be reduced. When deciding how much to reduce or increase the N fertilization rate, a nitrogen budget is helpful (see next section).

It is impossible for a single range of leaf tissue N values to be accurate for all of California. In some areas of California, walnut leaf N will never go above 2.3%, even when hundreds of pounds of excess fertilizer are applied! So even if leaf analysis shows N in the good range, in some cases the trees may still be receiving excessive amounts of fertilizer. A nitrogen budget is helpful in this case because actual tree nitrogen needs can be estimated.

Trust your leaf sample results. If your leaves are in the high range, reduce the amount of applied nitrogen fertilizer by the amount indicated from your nitrogen budget.

II. Instructions for Worksheet

Get the necessary papers together: yield data for the past few years, irrigation records, well water analysis and soil analysis reports. A calculator will be helpful.

Line 1. Fruit or nut nitrogen removal. Write down the average yield in tons per acre on the first blank space. Almonds are kernal weight at 5% moisture, walnuts are in-shell at 8% moisture. In the second blank space write 100 for almonds or 36 for walnuts. Multiply. This is the number of lbs. of nitrogen removed each year in the crop.

Line 2. Annual accumulation of N in the tree structure. Select the appropriate value.

Line 3. Total lbs. N used by the tree each year. Add lines 1 and 2. Write your answer on line 3.

Line 4. Pounds N from irrigation water. The concentration of N in irrigation water can be reported with two different units: NO_3-N ppm or NO_3 ppm (mg/l is the same as ppm). Be sure to use the correct units!

Line 5. Native soil fertility from organic matter. Write the percent soil organic matter of your soil on the first blank space. Multiply by 20 to obtain lbs./acre of N released. This is only an approximation. The actual N released from organic matter depends on climatic factors, soil pH, type of material undergoing decomposition, and other factors.

Line 6. Native soil fertility from soil texture. Select the appropriate value.

Line 7. Total lbs. N supplied by soil and irrigation water. Add lines 4, 5, and 6. Write the total on line 7.

Line 8. Manure Write the tons per acre of manure applied on the first blank space. In the second blank space, use Table 2 to decide how many lbs. N per ton of manure is supplied. Write that number in the second blank space. Multiply these two numbers and write your answer on line 8.

Table 2. Nitrogen release from selected types of animal manure.

	Pounds of N released / ton of manure			
Type of manure	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Chicken manure, 1.6% N	29	0.3	0.2	0.1
Fresh bovine waste, 3.5% N	52	2.6	1.5	1.0
Dry corral manure, 2.5% N	20	7.5	1.4	0.6
Dry corral manure, 1.5% N	10	3.0	1.7	1.2
Dry corral manure, 1.0% N	4	1.6	1.1	0.7
Liquid sludge, 2.5% N	18	3.2	1.7	1.4

Line 9. Compost Write the tons per acre of compost applied in the first blank space. Write the percent N on the second blank space. Using Table 3, select the first year release rate and write that number on the third blank line. Multiply these three numbers by 20. This is the lbs. N supplied by compost. Write the answer on line 9.

Line 10. Legume cover crops. Choose the best description of your cover crop and write the lbs. of nitrogen on the first blank line. On the second blank line write 0.5 for mowing or 0.7 for discing . Multiply these two numbers. Write the answer on line 10.

Table 3. First year release rate for composts

Fresh, incorporated	0.6
Fresh, unincorporated	0.3
Medium	0.4
Well composted	0.2

Line 11. Total amount of available N from non-fertilizer resources. Sum lines 7, 8, 9, and 10 together. Multiply this sum by the uptake efficiency factor of 0.67. Write the answer on line 11.

Line 12. Tree N needs. To determine the N needs of the tree beyond that supplied by non-fertilizer sources, subtract line 11 from line 3. Write the answer on line 12. If this number is negative, the trees probably do not need any additional source of nitrogen (no N fertilizer is needed this year).

Line 13. Fertilizer application rate. Multiply line 12 times the appropriate uptake efficiency factor on the worksheet. Write the answer on line 13. This is your estimated fertilization rate. Don't be surprised if the fertilizer rate seems low. Many orchards just don't need much additional fertilizer.

Disclaimer: *Although based on sound scientific principles, calculating a nitrogen budget involves some assumptions and "best guesses" by experts in the field of plant mineral nutrition. Even leaf tissue guidelines are often based on limited data. Therefore, the guidelines presented here are just that, guidelines to help decide how much to reduce fertilizer application rates. Every orchard is different and careful, personal, experimentation in your orchard is the only way to determine optimal fertilization rates without over fertilization.*

Nitrogen Budgeting Worksheet *for Almond & Walnut Orchards*

Name Date

Crop Block ID

Nitrogen used by trees

1 Fruit or nut removal (average over 2 or 3 years).

_____ (yield in tons/acre) X _____ (100 lbs. N/ton yield of almonds; 36 lbs. N/ton yield of walnuts)

1 _____ lbs. N/acre lost in crop

2 Annual accumulation in tree structure (after prunning).

Low vigor = 10 lbs. N/acre

Moderate = 15-20 lbs. N/acre

High vigor = 25 lbs. N/acre

2 _____ lbs. N/acre used in growth

3 Add lines 1 and 2, write the answer on line 3.

This is the estimated N used by the trees each year.

3 _____ lbs. N/acre used per year

Nitrogen contributions from non-fertilizer sources

4 Irrigation water (if units are in NO_3-N ppm use the first line, if units are in NO_3 ppm use the second line — not both).

_____ (NO_3-N ppm or mg/l) X _____ (Water applied in feet) X 2.7 =

OR

_____ (NO_3-N ppm or mg/l) X _____ (Water applied in feet) X 0.614 =

Fill in only on line:

4a _____ lbs. N/acre from nitrate-N in H_2O

4b _____ lbs. N/acre from nitrate in H_2O

5 Native soil fertility.

_____ (Soil Organic Matter) % X 20

5 _____ lbs. N/acre from organic matter

6 If your soil is clay loam, put 50 on line 6.

If your soil is silt loam, put 40 on line 6.

If your soil is sandy loam, put 30 on line 6.

6 _____ lbs. N/acre

7 Add lines 4, 5, and 6. This is our estimated total pounds N supplied by soil and irrigation water.

7 _____ lbs. N/acre from soil and water

Nitrogen Budgeting Worksheet *for Almond & Walnut Orchards*

Nitrogen contributions from manure & compost

8 Manure. (*If you do not apply manure, skip to line 9.*)

_____ (tons/acre) X _____ (lbs. N released/ton of manure)

8 _____ lbs. N/acre from manure

9 Compost. (*If you do not apply compost, skip to line 10. Compost tons is in **dry weight!***)

_____ (tons/acre dry) X _____ (percent N in compost) % X _____ (first year release rate) X 20

9 _____ lbs. N/acre from compost

Nitrogen contributions from legume cover crips

10 Legume cover crops

_____ (lbs. N/acre in cover crop) X _____ (for mow only: 0.5; for discing in: 0.7)

Cover crop lbs./acre N (assuming 75% floor planted)

Poor crop	Good crop	Great crop	Weeds	Summer grass
30	70	120	0	-30

10 _____ lbs. N/acre from cover crop

All available nitrogen

11 Total nitrogen available from all non-fertilizer sources. Add lines 7, 8, 9 and 10. Then multiply this sum times 0.67 and write the answer on line 11.

11 _____ lbs N/acre

Additional nitrogen needs

12 Additional tree N needs.

To figure how much additional nitrogen is needed by your trees, subtact line 11 from line 3. Write the answer on line 12. If the answer is negative, no fertilizer is needed.

12 _____ lbs. N/acre needed by trees

Nitrogen fertilizer application rate

13 Fertilizer aplication rate.

_____ (Line 12) X _____ (Uptake efficiency)

Fertilizer uptake efficiency

Low (single application)	Medium (split applications)	High (fertigation)
3	2	1.5

13 _____ lbs. N/acre fertilizer rate

Nitrogen Budgeting Worksheet *for Almond & Walnut Orchards*

Congratulations! You have just completed a N budget for your orchard. If you think your calculated fertilizer recommendation is too high or too low, here are some things to check:

- Did you use the correct units for yield, tons/acre not lbs./acre?
- Do you have well water with a lot of nitrate? In some orchards well water can supply ALL of the trees' needs.
- If line 12 was negative, that means all N needs are supplied by sources other than fertilizer. You probably do not need to apply any fertilizer this year, especially if your leaf tissue is in the high range.
- Did you use the correct units of N in the water (NO_3 ppm or NO_3-N ppm)?
- Does you orchard currently have high vigor that requires a lot of pruning? High vigor can use nitrogen that really isn't needed by the tree.
- What are your leaf tissue samples like, are they high or low, and how do they compare to your N budget?

If July leaf N is in the low range, increase fertilizer rates. If leaf N is in the high range, decrease fertilizer application rates.

This Nitrogen Budgeting Worksheet was developed in March, 1999 by Max Stevenson, BIOS Staff Scientist.

Many thanks to the farmers, farm advisors, UC researchers, the Fertilizer Research and Education Program of CDFA, BIOS Management Team members, and Certified Crop Consultants who have assisted in developing the BIOS Nitrogen Budgeting Worksheet.

Appendix H

DRIP/MICRO EVALUATION EQUIPMENT LIST

SURVEY EQUIPMENT

1 - Hand level
1 - 100 ft plastic tape

PRESSURE MEASURING EQUIPMENT

2 - Oil filled pressure gauges, 0-60 psi
1 - Oil filled pressure gauge, 0-100 psi
1 - Air chuck
2 - Pitot tubes
1 - Hole punch for hose (extras advisable)

PRESSURE TAP INSTALLATION EQUIPMENT

1 - Cordless electric drill
1 - 21/64 inch or 'R' drill bit (extras advisable)
1 - 1/8 inch NPT tap (extras advisable)
1 - Tapping tool
1 - Can tapping oil
1 - Roll teflon tape
1 - 7/16 inch open ended wrench
2 - Crescent wrench (medium size)
1 - 3/8 inch drill bit
1 - 'Easy-out'

PLUGGING PROBLEMS EQUIPMENT

1 - Small acid bottle with eye-dropper to check for $CaCO_3$ precipitation
2 - Sharp pocket knives to cut apart emitters

FLOW RATE MEASUREMENT EQUIPMENT

1 - Stop watch capable of measuring to closest second (extra advisable)
20 - Plastic freezerettes (1 quart containers)
2 - 250 ml plastic graduated cylinders (extras advisable)
2 - 500 ml plastic graduated cylinders (extras advisable)
1 - Adjustable clamp to reduce hose pressure

DISPOSABLE ITEMS NEEDED FOR EACH EVALUATION

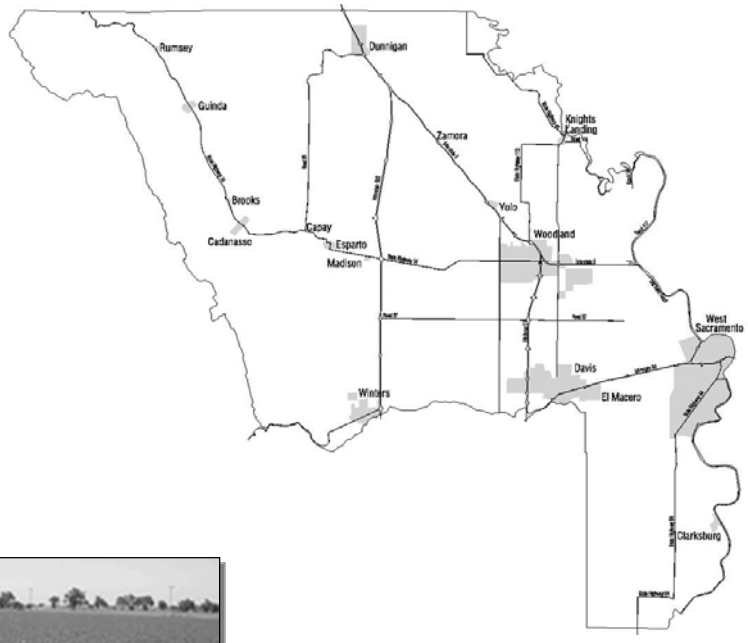
30 - Goof plugs (to match hole punch size)
6 - Emitters from farm shop to replace those removed for inspection of contaminants.
5 - each of 0.5 gph, 1 gph, and 2 gph emitters ('standard' spares just in case)
10 - Schrader valves
2 - Nylon knee stockings to check dirt in hose ends

Cal Poly (SLO) ITRC and Calif DWR/WCO

Appendix I

Mobile Water Lab- Evaluation Report

Farm 080404
08/04/2004



Yolo County Resource Conservation District
221 West Court St. #1
Woodland, CA 95695
http://www.yolorcd.org
530-662-2037

Mobile Water Lab Evaluation for
Farm 080404
Field ID: Road 2 Orchard (72 acres)
8/4/04

The following are the results of an evaluation conducted for Farm 080404 on 72 acres of almonds.

IRRIGATION SYSTEM TYPE

This orchard is irrigated with Tehama-Colusa canal water using Netafim button drippers rated at 1 gph, with 4 or 5 emitters per tree. The system is seven years old. Tree spacing is 16 by 22 feet. Attached to this report is the spec sheet for Netafim emitters.

DISTRIBUTION UNIFORMITY

Overall Distribution Uniformity (entire block)..... 73%

Overall Distribution Uniformity (first two submains off) 77%

The value for Distribution Uniformity (DU) is for a single-event evaluation.

Overall Distribution Uniformity - The Overall DU represents how evenly the applied water is being distributed over the entire field. The Distribution Uniformity is calculated by combining flow rate data, system pressures, irregular spacing, and any leaks that may be present. It does not consider scheduling information or variations in soil type. *An overall DU of 73% is below average for this type of system. 80% is considered an industry standard minimum value.*

Flow Distribution Uniformity……..……. …….…….56%.

Flow Distribution Uniformity - Flow DU is the most important component of the overall system DU. The flow DU is obtained by comparing flow rates from emitters throughout the system.

A flow DU of 56% is very low, and is caused by the plugged emitters in flow measurement location #1. Without plugging, as in flow measurement areas #2 and #3, the flow DU is between 86% and 91%, a very good value.

Flow DU is calculated based on individual emitters. Since each tree has an average of 4.5 emitters per tree, one plugged emitter is not so bad. There would be more problems if this system had one emitter per tree and a DU of 56%. However, with so many emitters per tree, the system is more "even" and "robust" than indicated by the DU. Additionally; the trees also appeared very healthy, with a large crop. Still, the potential for very serious problems exists in this system. Plugging can progress within a few weeks to catastrophic levels. Please see the next section on emitter plugging.

EMITTER PLUGGING

In 5 areas, a total of three hundred and sixty emitters were visually checked for plugging. Please see the pressure map for row locations (also note that north is down on the map). In the table below "N" and "S" refer to north and south.

Emitter Plugging	
Location	**% plugged**
Row 1 (N)	1.7%
Row 31 (N)	13.0%
Row 75 (N)	6.3%
Row 119 (N)	3.3%
Row 119 (S)	6.7%
Average	6.2%

There is a potentially severe problem with plugging around the north end of row 31.

Four plugged emitters were cut open to look for the source of plugging. Plugging is caused mostly by bacterial slime, with a small amount of additional clay particles. It is not uncommon to have bacterial plugging problems with TC Canal water and sand media filters.

Please see the attachments on the use of chlorine injection. Chlorine injection can be a very cost effective method for removing plugging from bacteria. We know walnut farmer who injects chlorine on weekly basis, but your orchard may not need that much. Please consult your PCA or chemical dealer for details before injecting chlorine.

Also consider the following:

-More frequent flushing of hose ends
-Inspect sand media in the filters for clumping and channeling
-Review micro nutrient injection program. Some micronutrients can create bacterial plugging problems, or make current plugging worse.

Prepared by Yolo County RCD
www.yolorcd.org

HOSE END FLUSHING

The hose ends were flushed in 4 areas and the maximum time to clear water was noted at 45 seconds. Thirty seconds to clear water is considered acceptable, with monthly flushing of each line. We recommend monthly flushing for at least 90 seconds on each line, or until clear water flows.

FILTER PRESSURE DROP

At the time of observation, filter pressure drop was at 8 PSI. The backflush switch is set to turn on at a pressure drop of 7 PSI. We do not know why the system was not starting its backflush.

WATER APPLICATION RATE

Water Application Rate during a 24 hour set……..0.523 inches

This application rate (0.523 inches per 24 hour set) is what we measured in our catch can test. This is slightly higher than design specifications (1.0 gph emitters), because of the operating pressure of the system. The rated flow of 1.0 gph is at 15 PSI, while the operating pressure was 15-28 PSI during the test. This results in a slightly higher flow rate, which is normal. The importance of knowing the actual flow rate is to compare the amount of water applied to tree water demand.

Water applied to 72 acre almond orchard in one 24 hour set.

Method of calculation	Acre feet	Inches
Catch can emitter measurements	3.138 - 3.456*	0.523 - 0.576*
District flow meter	3.544	0.590
Design specifications at 1.0 gph /emitter	2.958	0.493

* a range is given. The low value includes flow measurement area #1, which had 13% plugged emitters. The emitter plugging was not that high in other areas, so the higher value in the range is calculated without flow measurement area #1.

Water use as measured with the flow meter is always higher than our catch can measurements.

This is because some water is lost to back flushing and leaks, and is not applied through the drip system.

The water district's flow meter is a valuable tool for monitoring the irrigation system. Leaks, plugging, excessive backflushing, and other problems can be detected by tracking water use with the flow meter. For example, a slight decline in flow rate can indicate greater emitter plugging.

TREE WATER DEMAND

We calculated tree water demand using the California Irrigation Management Information System CIMIS (http://wwwcimis.water.ca.gov/cimis/welcome.jsp). We then compared tree demand to the water applied.

Average weekly CIMIS almond water demand for Colusa Station, July 2004 versus applied water.

Tree Demand (in/week)	Water Applied (in/week)
1.855	1.831 - 2.016*

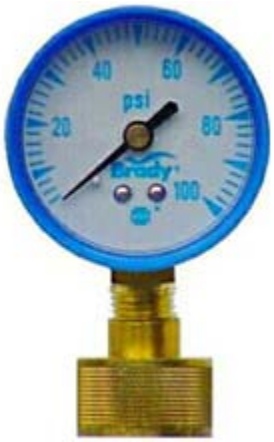
* the low value includes flow measurement area #1 with many plugged emitters, while the high value does not.

The normal irrigation for this orchard during the hottest time of the year (highest evapotranspiration) is every other day. It appears that this orchard is receiving almost exactly the amount of water required (as calculated with CIMIS).

OTHER INFORMATION

EQUIPMENT CHECKLIST For pressure measurements

1. **Pressure gauge**- An example of this type is available at Ace Hardware: Brady® Water Pressure Gauge (Btg0-100) Item no: 45347 Price: $11.79



http://www.acehardware.com/product/index.jsp?productId=1277971

2. Pitot tube- a pitot tube can be ordered from your irrigation supplier for about $15. The pitot then screws on to the pressure gauge.

3. Air chuck – the same as used to put air into a car tire. I found a 6 inch chuck in the welding supply section of the local hardware store. This also screws onto the pressure gauge. Its about $5. The air chuck is used to measure pressure at the pressure regulator assembly.

4. Hole punch- use the punch you currently use for installing new drippers. Then insert the pitot in the hole, take a pressure measurement, and plug the hole with a goof plug.

5. Goof Plugs – carry a good supply.

6. Vise grips – handy for installing goof plugs

7. Paper and pencil –for recording pressures. It may be helpful to make a system map, photocopy it, and take out a new dated copy each time you measure pressures. Just write the pressure on the map.

EQUIPMENT CHECKLIST For flow measurements

1. Short freezerette cups – I bought 30 plastic cups from Target. You only need 10 or so. The shorter the better, less than 4 inches for sure.

2. Stop watch

3. Volumetric flask or cylinder – You may be able to order this from your chemical supplier (or maybe he'll give you one.) One liter is a nice size. A large kitchen measuring cup will also work, but often they do not have many gradation lines.

4. Paper and pencil – be sure to record both the volume and time elapsed.

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www.yolorcd.org

Water Quality Two water samples were taken from domestic wells and sent off for drinking water suitability tests. Drinking water tests are not part of our regular free testing service for irrigation suitability. Drew will be billed approximately $40 per sample. The results will be sent within a few weeks.

After reviewing this report, if you have any questions or comments regarding its contents, please contact **the Yolo/Colusa Mobile Water Lab program at (530) 662-2037, ext. 120.** We appreciate your participation in the Mobile Lab program and hope that the contents of this report can be of some benefit to you in your irrigation practices.

EVALUATION ATTACHMENTS (not included with this WUEP proposal)

INCLUDE:

- **PRESSURE MAPS**
- **AERIAL PHOTOS**
- **NETAFIM TRITON X**
- **SPEC SHEETS**
- **FLOW CALCULATIONS**
- **EXPERT SOFTWARE**
- **DATA and RESULTS**
- **SOIL MAPS**