99D-117

Proposal Title: *Implementation of Management Practices that Prevent Offsite Movement of Chlorpyrifos and Other Pesticides from Alfalfa*

Applicant Name: California Department of Pesticide Regulation
Project Contact : John Troiano

Mailing Address: 830 K Street
Sacramento, California 95814

Telephone: (916) 324-4100

Fax: (916) 324-4088

Email: jtroiano@cdpr.ca.gov

Amount of funding requested: $690,466 for 3 years

Indicate the Topic for which you are applying (check only one box).

Fish Passage/Fish Screens	Introduced Species
Habitat Restoration	Fish Management/Hatchery
Local Watershed Stewardship	[i] Environmental Education
X Water Quality	

Does the proposal address a specified Focused Action? _____ yes __X__ no

What county or counties is the project located in?
Stanislaus, San Joaquin, and/or Merced counties.

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

Sacramento River Mainstem	East Side Trib:
Sacramento Trib:	Suisun Marsh and Bay
X San Joaquin River Mainstem	North Bay/South Bay:
San Joaquin Trib:	Landscape (entire Bay-Delta watershed)
Delta:	Other:

Indicate the primary species which the proposal addresses (check all that apply):

San Joaquin and East-side Delta tributaries fall-run chinook salmon	Winter-run chinook salmon
Spring-run chinook salmon	Late-fall run chinook salmon
Fall-run chinook salmon	Delta smelt
Longfin smelt	Splittail
Steelhead trout	Green sturgeon
Striped bass	Migratory birds
X All chinook species	Other:
X All anadromous salmonids	

Specify the ERP strategic objective and target (s) that the project addresses. Include page numbers from January 1999 version of ERP Volume I and II:

(Strategic Plan Goal 6, Objective 1'). ERP Vol. I, page 506
LONG-TERM OBJECTIVE: Reduce concentrations and loadings of contaminants to levels that do not cause adverse affects on all organisms and ecosystems in the aquatic environment.
SHORT-TERM OBJECTIVE: Reduce concentrations and loadings of contaminants that affect the health of organisms and ecosystems in water and sediments to the extent feasible based on benefits achieved, cost and technological feasibility.

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

X State agency	Federal agency
Public/Non-profit joint venture	Non-profit
Local government/district	Private party
University	Other:

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

Planning	X Implementation
Monitoring	Education
Research	

By signing below, the applicant declares the following:

1.) The truthfulness of all representations in their proposal;

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

3.) The person submitting the application has read and understood the conflict of interest and confidentiality discussion in the PSP (Section 2.4) and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent as provided in the Section.

Paul Gosselin

Signature of applicant

I-019034

Project Title:

Implementation of Management Practices that Prevent Offsite Movement of Chlorpyrifos and Other Pesticides from Alfalfa

Primary Contact:

John Troiano
Environmental Monitoring and Pest Management Branch
Department of Pesticide Regulation
California Environmental Protection Agency
830 K Street, Room 200
Sacramento, Ca 95814-3510

Participants and Collaborators:

Mick Canevari, Weed Specialist, Farm Advisor, San Joaquin County
Dan Putnam, Statewide Alfalfa Specialist, University of California
Larry Godfrey, Entomologist, University of California
Stacy Roberts, Executive Director, California Alfalfa & Forage Association
Gary Stockel, Deputy Agricultural Commissioner, San Joaquin County Agricultural Department
Dennis Kelly, Novartis
Brian Stuart, Dow Chemical
Kati Buehler, Regulatory and Environmental Affairs Director, Western Crop Protection Association.

Type of Organization and Tax Status:

State Government

Tax Identification Number:

68-0325102

Executive Summary

The presence of pesticides and their potential toxicity in waters supplying the Bay-Delta is well documented. Chapter 5 of the Draft Revised Water Quality Program, Calfed Bay-Delta Program is dedicated to pesticides and explains the toxicity testing and monitoring that has been conducted in contributory waters of the Bay-Delta (1). Many of the studies have implicated agricultural applications of chlorpyrifos and diazinon as a source of residue movement into sloughs and then into main contributing watercourses of the Bay-Delta, such as the San Joaquin River. Use of chlorpyrifos in alfalfa is specifically designated in Chapter 5 as a source of residue in the river water samples. This conclusion was based on correlations between the timing of applications made to alfalfa and subsequent detections in the San Joaquin River.

Alfalfa is the principal feed for the 4.5 billion dollar Dairy Industry in California. It is the largest acreage crop grown in the state at approximately 1 million acres in which 65% or 650,000 acres are located in the San Joaquin and Sacramento valleys. Since many alfalfa fields are in close proximity to San Joaquin River and other contributing watercourses, the potential for impacts on restoration is high (Figure 1). Annual consumptive water use by the crop is 4.0 ft /acre with nearly all of the acreage grown in the valleys using the border check method of irrigation. Irrigation efficiencies range between 40 and 80% with applied water volumes ranging from 5 to 10 acre-feet of water and with calculated drainage or runoff ranging from 1 to 9 acre-feet of water. Herbicide and insecticide applications are applied between February and August, a time when both irrigation and rainfall can cause significant runoff.

In response to concerns for maintaining both a healthy viable ecosystem and an economically productive agricultural society, an alfalfa task force has been formed. This group will identify and implement management practices that will significantly reduce or, if possible, eliminate the mass of pesticides entering the river through runoff which in turn would drastically reduce potential effects on the ecosystem. The major pathway for movement of pesticide residues into surface water is via runoff water produced by winter rains or irrigation. With respect to winter rain, the insecticides, diazinon and chlorpyriphos, and the herbicides, diruon and simazine, have been measured in the San Joaquin river and related to movement caused by winter storm events. Recent studies conducted by the United States Geological Survey (USGS) and the Department of Pesticide Regulation (DPR) have reported residues of other herbicides and insecticides in surface water samples (2, 3, 4, 5,). It is important to note that these pesticides represent a range in pesticide use patterns where the target for dormant insecticide sprays are the trees and the target for pre-emergence herbicides is the soil, and also a range in pesticide chemical properties i.e. shorter-lived insecticides compared to longer-lived herbicides.

Mitigation measures that rely upon substitution of pesticide active ingredients may not be an effective solution to ecosystem restoration because detections of the substituted pesticides would result in a new spectrum of environmental concerns, requiring a whole new set of experimental tests and monitoring studies to develop data for further mitigation or regulatory actions. The only method for getting off the replacement treadmill is to affect change in behavioral patterns by moving from current agricultural management practices to systems that are more effective in maintaining residues

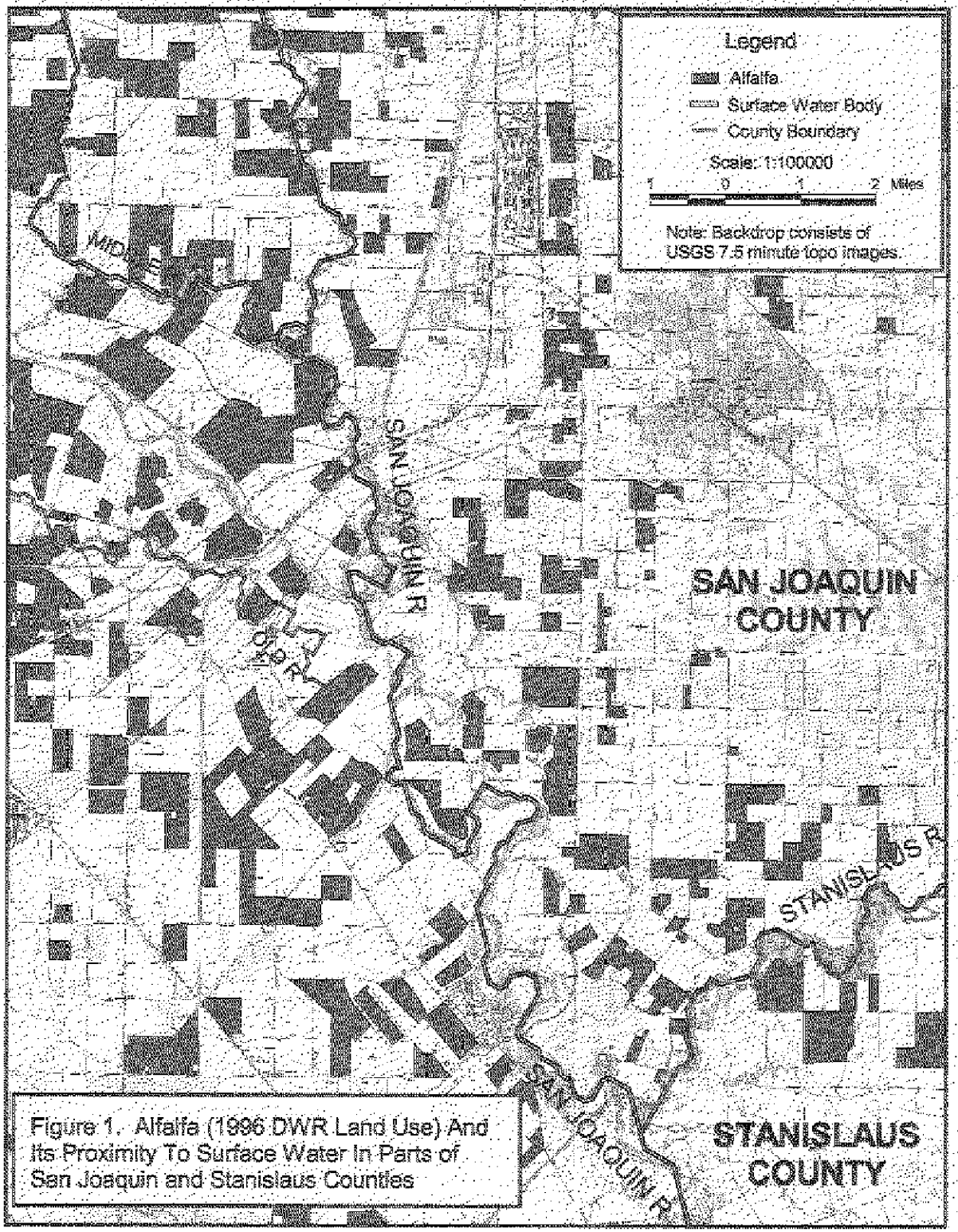


Figure 1. Alfalfa (1996 DWR Land Use) And Its Proximity To Surface Water In Parts of San Joaquin and Stanislaus Counties

I-019037

onsite. In order to achieve this goal, cooperators with a broad spectrum in expertise have been assembled, ranging from individuals with research experience to individuals with organizational and educational skills. This group reflects the breadth of expertise required to understand the processes of offsite movement, implement and monitor effective management practices, and then, ultimately, demonstrate and educate the users. Demonstration and education alone may not necessarily produce the desired change, hence the coordination of the effort through the DPR which through its regulatory authority could mandate change. Also, the DPR has developed a surface water database for sampling of pesticides conducted by DPR, and other state and federal agencies. Comparison of the level of adoption of management practices to the monitoring results in this database will be a direct measure of the success of the project.

The probability for success of the project is high because the management measures that will be implemented are those that have been successfully applied to other environmental problems. For example, management of irrigation tailwater through irrigation control or redirection into retention structures has been a key factor in the reduction of selenium and salts into the San Joaquin River that originate from agricultural operations on the Western side of the San Joaquin Valley. Alfalfa is a perennial crop with plants present and productive for at least 3 consecutive years. The crop receives applications of insecticide and herbicide active ingredients that have been detected in surface water - chlorpyriphos, an active ingredient in insecticide sprays; carbofuran an insecticide which is on CAL-FED's "Parameter of Concern" list; and the pre-emergent herbicides diuron and norflurazon both detected in surface water sampling (1). Thus, the crop presents a unique situation for developing mitigation measures that would be effective for other pesticides and that could be applied to other crops with runoff problems.

The project will be conducted in three phases. In Phase I, a task force will be formed consisting of individuals with expertise in alfalfa culture, pest management, pesticide chemistry, environmental sampling, and grower education. The task force will consist of representatives from the University of California, alfalfa grower/commodity representatives, registrants of the pesticides, and DPR. The task force will identify management measures that mitigate off-site movement of residues. In Phase II, the mitigation measures will be implemented in the field using active alfalfa fields and employing adaptive management techniques; monitoring will be conducted to indicate the level of success for each management practice and the need for further refinement. In Phase III, the mitigation measures that are practical and effective will be identified in an education and demonstration program. The study would require a minimum of 3 years, initiating in the first year with Phase I and the identification of management practices. Phase II will consist of the implementation and testing of the mitigation measures also initiated in the first year, continuing through the second year. The education and demonstration component of Phase III would begin in the third year after identification of practical mitigation measures. Specific management practices that have been identified as potential objectives are application of surge irrigation technology to irrigated alfalfa, improved management of tailwater, use of adjuvants in irrigation water to decrease sediment, use of adjuvants in pesticide applications to increase bonding to plants, and tillage as a means to hold herbicides onsite during the dormant season. The approximate amount requested is $322,000 the first, $200,000 the second and $150,000 the third year for a total of $677,000.

Project Description

Scope of Work: The goals of the project are 1) to change agricultural management behavioral patterns by implementing proven management practices that are effective in reducing or eliminating the offsite movement of chlorpyrifos and other pesticides to surface waters from application to alfalfa; 2) to promote behavioral change through demonstration and education; and 3) to develop methodology that correlates the level of adoption of management practices to effects on concentration of chlorpyrifos and other pesticides in the San Joaquin River. In order to ensure protection of the Bay-Delta environment, the DPR could invoke its regulatory authority based on the results of goal #3. An Alfalfa Task Force has been developed and currently consists of the individuals identified on the first page, but the group is not limited to these individuals and will expand as needed. Currently, the group reflects individuals with experience in pesticide sampling, alfalfa management practices, enlistment of grower participation, local and state regulatory agencies. The group was formed in response to concerns over mitigation measures proposed by DPR for surface and ground water. Owing to the perennial nature of alfalfa, the proposed measures would have been difficult to implement without causing undue economic hardship. Project funding would enable implementation and evaluation of managements practices that are effective in reducing offsite movement of pesticides and that will be practical and adopted by growers.

The surface water concerns with respect to insecticide active ingredients are outlined in Chapter 5 of the Draft Revised Water Quality Plan. Briefly, detections of chlorpyriphos in the San Joaquin river have coincided with dormant spray applications made to alfalfa in late winter and early spring. Figure 1 illustrates the location of alfalfa fields, as of 1996, in San Joaquin and northern Stainislaus counties in relation to watercourses in the San Joaquin Basin that feeds the Bay-Delta. Many of the fields are adjacent to the San Joaquin River and thus could potentially have a direct impact on chlorpyrifos concentrations in the river.

The project has been divided into 3 phases with the following objectives.

Phase I - The Phase I objective is to form a working group tasked with assessing existing management practices that have a high probability of reducing or eliminating runoff of chlorpyrifos and other pesticides from alfalfa. Specific tasks in Phase I are:

Task 1: Project management and identification of participants in the task force. The alfalfa task force was initially formed to address economic concerns to proposed changes in ground water regulations by the DPR. The objectives of the task force are relevant to the problems with pesticides in surface water and would be an effective working group to manage and evaluate the progress of the project. Meetings were initiated through the cooperative efforts of UC and DPR staff. The task force is composed of the individuals identified on the first page but additional members have already been identified. For example, Blaine Hanson and Terry Pritchard irrigation specialists with the UC Cooperative Extension will participate in studies involving irrigation and tailwater management. The task force will employ a project manager. DPR's intent is to assure that protocols will be adequate to support potential regulatory actions.

Task 2: Identify potential mitigation measures for runoff of pesticides. The task force has identified the following areas as a high priority for study:

- Surge irrigation - surge irrigation has improved water management in furrow irrigation by improving irrigation efficiency and reducing runoff by as much as 57% (6). This emerging technology also could effectively reduce runoff from alfalfa.
- Tailwater management - analyze the feasibility of using tailwater recovery systems to reduce runoff volume and improve water quality if discharged from the site (7).
- Tillage - the possibility of using selective mechanical equipment to incorporate herbicides into the soil of existing alfalfa stands (8).
- Irrigation adjuvants - use of materials such as Polyacrylamide (PAM) have shown the ability to stabilize soil particles minimizing soil erosion and potential runoff (9).
- Pesticide application adjuvants - use of materials added to the spray solution during application to increase pesticide bond to soil or plant surfaces.

The task force will continue to explore other sources of information on mitigation measures and prioritize each based on their practical application and feasibility.

Task 3. Formulate study protocol and identify study locations. The study protocol will specify the design used to monitor the effectiveness of the management practice. One important aspect of design is that the studies will be replicated at more than one location. Replication increases the cost of the project but it ensures proposed management practices will be effective over a broad range of growing conditions. Specific studies will be conducted and replicated in locations throughout the San Joaquin Basin that specifically impact the San Joaquin River. Potential cooperators will be recruited using the resources available through the farm advisors and industry representatives that are members of the task force.

Phase II - The objective is to implement studies for adaptive management of the practices specified in Task 2.

Task 4. Implementation of studies designed in Task 3. The number of management practices tested (identified in Task 2) will be directly related to the leveling of funding. At the minimum, each study will be required to report the estimated mass of chlorpyriphos that leaves the application site in the absence and then in the presence of the mitigation measure. In order to estimate mass of pesticide, measurements will be made on the concentration of pesticide in runoff water and on the volume of runoff water produced either by rainfall or irrigation events. To provide a measure of the economic impact of the management practices, measurements also will be made to provide an evaluation of the effect of the mitigation measures on crop yield.

Phase III- In Phase III, the objectives are to coordinate full implementation of effective management practices and to develop a measure of success for adoption of the practices.

Task 5. Employ the resources of the Alfalfa Task Force in demonstration and education.

Upon development of an effective management practice, demonstration and education will commence through the resources represented by the task force including the UC Cooperative Extension Service, the California Alfalfa and Forage Association (CAFA) organization, and industry-sponsored programs such as the Coalition for Urban/Rural Environmental Stewardship (CURES) program. CURES is a program developed by the Farm Bureau to educate both rural and urban users of pesticides about potential environmental problems caused by pesticides and about management practices that mitigate them. Drawing upon these diverse resources will produce an effective program of education that increases public awareness and knowledge of the problems associated with pesticide use, proven mitigation measures, and potential regulatory consequences of non-participation.

Task 6. **Develop a method to track adoption of mitigation measures.** A method will be developed to measure the success of the project. One method would be to compare the level of adoption of management practices, as measured through local surveys, to detections in DPR's surface water database. The DPR database is a collection of data from DPR projects and other projects supported by CALFED or other State and Federal agencies. Historically, changes in behavioral patterns have occurred through observation of practices on adjacent lands and then through personal experimentation. The tracking of these changes could be accomplished through surveys conducted by UC Cooperative Extension or by more formal contact with local agencies such as the local County Agricultural Commissioner. An analysis of the measure of success will be used by DPR to gauge whether or not regulatory activity will be required.

Timeline and Deliverables: The timeline for the project is indicated in Table 1 and the deliverables are as follows:

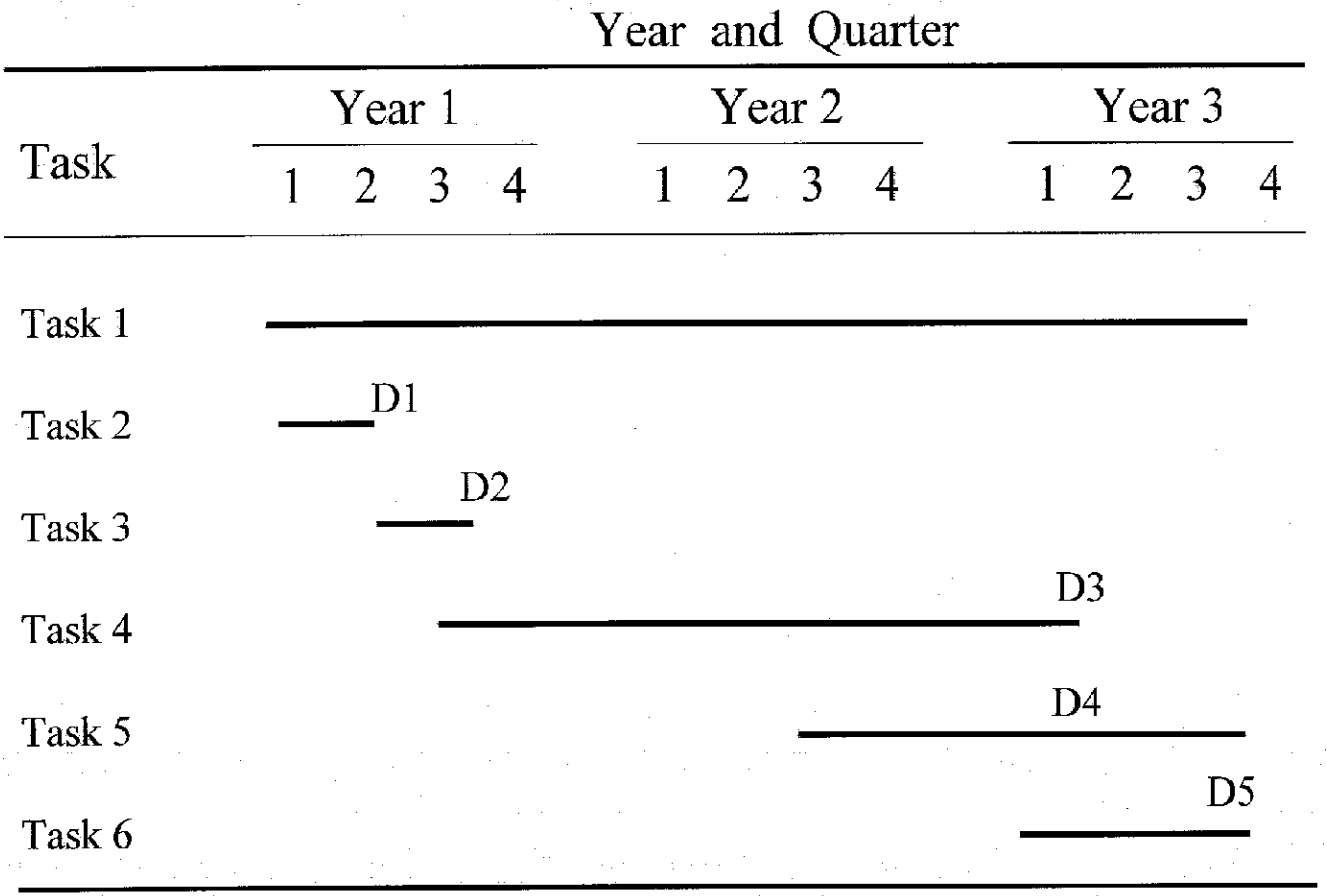
Phase I - D1. List of eligible management practices.
D2. Study protocols for measuring the effectiveness of management practices.

Phase II - D3. Reports for the results of each management practice with an analysis of the potential for practical reductions in chlorpyrofos movement to watercourses.

Phase III - D4. Schedule for demonstration and education courses given to promote adoption of effective management practices.
D5. Estimate for the potential of adoption of mitigation measures as determined from surveys or other methodology.

Location and/or Geographic Boundaries of the Project: The project will focus on fields located in San Joaquin, Stainislaus, and Merced Counties in the San Joaquin Basin. Figure 1 is a map (1:100,000) of the location of alfalfa fields in San Joaquin and Stanislaus counties in relation to the major watercourses and overlaid upon USGS Quad maps. This map was generated by DPR using GIS technology and uses DWR land use from 1996 and a hydrology layer obtained from the Teale data center. The map aids in identification of those sites that have a direct influence on water quality and, hence, with a high priority for implementation of management practices.

Table 1. Timeline for each task and deliverable.



Tasks as defined in Project Description and D1-D5 refers to deliverables outlined on page 5.

I-019042

Ecological/Biological Benefits

Ecological/Biological Objectives

The primary ecological/biological objective of the proposal is to reduce or eliminate the potential for toxic impacts of chlorpyrifos in the watercourses that are tributaries to the BAY-DELTA. This objective specifically addresses Goal #6 of the Draft Strategic Plan for Ecosystem Restoration. The need for the project is articulated in Chapter 5 of the Draft Revised Water Quality Program, Calfed Bay-Delta Program in that chlorpyrifos applications to alfalfa have been correlated to toxic concentrations measured in the San Joaquin River and its tributaries (1). These measurements have provided the impetus for implementation of effective management practices to reduce the impacts of offsite movement of pesticides.

The basic thesis of the proposal is to change the behavior of individuals by implementing practices that specifically address the mass of pesticide that moves offsite. Alternative projects have been funded that propose to substitute use with other pesticides. In our experience, simple substitution of one toxicant for another does not solve the problem because it does not address the cause of the problem. In addition, there are usually impacts on the environment or on pesticide effectiveness that limit the utility of substituted pesticides. Some reasons why substitution may not be effective are:

1. The impacts of the substitutes upon the ecosystem are usually unknown. Since proposed substitutes may not have been used on the crop, monitoring would be needed to track the potential effects that the substitute has on the environment. Potential problems may actually shift from one aspect of the environment to the other, for instance from water to air, so chemical method development may be necessary in order to measure the substituted pesticide in water, air, plant, and soil media.
2. Substituted pesticides may be more persistent in the environment and the effects may not be easily measured or observed for years or decades.
3. Ecological effects of the substituted pesticides may occur at levels that are currently below chemical detection limits. How can one attribute cause and effect when concentration of a stressor cannot be quantified?
4. The desired level of pest control may require a greater number of applications so cumulative effects would need to be investigated.

It should be noted that the approach to change management practices to those that retain pesticides onsite is robust in that it would affect all pesticides applied to the crop. For example, if a shift to surge irrigation is shown to decrease offsite movement in the mass of chlorpyrifos, then offsite movement of other pesticides applied to the crop such as pre-emergence herbicides would be similarly affected.

The habitats that are the focus of the study are those that are listed as impaired due to chlorpyrifos under the Clean Water Act Section 303(d) (1). Although the main water body on this list in the area of study is the San Joaquin River, any effective management practice would have the potential to mitigate the problem of offsite movement of pesticides in other similarly listed water bodies.

The specific scientific hypothesis evaluated in these studies is that the mass of pesticide leaving a site can be reduced through the adoption of practices that either reduce the volume of water and sediment that leaves a field, or through greater retention of the pesticide on surfaces that resist wash-off. Reductions in mass that leaves the site should result in decreased mass loading of chlorpyrifos into the San Joaquin River which in turn should result in reductions in the measurement of toxicity as measured by survival of *Ceriodaphnia dubia*.

The benefit and durability for the project will be expressed through the adoption of management practices that maintain pesticides at the site of application. Growers adopting this philosophy will be showing a greater desire and willingness to minimize the potential impacts of agriculture on the environment. Demonstration and education are key components for raising awareness that a potential exists for toxicity in receiving waters and, subsequently, for adopting some proven solutions to the problem. Feedback during all phases of this program is key to adapting management practices to the concerns and growing conditions experienced by individual growers.

Linkages

This project was developed directly from the studies which have identified alfalfa as a potential source for detections of chlorpyrifos residues in San Joaquin River water (Chapter 5, Draft Revised Water Quality Program, Calfed Bay-Delta Program). The first efforts, partially funded by CALFED, have been to search for alternative pesticides to the organophosphates. However, implementation of other legislation such as the Food Quality Protection Act (FQPA) place the validity of this approach in question. If residues continue to move offsite regardless of the pesticide, then questions will always be asked as to the human health effects, e.g. FQPA, or the ecological significance will continually be addressed through the CALFED and other processes.

System-Wide Ecosystem Benefits

The main system-wide benefit is that adoption of practices such as surge irrigation should affect the mass of offsite movement for many pesticides applied to alfalfa. For example, herbicides may have an affect primarily on algal populations. Reduction in the total pesticide mass discharged for a range of pesticides will have the potential benefit of decreasing the risk to all species of concern to CALFED.

Compatibility with Non-Ecosystem Objectives

Since many of the implementation measures involve more efficient water delivery and increased management of tailwater, there will be a direct benefit for the CALFED Water Use Efficiency program. The sciences of pesticide use and irrigation have traditionally evolved separately with little interest about their interactive effects. Detections of pesticide residues in surface water at potentially toxic levels drastically changes this relationship, especially because irrigation has been identified an important source for detections. But irrigation can provide the solution for mitigation. Resistance to adoption of efficient water methods would be lessened once efficient water management is linked to reductions in pesticide concentration and eventually as a mechanism to reduce ecological or FQPA concerns.

Technical Feasibility and Timing

Other alternatives that simply change the spectrum of applied pesticides were not selected because they are not sustainable alternatives to decreasing the mass of pesticides that are moved offsite in runoff water. Management practices that reduce the mass of offsite movement of pesticides are robust solutions because; 1) they are actual solutions to the problem, assuring that the maximum amount of pesticide is retained and degraded at the site of application; 2) they are potentially applicable to a other pesticides applied to the crop; and 3) they have benefits for affecting other programs such as FQPA.

The major issue that could affect the implementation of the program is the identification of growers willing to cooperate. However, the task force is represented by industry and grower groups which will encourage participation.

Monitoring and Data Collection Methodology

Biological/Ecological Objectives. The objectives are to implement changes in management practices that result in substantial decreases in the mass of pesticides that are removed from fields by runoff water. Comparisons of the mass of chlorpyrifos that leaves the field in runoff water will be made between fields with and without the proposed management practice. For example, surge irrigation will be applied to a field that is adjacent to a field that receives the historical method of irrigation. Monitoring is a key component of these types of studies because the mass of pesticide that is moved offsite is determined as the product of the volume of runoff water from the site and the concentration of pesticide in the water. Replication is important for determinating the validity of the management practice. For practices such as surge irrigation, the potential benefit for reductions in mass is large so replications will be made over as many locations as possible. Other practices may require more replication within a field in order to determine the potential level of reduction or to test a specific comparison. For example, effectiveness of addition of adjuvants to irrigation water that reduce sediment load may differ with soil type. Since many factors affect the sediment load from a field, replication at a site may be necessary in order to produce an accurate estimate of discharge for that location.

Monitoring Parameters and Data Collection Approach. Mass determinations are the mathematical product of the volume of runoff water and pesticide concentration in runoff water. Volume of water will be measured using the Sunken Barrel Method which employs flumes and/or submerged pumps in conjunction with water meters. Water samples for pesticide analysis will be taken with sequential samplers. Chemical analysis will be conducted on filtered and unfiltered water samples which provides an estimate of the amount of sediment in the water, and on the pesticides in the dissolved vs sorbed phase. These methods have been previously used to measure the mass and distribution of pesticide residues in runoff water from almonds (10). Since previous runoff studies have indicated that the first runoff event has the greatest effect on removing pesticide with decreasing effects in subsequent events, measurements will be made for the first two events following pesticide application and should provide an adequate assessment of the effectiveness of the management practice that will be tested (11). An assessment of the economic feasibility will be also be made with respect to the effect of the management practice on crop growth and on the cost for implementation. For crop growth, measurements will be made to provide an evaluation of the effect of the mitigation measure on crop yield. These include total stand count, number of dislodged plants, and numbers of stems per unit area. Insect counts will be made to determine the efficacy of the insecticidal treatment. An economic analysis will also be provided to indicate the cost of adoption for that management practice. For example, a change from flood-irrigation to surge would require changes to the conveyance system and equipment additions such as pumps to facilitate the ability to pulse the water into the crop.

Data Evaluation Approach. Specific hypotheses tested are in Table 2. The cooperators in the study have previously conducted field studies using similar techniques that have been subjected to peer review and publication in scientific journals. An even higher level of critique exists because the practices developed will have to be acceptable to growers in terms of economic and political considerations.

Table 2. Monitoring and Data Collection Information

Hypothesis/Question to be Evaluated	Monitoring Parameter(s) and Data Collection Approach	Data Evaluation Approach	Comments/Data Priority
Application of Surge Irrigation to Alfalfa fields	1. Adaption of surge techniques 2. Measure runoff volume and pesticide concentration	1. Economic analysis 2. ANOVA of paired comparisons replicated over locations	High priority
Tailwater management	1. Survey tailwater management 2. Implement tailwater recovery systems 3. Monitor pesticide concentration in the recovery system	1. Determine landscape, and/or economic parameters that inhibit implementation 2. Provide degradation curves to determine fate	Water management techniques successfully used in rice to drastically reduce pesticide concentrations in the Sacramento River
Tillage practice - method to gently disrupt the soil surface	1. Survey available equipment 2. Measure runoff volume and pesticide concentration 3. Stand performance 4. Insecticide efficacy	Anova of paired comparison to determine effects on pesticide mass, plant health, and insect populations	Mechanical incorporation increases surface roughness; application to alfalfa may depend on stage of growth
Irrigation Adjuvants - test materials such as PAM	1. Runoff volume and pesticide concentration 2. Compare effects in erodible and non-erodible soils	Anova of paired comparison to determine effects on pesticide mass and potential differences between soils	Recent studies with lower levels of PAM have been more economical; limitations due to soil needs to be determined
Pestide application adjuvants to increase pesticide bond to plant/soil	1. Survey mode of action of pesticide adjuvants 2. Measure runoff volume and pesticide concentration 3. Stand performance	Anova of paired comparison to determine effects on pesticide mass, plant health, and insect populations	Use of spreaders and stickers needs to evaluated for dormant spray applications

Local Involvement

Proposed locations for study are in San Joaquin, Stainislaus, and Merced Counties. The Board of Supervisors and the County Agricultural Commissioner have been contacted and informed that investigation of management practices for reducing chlorpyrifos runoff from alfalfa might be conducted in their respective counties. These types of studies are commonly conducted by UC Cooperative Extension and DPR staff. The Farm Bureau, pesticide registrants, and CAFA representatives on the task force have been instrumental in the planning of the proposed projects. Their expertise in public outreach and involvement at the local level will be important in securing local participation.

Cost

Budget. The costs for the project are indicated in Table 3 and the quarterly estimates in Table 4. Only costs for completing tasks that involve implementation, monitoring, demonstration, and education are indicated. These costs reflect those associated with equipment, travel, labor, securing study sites, and publication. Costs for chemical analysis and salaries of the task force members will be provided under cost-sharing.

Table 3. Total budget (CALFED funds only)

Task	Direct Labor Hours	Direct Salary and Benefits	Service Contracts	Material and Acquisition Costs	Misc. and Other Direct Costs	Overhead and Indirect Costs	Total Cost
Task 4		52,061	319,000	72,000	36,000	19,405	
Task 5			92,000				
Task 6				10,000			
Project Mgmt Task 1			90,000				

The Indirect Cost Rate is determined by dividing the overhead costs by the total Personal Services (Salaries and Benefits) for direct program activities. Overhead includes all the costs of the Executive Offices, the Division of Administration, and DPR's Program Supervision Offices as well as the statewide cost centers (i.e. Dept. of Finance, State Controller's, etc.). The rates used are approved annually by U.S.EPA and are in accordance with Federal requirements.

Schedule. Table 1 contains the schedule for start and completion of each Phase. The payments relate to the project date for deliverables in the task.

Cost-Sharing

Cost-sharing will be contributed by participants on the Alfalfa Task Force. Analytical costs for pesticide analysis which is estimated at $250,000 will be apportioned between DPR and other participants of the task force. Salaries of the participants in the Task Force will be supplied by the participating entities.

Table 4.

Task	Quarterly Budget Oct-Dec 99	Quarterly Budget Jan-Mar 00	Quarterly Budget Apr-Jun 00	Quarterly Budget Jul-Sept 00	Quarterly Budget Oct-Dec 00	Quarterly Budget Jan-Mar 01	Quarterly Budget Apr-Jun 01	Quarterly Budget Jul-Sept 01	Quarterly Budget Oct-Dec 01	Quarterly Budget Jan-Mar 02	Quarterly Budget Apr-Jun 02	Quarterly Budget Jul-Sept 02
Project Management	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500
Task 4	105,000	105,000	55,000	27,000	57,000	46,000	28,000	28,000	28,000	0	0	0
Task 5	0	0	0	0	0	0	5,000	5,000	20,000	47,000	10,000	5,000
Task 6	0	0	0	0	0	0	0	0	0	0	5,000	5,000

I-019051

Applicant Qualifications

John Troiano received a Ph.D in Pant Pathology from Rutgers University in 1977. He is a Senior Environmental Research Scientist for the Environmental Monitoring and Assessment Branch of the Department of Pesticide Regulation, California Environmental Protection. For the past 15 years, he has conducted studies on the fate of pesticides in the environment and on the agronomic and geographic factors that contribute to offsite movement. John has participated in the development of DPRs ground water regulations which have identified runoff of pesticides from fields as a process for movement of residues into ground water. The initial meetings of the Alfalfa Task Force were hosted by DPR in response to a request by Mick Canevari.

Mick Canevari received a M.S. degree in Agronomy, Plant Protection from the California State University, Fresno in 1973. Mick is an Agronomy and Weed Science Advisor with University of California Cooperative Extension and he is responsible for Research and Education programs for field crops and Weed Science programs in San Joaquin County. The crops include alfalfa, dry beans, rice, winter cereals, corn, sugar beets, oil crops, rangeland and pasture, and certified seedprogram. He activities include weed management, variety development, disease management, insect control, and fertility research. He also has educational responsibilities for developing publications and conducting county, state and Regional Meetings.

Stacy Roberts received an MBA from the UC Davis Graduate School of Management and an MS and BS in Agronomy from UC Davis and Cornell. She is currently Executive Director, of the California Alfalfa and Forage Association. In the previous 7 years, Stacy gained experience in field investigations and interagency cooperation in agricultural water quality issues, working to solve surface water movement problems associated with pesticide applications to rice.

Larry D. Godfrey received a Ph. D. Major in Entomology from the University of Kentucky in 1984. He is an Associate Extension Specialist/Associate Entomologist, Lecturer, Dept. of Entomology, Univ. of California, Davis. His research and fields of interest are applied insect ecology, plant/insect interactions-influence of arthropod injury on plant physiology, soil insect biology, and field/vegetable crop integrated pest management.

Kati Buehler is the Regulatory and Environmental Affairs Director for the Western Crop Protection Association (WCPA). WCPA is a non profit trade association representing manufacturers, formulators, distributors and retailers of crop protection products and services in 10 western states. Its mission is to advance industry goodwill, promote a positive business climate and increase the knowledge of the public, allied organizations, and WCPA members on the environmentally sound use of crop protection products and services for the economical production of safe, high quality, abundant food, fiber and other crops. Prior to joining WCPA last October, Kati handled water quality issues for the Northern California Water Association for two years, and prior to that was the government and member affairs director for the CA Rice Industry Association.

Gary Stockel is a Deputy Agricultural Commissioner with San Joaquin County. He has 16 years

experience in the Agricultural Commissioner's Office and currently supervises San Joaquin County's pesticide use enforcement program.

Brian Stewart is received a Ph.D. from Texas Tech Univ in 1984 and then spent 10years in the Research and Development division of Dow AgroSciences. He currently Governmental Relations Manager for the Western U.S.

References

1. CALFED Bay-Delta Program. 1999. Water Quality Program, Revised Draft, February, 1999

2. Panshin, S.Y., N.M. Dubrovsky, J.M. Gronberg, and J.L. Domagalski. 1998. Occurrence and distribution of dissolved pesticides in the San Joaquin River Basin, California. USGS Water-Resources Investigation Report 98-4032.

3. Dubrovsky, N. 1998. Water-Quality assessment of the San Joaquin-Tulare basins, California, 1992-1995. USGS Geological Survey Circular

4. Foe, C. 1995. Insecticide concentrations and invertebrate bioassay mortality in agricultural return water from the San Joaquin Basin. Central Valley Regional Water Quality Control Board. December, 1995.

5. Ross, L.J., R. Stein, J. Hsu, J. White, and K. Hefner. 1996. Distribution and mass loading of insecticides in the San Joaquin River, California, 1991-1993 Department of Pesticide Regulation, EH 96-02.

6. Goldhammer, D.A., M.H. Alemi, and R.C. Phene. 1987. Surge vs. continuous flow irrigation. California Agriculture. September-October 1987 41:29-32.

7. Burt, C.M. and K. Katen. 1988. Westside Resource Conservation District 1986/87 Water Conservation and Drainage Reduction Program. Technical Report to Office of Water Conservation, Ca. Dept. of Water Resources. March 26, 1988.

8. Troiano, J. and C. Garretson. 1998. Movement of simazine in runoff water from citrus orchard row middles as affected by mechanical incorporation. Journal of Environmental Quality 28:488-494.

9. Sojka, R.E., R.D. Lentz, and D.T. Westermann. 1988. Water and erosion management with multiple applications of polyacrylamide in furrow irrigation. Soil Sci. Soc. Am. J. 62:1672-1680.

10. Ross, L.J., K.P. Benenett, K.D. Kim, K. Hefner, and J. Hernandez. 1997. Reducing dormant spray runoff from orchards. Department of Pesticide Regulation. EH 97-03.

11. Leonard, R.A. 1990. Movement of pesticides into surface waters. *In* H.H. Cheng (ed.) Pesticides in the soil environment: Processes, impacts, and modeling. p. 303-348. Soil Sci. Soc. Amer. Book Series No. 2. Soil Sci. Soc. Amer., Inc, Madision, WI.