99D-109

Proposal Title: *Reduction of Insecticides Loads in the San Joaquin Watershed*

Applicant Name: California Department of Pesticide Regulation
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Amount of funding requested: $1,041,000 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	iii 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

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TITLE PAGE

Project Title:

Reduction of Insecticide Loads in the San Joaquin River Watershed.

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Type of Organization and Tax Status:

State Government

Tax Identification Number: 68-0325102

Executive Summary

Since 1988, scientists from the Central Valley Regional Water Quality Control Board, U.S. Geological Survey, California Department of Pesticide Regulation, and California Department of Fish and Game have tested water quality in the San Joaquin River watershed using chemical analyses and bioassays (Foe and Connor 1991; Foe and Sheipline 1993; MacCoy et al., 1995; Ross et al., 1996; Panshin et al., 1998). They found water samples from the watershed, particularly during winter months, caused mortality to a species of water flea, *Ceriodaphnia dubia*. *Ceriodaphnia dubia* is used in bioassays because it is sensitive to insecticides and represents aquatic arthropods, one of the organisms used in the U.S. Environmental Protection Agency's three-species bioassays. The San Joaquin River is located in the San Joaquin Basin of the central valley of California, a region of dense agricultural use. Based on results from these monitoring efforts and land use patterns, the potential cause of toxicity was attributed to chlorpyrifos and diazinon used as dormant sprays in orchards.

The San Joaquin-Tulare Basins have a drainage area of approximately 31,200 miles^2 that consists of the San Joaquin Valley, the eastern slope of the Coast Ranges to the east, and the western slope of the Sierra Nevada mountains to the west (Gronberg et al., 1998). The Tulare Basin is generally a closed basin: water drainage begins and ends within the basin boundaries. However, during wet years surface water may flow from the Tulare Basin north to the San Joaquin Basin. The San Joaquin Basin alone is approximately 14,800 miles^2 in drainage area. Within this basin, the region of perennial flow has been defined by the U.S. Geological Survey as the Lower San Joaquin River Basin, a drainage area of approximately 7,345 miles^2 (Kratzer and Shelton 1998). The Lower San Joaquin River Basin begins at the San Joaquin River and Bear Creek confluence northward to the San Joaquin River near Vernalis. South of the Bear Creek confluence, San Joaquin river flow is intermittent and north of Vernalis tidal influence from the Delta begins, comprising a perennial river reach of over 40 miles. It is this area of the watershed that has been most intensively investigated for surface water quality.

Nearly one third of the land use in the San Joaquin-Tulare Basins is agricultural, while most of the agriculture is located on the valley floor (Gronberg et al., 1998). Major agricultural products from this region include livestock and livestock products, fruit and nuts, cotton, vegetables, hay and grains. Along with intensive agriculture, pesticide use to control agricultural pests is not uncommon, even during winter months. Over-wintering peach twig borer and San Jose scale in orchard trees are typically controlled with applications of dormant spray insecticides, e.g. chlorpyrifos and diazinon, mixed with weed oil. In 1992-93, about 31,000 lbs of chlorpyrifos and 77,000 lbs of diazinon were applied, respectively, in Merced and Stanislaus counties during the dormant season (December, January, and February).

The ecological significance of the presence of dormant spray insecticides in the San Joaquin River watershed is not fully understood. However, a significant correlation between acute *C. dubia* mortality and chlorpyrifos and diazinon concentrations has been established (Barry 1999).

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This sentinel organism is intended to represent macro-invertebrates in the aquatic system and therefore, potential effects on native and local macro-invertebrates and subsequent effects on higher organisms feeding on macro-invertebrates may be inferred.

Due to the widespread use of dormant spray insecticides, their presence in the San Joaquin River watershed at concentrations toxic to *C. dubia*, and the potential impact on native and local species, the reduction in surface runoff of these insecticides may be important for restoring ecological health to the system. The primary biological objective will be to reduce concentrations of the dormant spray insecticides below levels toxic to macro-invertebrates. The project will focus on effectiveness of cover crops and/or mulched buffer zones for reducing surface runoff of chlorpyrifos or diazinon. Once effective practices are established, results from field trials in a small watershed will be compared with a non-point source runoff model for validation purposes. The runoff model could then be applied to larger tributaries of the San Joaquin River to determine, on a large scale, how effective management practices could be in reducing insecticide concentrations and loads in the watershed.

Data will be evaluated using analysis of variance and model validation techniques. Assignment of treatments to entire orchards or rows in a commercial orchard will be achieved randomly. Treatment types may include native vegetation (control condition), cover crop, mulched edge of field borders, and/or smart sprayer technology. Monitoring in a small watershed will be conducted for chlorpyrifos and/or diazinon concentrations and discharge. Insecticide loads measured with monitoring will be used to validate and calibrate a surface runoff model.

Project cost: Cost for the three year proposed study is $1,041,000. There are no known adverse or third party impacts from this project.

Applicant qualifications: Dr. Lisa Ross is a Senior Environmental Research Scientist who has been working on the environmental fate and behavior of pesticides for the past 14 years. In addition to conducting a number of large field-scale mass-balance studies, Dr. Ross has been conducting pesticide mitigation research in commercial and small field plots. Dr. Ross has extensive experience coordinating research and cooperating with scientists from local, state, and federal governments, and private industry, as well as with growers.

Local support/coordination: The project complements monitoring work done previously and currently being conducted by the Department of Pesticide Regulation in the San Joaquin River watershed. Contact and coordination with the county Agricultural Commissioner of Stanislaus and Merced counties, West Stanislaus Resource Conservation District and the U.S. Department of Agriculture, Natural Resources Conservation Service have been initiated.

Compatibility with CALFED objectives: This project is compatible with the CALFED objective to reduce or eliminate stressors in the aquatic environment. The stated strategic objective is "Reduce the concentrations and loading of contaminants in all aquatic environments in the Bay-Delta watershed" and to "Develop regional plans to reduce the effects of non-point source contaminants." The development of farm management practices that reduce insecticide runoff addresses the first CALFED objective, while the use of the runoff model will aid in addressing the second.

Project Description

Proposed Scope of Work

A number of studies have examined pesticide runoff from agricultural sources (Wauchope 1978: Leonard 1990; Wauchope et al., 1990; Spencer et al., 1985; Ross and Sava 1986; Ross et al., 1997). For most pesticides, runoff losses are 1% or less of applied amounts. Work by Ross et al. (1996, 1997) indicates less than 1% of the applied chlorpyrifos and diazinon flows from an orchard after a rain event. Although seemingly small, the mass of material leaving individual orchards, combined with other orchards in heavy use areas can contribute enough residue to the aquatic system to cause toxicity in bioassay tests (Kuivila and Foe, 1995).

It is generally believed that most pesticide loading to surface water occurs from surface runoff generated by rain events and irrigation (Leonard 1990; Larson et al., 1997). Research involving reduction of pesticide runoff has included such methods as bioremediation, soil management, and irrigation management (Felsot et al., 1995; Saurer and Daniel 1987; Kenimer et al., 1989). In addition, vegetative filter strips and cover crops have met with some success (Fawcett et al., 1992; Ross et al., 1997). However, most scale of research has been at the small plot level. There is a real need for demonstrated effectiveness in commercial orchards before new methods are adopted by the agricultural community. In addition, the overall effectiveness at the watershed scale of research, must be demonstrated in order to control pesticides in runoff water and improve ecosystem health.

There are two main tasks of this project. First, to examine differences in insecticide runoff from an orchard using a cover crop on the orchard floor and/or mulch at the edge of field compared with a control. A typical control would be no floor management prior to dormant spray application. A clover cover crop was shown effective at reducing the mass of insecticide in surface runoff in a small field trial (Ross et al., 1997). Mulch (either wood chips or live vegetation) may also be effective as an absorptive and physical barrier to insecticide runoff. An alternate method for testing, if the technology is available, is the use of a smart sprayer. This has been employed in northern California for dormant spray application (personal communication Robert Boyes). This method simply reduces the amount of material applied to an orchard, theoretically reducing the amount leaving in surface runoff.

The second task involves the use of models to predict if reductions insecticide concentration and/or mass seen at the field edge translate into reductions in the watershed. A small watershed, such as the Newman Wasteway (Figure 1), will be monitored for insecticide concentrations and discharge. Pertinent parameters and characteristics of this watershed will also be measured and/or collected and digitized for use in the model and GIS (Geographical Information System) purposes. Candidate models for performing the required calculations are the U.S. EPA EXAMS model (Burns 1997, Burns et al. 1982) or the U.S. Department of Agriculture GLEAMS model (Knisel 1993). These models contain sufficient flexibility to characterize the geometry of a variety of river/stream/field configurations. In addition, there are chemical fate parameters which permit the assessment of longevity and compartment distribution. The modeled data will be compared with measured watershed concentrations to validate and calibrate the model. Ultimately, modeled concentrations, generated using edge-of-field concentrations from the various treatments tested in task one, will be compared with concentrations known to affect macro-invertebrate species.

The project will take a minimum of three years to complete. For task one, two years will be required to test all treatment types with either chlorpyrifos or diazinon. Ideally, all treatment types will be tested in a single year, and repeated in the second year. If data are inconsistent between years, a third year may be required. For task two, three years will be required. The first year to collect and measure all watershed parameters necessary for modeling and to digitize the information and create GIS maps. The first and second years for surface water monitoring of insecticide concentrations and discharge. While the second and third years are for validating and calibrating the model, and making predictions about changes in watershed concentrations with changes in orchard management practices.

Equipment required to perform task one includes automated water samplers (the Department of Pesticide Regulation (DPR) currently owns or has access to eight of the 12-15 needed for the project), data-loggers (DPR currently owns four), one or two weather stations (DPR owns two), weirs or flumes and transducers, and deep cycle batteries and/or generators (DPR currently owns a sufficient number of these). The Department of Pesticide Regulation has a warehouse and sample preparation/storage facility in West Sacramento and a field office at Fresno State University which houses equipment, staff, and a soil laboratory. In addition, the Department uses the California Department of Food and Agriculture, Center for Analytical Chemistry in Meadowview (Sacramento) for chemical analyses.

Equipment required to perform task two includes computer facilities, GIS digitizing table, and software. Global positioning instrumentation may be necessary to aid in data collection of field information needed for the model and GIS mapping. All this equipment is currently owned, maintained, and used regularly by trained DPR staff. In addition, water samples will be collected using standard surface water sampling equipment (DH77 sampler or hand held sampler, current meters, bridge board, wading rods, etc.) that DPR owns. Staff at DPR are trained in proper surface water sampling and discharge measurement techniques by staff from the US Geological Survey.

It is anticipated that task one could be performed independently of task two, if funding for only one task is available. However, task two relies on reductions made by new orchard management techniques examined in task one to determine if significant changes in insecticide concentrations and loads will occur in the watershed if the practices are adopted by the agricultural community. It is possible that task two could be performed without task one. In that case, theoretical reductions at the field edge would be back calculated from concentration goals set for the watershed. This would serve as a goal for edge-of-field reductions, which still would need to be field-tested. Alternatively, edge-of-field concentrations from a small field trial (Ross et al., 1997) could be used in modeling for watershed predictions.

Project Location

Field sampling for both tasks one and two will be conducted mainly in Stanislaus County and possibly Merced and San Joaquin Counties as well (Figure 1). Ideally, field locations will be as close as possible, to minimize local differences in rainfall. The Lower San Joaquin River Basin (see Executive Summary) is contained entirely within these three counties. The tributaries potentially used for modeling, include Mud Slough, Salt Slough, Los Banos Creek, the Newman Wasteway, Orestimba Creek, Spanish Grant Drain, or Ingram/Hospital Creeks (Figure 1). These are small tributaries on the west-side of the San Joaquin River which carry rain-runoff water from the Coastal Ranges (with the exception of Newman Wasteway) to the San Joaquin River. These small watersheds with dormant spray use (Figures 2 and 3, Ross et al., 1996) and known insecticide contamination and loads (Figure 4, Ross et al., 1996), make them ideal for this type of project. Selection of a specific tributary for modeling will depend on how much information required by the model, is available for a given watershed. In addition, watersheds highly manipulated by man, such as Mud and Salt Sloughs and Orestimba Creek, may not be good candidates for runoff/watershed modeling since water discharges are artificially controlled.

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Ecological/Biological Benefits

Ecological/Biological Objectives

Due to the widespread use of dormant spray insecticides, their presence in the San Joaquin River watershed at concentrations toxic to *C. dubia*, and the potential impact on native and locally important species, the reduction in surface runoff of these insecticides may be important for restoring ecosystem health. The primary biological objective is to reduce concentrations of chlorpyrifos and/or diazinon below levels of concern to macro-invertebrate species. These organisms are an important part of the food web, as well as a part of the diet of fish species, including chinook salmon, a CALFED priority species. The acute LC_{50} for the sentinel organism, *C. dubia*, will be the primary target concentration. The primary stressors for this organism have been found to be chlorpyrifos and diazinon in surface water (Kuivila and Foe, 1995; Barry 1998). Exposures to chlorpyrifos and diazinon are typically acute in nature while chronic toxicity is reported less frequently (Ganapathy 1999; Bennett et al., 1998). The 96-hour acute LC_{50} for *C. dubia* is 0.10 μg/L for chlorpyrifos (Menconi and Paul 1994) and 0.49 μg/L for diazinon (Menconi and Cox 1994). (Note, these are species mean averages calculated by the California Department of Fish and Game.) As a secondary objective, chronic LC_{50} values and/or criteria will also be compared with modeled results to determine if management practices will potentially be effective for protecting macro-invertebrate species from long-term exposures.

Alternative approaches which look at replacing the traditional dormant sprays with other insecticides simply shift the potential problem from one chemical to another. Insecticides, by their very nature, are designed to target insect and other invertebrate pests. Insecticides with a general mode of action, whether it be a chitin inhibitor, growth regulator, or nervous system poison, will kill non-target organisms which have similar physiology. In addition, growers need a variety of tools for pest control because every year is different and some products are more or less effective depending on location, climatic factors, and pests. The more pest control options a grower has, the more productive and the more competitive he or she will be in the U.S. and world marketplace.

The primary expected benefit is improved water quality for ecological uses by reducing chlorpyrifos and diazinon concentrations in the Lower San Joaquin River Basin. Export of pulses of chlorpyrifos and diazinon have been demonstrated from the San Joaquin River at Vernalis, into the Delta (Kuivila and Foe, 1995; Ross et al., 1996). Therefore, improved water quality in the San Joaquin River should contribute to improvements in the Bay and Delta. In addition to the primary benefit (i.e. reduction in concentrations below levels toxic to macro-invertebrate species) the secondary benefit is to organisms that use macro-invertebrates as a food source. By improving food quantity and distribution of a major group of organisms in the food web, improvements in species from higher trophic levels may be realized, potentially strengthening food web resilience. This then benefits recreational uses of the aquatic system, such as fishing and wildlife viewing activities.

It is hypothesized that best management practices can be developed to reduce runoff concentrations from orchards treated with chlorpyrifos and diazinon. It is also hypothesized that these reductions will translate into reductions in concentrations in the watershed below levels of concern to macro-invertebrate species. Once effective management practices are demonstrated in the field, they could be sustained through voluntary and/or regulatory measures. Education and outreach efforts by DPR as well as agricultural commissioner staff and local resource conservation districts could sustain long-term changes in orchard floor management. Additionally, changes in dormant spray product labels or permit conditions could be employed by DPR if voluntary measures are not effective. These are legally enforceable changes that could be required of all growers and pesticide applicators. These proposed changes could apply statewide, or specifically to the Bay-Delta watersheds, thereby encompassing the entire ecosystem affected by these contaminants.

Linkages

This project builds on past projects conducted by DPR on reducing dormant spray runoff through the use of best management practices (Ross and Biermann 1996; Ross et al., 1997; Ando et al., 1999). Prior studies focused on testing sampling equipment and electronics (Ross and Biermann 1996) and examining best management practices in small field plots (Ross et al., 1997; Ando et al., 1999).

In addition, this project relates to other previously funded CALFED projects aimed at reducing runoff of dormant spray insecticides. However, those studies (on alternate practices for reducing pesticide impacts and on the use of *Bacillus thuringiensis* [Bt]) focus on shifting use from chlorpyrifos and diazinon to other pesticides (note: Bt is a registered pesticide). From our experience, shifting from one chemical to another only shifts potential problems caused by one chemical to those of another (for example, shifting from methyl bromide use to MITC). In addition, shifts in pesticide usage create impacts that are largely unknown when alternate pesticides have not been widely used. In addition, alternate pesticides may be more toxic (e.g. the pyrethroids), and therefore may cause adverse ecological impacts at levels below our current detection limits.

The strategic objective addressed by this project is the reduction of concentrations and loading of contaminants in all aquatic environments in the Bay-Delta watershed (Ecosystem Restoration Program Plan, Volume I, page 421 and 506, February 1999). The target of this objective is to improve water quality by reducing pesticide concentrations below acutely and chronically toxic levels, in order to benefit the health of the aquatic system. Improving aquatic system health in the Bay-Delta is a major CALFED goal.

System-Wide Ecosystem Benefits

Improvement in health of the macro-invertebrate group of organisms will help improve the food supply for species feeding on that trophic level. In addition, this project compliments other projects funded by CALFED, including one on alternate practices for reducing pesticide impacts and BIOS. These other projects focus on shifting the use from traditional dormant sprays to the use of other pesticides. In the case of this project, we are focusing on best management strategies that might be used with any pesticide that runs off target via surface runoff water. By controlling runoff at the site of application, we can reduce potential impacts that might occur with any pesticide in the watershed.

Compatibility With Non-Ecosystem Objectives

Another CALFED objective that benefits from this type of project is the reduction of human activities that adversely affect wildlife reproductive success and contribute to the decline of important species (ERP, Volume I, Page 421, February 1999). By changing a management strategy used by growers, we can reduce the type of human activity that leads to excessive pesticide runoff from treated fields. By improving the health, quantity and distribution of macro-invertebrates in the ecosystem we can potentially improve fish populations reliant on macro-invertebrates for food.

Potential benefits to third parties include fisheries, recreational, and commercial users of the watershed for fishing purposes.

Technical Feasibility and Timing

Other alternatives considered for the reduction of dormant spray runoff included microbial augmentation and soil incorporation. Field trials conducted at Fresno State University indicate these methods may not be effective at reducing concentrations or mass runoff of chlorpyrifos or diazinon (Ando et al., 1999). In addition, increased soil erosion was seen using the soil incorporation method (Ando et al., 1999; Troiano and Garretson 1998).

Written permission from participating growers will be solicited. In addition, grants will be awarded to growers to cover their cost for application, implementation of the proposed management practices, and for any irrigation costs incurred (e.g. to establish the cover crop and/or simulate a rain event). Cooperating growers will be solicited through the local resource conservation districts, U.C. cooperative extension staff, the U.S. Department of Agriculture, Natural Resource Conservation Service and the Agricultural Commissioner.

All pesticide applications will be done in compliance with state and federal laws and regulations including obtaining permits for use of restricted materials. No other permits are necessary for this project.

One implementation issue is attaining enough growers/orchards to perform the required number of replicated fields. Sufficient replication in field trials is essential since environmental variability is large and management practices need to prove effective under various conditions. The alternative is to use fewer fields and randomly assign replicate treatments to rows within a field. It has been found that three replicate rows within a small field plot are not sufficient (Ross et al., 1997). It is recommended that five or more replicate rows in a commercial orchard be used. This alternative would still provide the necessary experimental design to test our hypothesis, although relevance to multiple field settings in a watershed would be diminished. However, the modeling could add the necessary component to predict relevance to the watershed.

Monitoring and Data Collection Methodology

Data Collection and Evaluation

For objective one, a minimum of four fields per treatment type (control and cover crop) will be needed, i.e. a minimum of 8 fields. If additional fields are available, we will use a mulch treatment at the edge of the field and/or a smart sprayer application. Surface runoff concentrations and discharge will be measured at the edge of each field using automated water samplers and weirs (or flumes with pressure transducers) connected to a campbell datalogger (see Ross et al., 1997 for sampling details). The first rainfall event after application will be monitored since this typically carries the highest pesticide loads and concentrations (Wauchope 1978; Spencer et al., 1985; Ross et al., 1997). If rain does not occur within 14 days of application, automatic sprinklers will be used to generate runoff. Ideally, all fields will be located in areas receiving similar rainfall. If not, we will consider using sprinkler irrigation or a modified experimental design to accommodate anticipated rainfall variances.

Analysis of variance, using a completely randomized design, will be used to test the null hypothesis that management practices do not influence the concentration or mass runoff of a dormant spray. It is anticipated that only one dormant spray can be evaluated with this project at this time. The preference of the majority of growers cooperating in this study will be respected. Water from the entire runoff period will be sampled, as well as total discharge to determine concentration as well as total mass discharged from the treated area. Analysis of variance results will therefore be expressed on a concentration basis, as well as mass. Both parameters are important for understanding potential impacts in the aquatic ecosystem. Concentrations are important from a toxicity standpoint, while mass is important for modeling purposes and estimating loads to the watershed.

For objective two, a variety of input parameters will be required: watershed boundary, slopes, land use, flow rates, etc. It is important to select an area that provides maximum information on the parameters required by the model. Ideally these data will also be available in Geographical Information System (GIS) format. Various state and federal agencies maintain databases on boundary outlines, discharge, slope, soil types, etc. The watersheds with the most complete amount of information, required as input to the model, will be selected for modeling. Monitoring in the watershed will be conducted to calibrate and validate the model. The initial runoff concentrations (loads) used for modeling will be the control condition. Once the model is validated under this management practice, additional model runs will be conducted with runoff concentrations (loads) seen under the test management practices. Predicted concentrations will then be compared with target goal concentrations. A detailed protocol, prior to study commencement, will be peer reviewed at DPR. In addition, our Management Agency Agreement with the State Water Resources Control Board requires review by scientists from the State and Regional Boards as well.

Table 1 summarizes the approach used for monitoring and data collection.

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Local Involvement

The Agricultural Commissioner of Stanislaus County has been notified of our proposed project. In addition, contact with the Western Stanislaus Resource Conservation District through the U.S. Department of Agriculture's Natural Resource Conservation Service was made.

In addition, the almond board has been notified of this proposal and has expressed support and an interest in study results. As a matter of course, project leaders at DPR keep a record of all interested parties and routinely mail progress reports, final reports, and participate in grower and other group meetings to share the information we produce.

The public outreach task of this project includes seminars at grower field days and other related meetings, pest control applicator training, and informational pamphlets and articles in local journals (such as California Agriculture).

Written permission for property use or access will obtained from each grower who participates in this project.

There are no known third party impacts from field trials on private property, nor from the monitoring/modeling task of this proposal.

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Cost

The cost for this three year study is $1,041,000. The costs for tasks one and two are summarized in Table 2 by year. The quarterly budget for each task is summarized in Table 3. Total project cost for task one is $805,042 for the three year study. Total project cost for task two is $235,958 for three years. Service contract monies are for chemical analyses and grower grants. Material and acquisition costs are for additional auto-samplers and discharge measuring instrumentation. Miscellaneous and other direct costs include travel, printing, postage, and communications. Overhead cost is 30.61% of salaries and benefit costs incurred by direct program activities (see Table 2 for detailed explanation).

Schedule

Task one commences with the search for grower cooperators in July and August 1999. Cover crop planting will occur in September 1999, and mulching at the edge of field with fine wood chips will be done when the orchard is pruned. Sampling and discharge equipment will be installed once the above field operations are complete. All field equipment will be installed prior to dormant spray application, which generally occurs prior to February 15. Water samples collected in the field will be transported and stored according to standard operating procedures (SOPs) developed by DPR (SOPs include ADMN 6.00, QAQC 3.00 and 4.00, and EQOT 1.00). These standard procedures are used for U.S. EPA and DPR studies. Chemical analysis and discharge data measurements will be completed by May 2000. Progress report on the first year of task one will be made by September 2000, the end of the first year of funding. The second year for task one will involve the same schedule, without the search for growers since they have already been identified in year one. Year three will be required if conflicting results occur between years one and two (i.e. if management practices are not consistently effective from one year to the next). A final report will be submitted in September 2002.

Task two commences with funding from CALFED in October of 1999. All parameters required for modeling will be collected and digitized (if not already available in that form). In addition, models will be installed on the DPR computer system and any access programs and/or system modifications made by September 2000. In addition, historical monitoring information from the small tributary for dormant spray concentrations will be gathered. A progress report of task two will be generated by September 2000. In year two, runoff data generated from task one and monitoring data collected during the second year will be used in model calibration and validation. Surface water monitoring will be conducted daily using automated water samplers during January and February. During that period discharge measurements will be made periodically. Monitoring data will support model validation and calibration. A progress report for task two will be generated in September 2001. The third year will be used to make model refinements and additional predictions as information from task one is refined. A final report will be submitted in September 2002.

There is the potential to incrementally fund tasks one and two. Task one could begin in October 1999, while task two could begin in October 2000 or later.

Cost Sharing

The DPR will contribute funds necessary to commence the project in July of 1999, prior to funding by CALFED in October of 1999. In addition, project management will be fully funded by DPR.

I-018739

Applicant Qualifications

Dr. Lisa Ross will be overall project manager. Under her direction tasks one and two will be implemented. Each task will have a project leader, responsible for the day to day operations of the project.

The project leader for task one will identify cooperating growers and be responsible for field site selection, scheduling, securing field sampling personnel, and transport of samples to the laboratory. Task one will also require a field coordinator who will be responsible for equipment installation and maintenance, as well as assist with field sampling. Progress reports and data analysis for task one will be performed by the project manager.

The project leader for task two, Dr. Bruce Johnson, will be responsible for modeling, model development, and computer programming. Under Dr. Johnson's direction, two individuals will assist with data acquisition for model input parameters, GIS mapping, and a GIS specialist responsible for obtaining, installing, and maintaining GIS data sets on the computer facilities at DPR. Dr. Johnson will also be responsible for model calibration, validation, and predictions, progress reports and a final report for task two.

Overall direction and coordination for the project will be provided by Dr. Ross, as well as collation and review of progress and final reports will be her responsibility. All contracts will be administered/coordinated through her as well as public contacts, publications in scientific journals, and seminars.

Brief Biographical Sketches of Key Personnel

Dr. Lisa Ross has over 14 years conducting research on the environmental fate and behavior of pesticides. She specializes in large scale research projects in commercial agricultural fields designed to identify the mass distribution of pesticides in the agro-ecosystem. Dr. Ross has organized and coordinated a large multi-agency study of surface water quality in the San Joaquin River, as well as examined best management practices in orchards in the central valley of California. Dr. Ross has over 25 publications and abstracts, and has been invited to speak at local, national, and international meetings to describe her environmental research. She is co-editor of a book on the effects of scale of research on agrochemical transport, as well as a contributing author. She holds a Master's degree in Botany from Arizona State University and a Doctorate in Ecology, with an emphasis on environmental toxicology, from U.C. Davis.

Dr. Bruce Johnson has 10 years experience with DPR, modeling the fate and distribution of pesticides in the environment. He has extensive experience modeling the movement of pesticides in subsurface flow as well as the atmosphere. He has over 20 publications and abstracts on pesticide fate and movement in the environment. He has a broad background with a

Bachelors Degree in mathematics and statistics from U.C. Berkeley, a Masters Degree in range management from U.C. Berkeley, and a Ph.D. in Ecology from U.C. Davis.

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I-018744

Project Title: Reduction of Insecticides Loads in the San Joaquin River Watershed.

Table 1. Monitoring and Data Collection Information.

Biological/Ecological Objective: To reduce concentrations of chlorpyrifos and/or diazinon below levels of concern to macro-invertebrate species.			
Hypothesis/Question to be Evaluated	**Monitoring Parameters and Data Collection Approach**	**Data Evaluation Approach**	**Comments/ Priorities**
Task 1 Null Hypothesis: Management practices do not influence the concentration or mass runoff of dormant sprays.	1. Two to three management practices tested: a control and 1 or 2 practices, such as cover crop, mulch at edge of field, smart sprayer. 2. Eight to 15 fields sampled for runoff concentrations and discharge. (Total number of fields used is dependent on the level of grower participation. 3. The study will be conducted during the first rain event after application. Simulated rainfall may be used if field sites in different regions or if rainfall does not occur within 14 days of application.	Analysis of Variance (completely randomized design or stratified, depending on field locations)	Priority is to get 15 fields to evaluate effectiveness and variability in management practices
Task 2 Question: Will changes in edge-of-field concentrations/mass runoff of dormant sprays correspond to reductions in watershed concentrations relevant to macro-invertebrate species.	1. Monitor a small tributary/basin in the Lower San Joaquin River Basin for dormant spray concentrations. 2. Use monitoring data and edge-of-field concentration data to calibrate and validate a runoff model. The edge-of-field data used initially will be from control plots such that current practices and resultant watershed concentrations will be used in model validation. 3. Once the model is validated and calibrated, runoff concentrations/mass from cover crop and/or mulched fields will be used in the model to predict watershed concentrations assuming widespread use of these new practices. 4. This modeling effort will help determine if these new practices should be recommended/required for use with dormant spray applications.	Calibrate and validate EXAMS or GLEAMS Conduct model to predict watershed concentrations should new management practices be adopted.	Priority is to obtain as much real world information as possible to make the most accurate model predictions.

I-018745

I-018745

Project Title: Reduction of Insecticides Loads in the San Joaquin River Watershed.

Table 2. Annual Budget (CALFED Funds Only).

Task	Year	Direct Labor Hours	Direct Salary and Benefits	Service Contracts	Material & Equipment	Misc. Costs & Other Direct Costs	Overhead & Indirect Costs[1]	Total Cost
Task 1	Year 1	5704	$125,727	$67,000	$107,750	$36,500	$38,485	$375,462
Task 2	Year 1	1044	$33,116	$26,200	$5,000	$6,400	$10,137	$80,853
Task 1	Year 2	3708	$82,528	$67,000	$6,000	$36,000	$25,262	$216,790
Task 2	Year 2	1044	$33,116	$26,400	$2,000	$5,900	$10,137	$77,553
Task 1	Year 3	3708	$82,528	$67,000	$2,000	$36,000	$25,262	$212,790
Task 2	Year 3	1044	$33,115	$26,400	$2,000	$5,900	$10,137	$77,552
							Grand Total	$1,041,000

Note: the cost for project management will be paid by the California Department of Pesticide Regulation as a cost share.

1. The overhead cost rate of 31% is determined by dividing total Personal Services (salaries and benefits) for direct program activities. Overhead includes all costs of the Executive Office, the Division of Administration, and DPR's Program Supervision Office as well as statewide cost centers (e.g. the Department of Finance, State Controller's Office, etc.). The rates are approved annually by the U.S. EPA and are in accordance with Federal requirements.

I-018746

I-018746

Project Title: Reduction of Insecticides Loads in the San Joaquin River Watershed.

Table 3. Quarterly Budget (CALFED Funds Only)

Task	Quarter Oct-Dec 99	Quarter Jan-Mar 00	Quarter Apr Jun 00	Quarter Jul-Sep 00	Total Budget
Task 1	$212,672	$107,617	$27,998	$27,175	$375,462
Task 2	$15,388	$38,588	$11,188	$15,689	$80,853
	Quarter Oct-Dec 00	Quarter Jan-Mar 01	Quarter Apr Jun 01	Quarter Jul-Sep 01	Total Budget
Task 1	$77,946	$88,532	$24,568	$25,744	$216,790
Task 2	$12,263	$38,663	$11,063	$15,564	$77,553
	Quarter Oct-Dec 01	Quarter Jan-Mar 02	Quarter Apr Jun 02	Quarter Jul-Sep 02	Total Budget
Task 1	$75,946	$88,532	$24,568	$23,744	$212,790
Task 2	$14,263	$38,663	$11,063	$13,563	$77,552

I-018747

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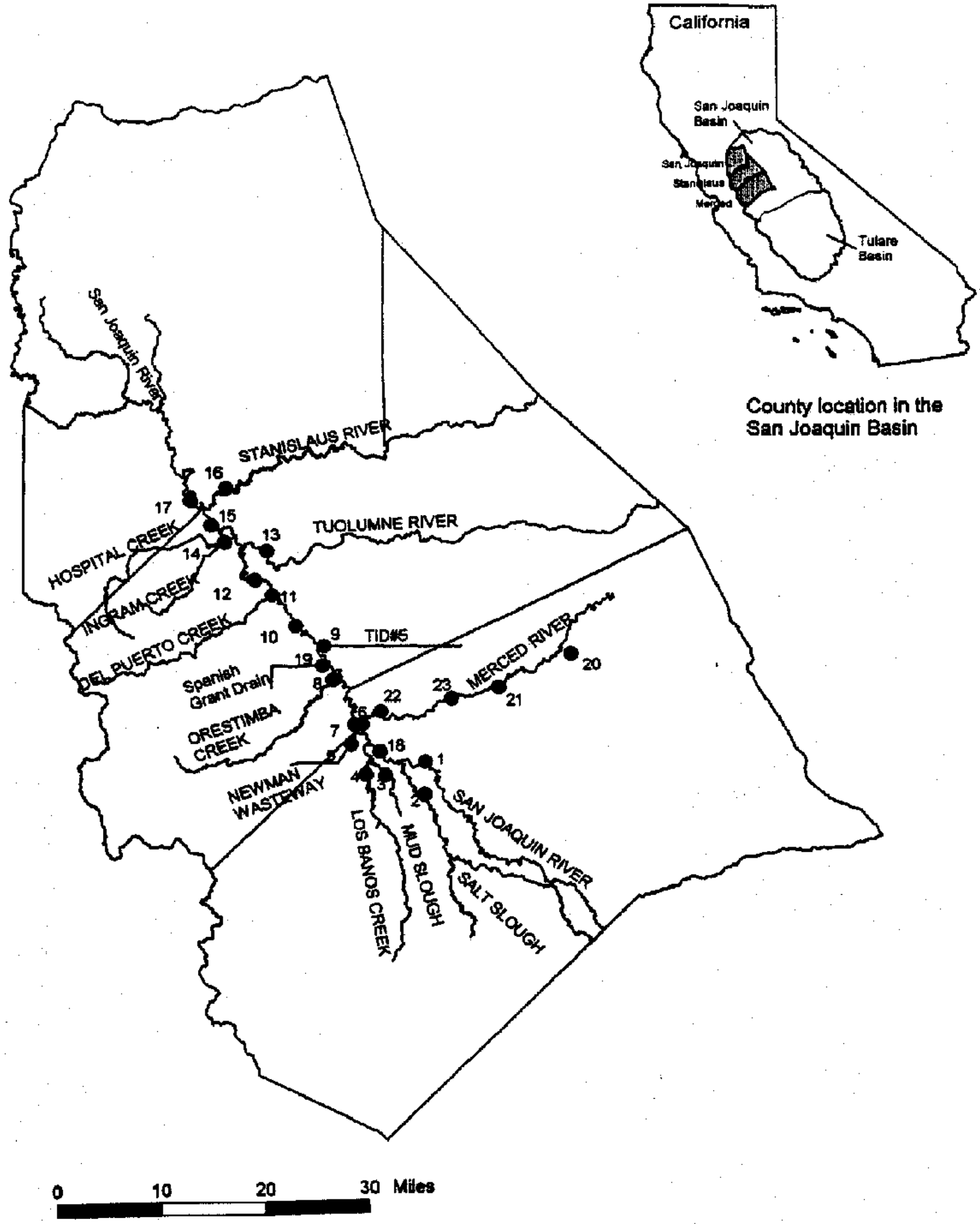

Figure 1. The San Joaquin River and main tributaries in the Lower San Joaquin River Basin. Sampling site numbers are from a prior monitoring study and relate to sites sampled in figures 2, 3, and 4.

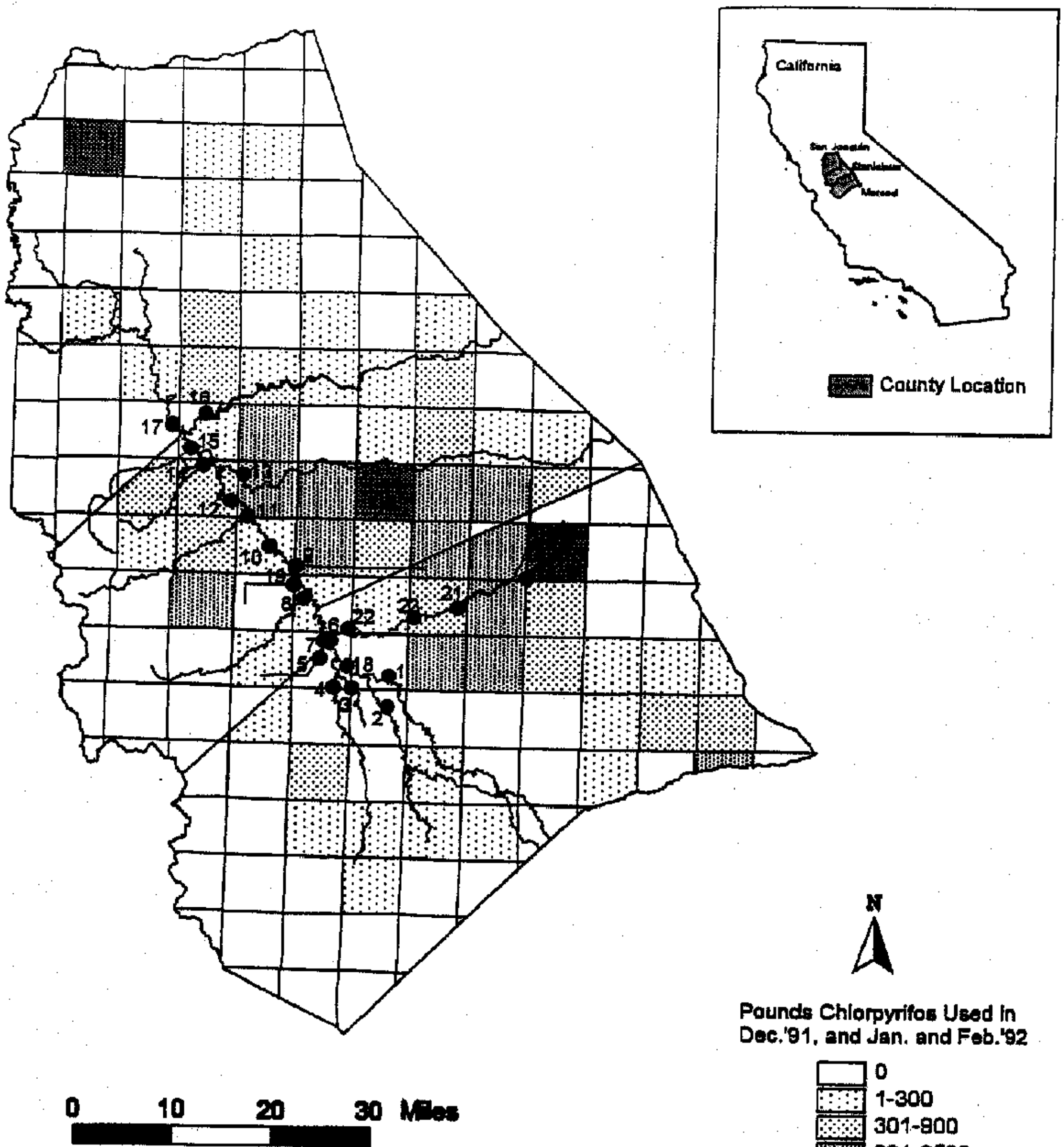

Figure 2. Chlorpyrifos use (lbs) during the 1991-92 dormant spray season.

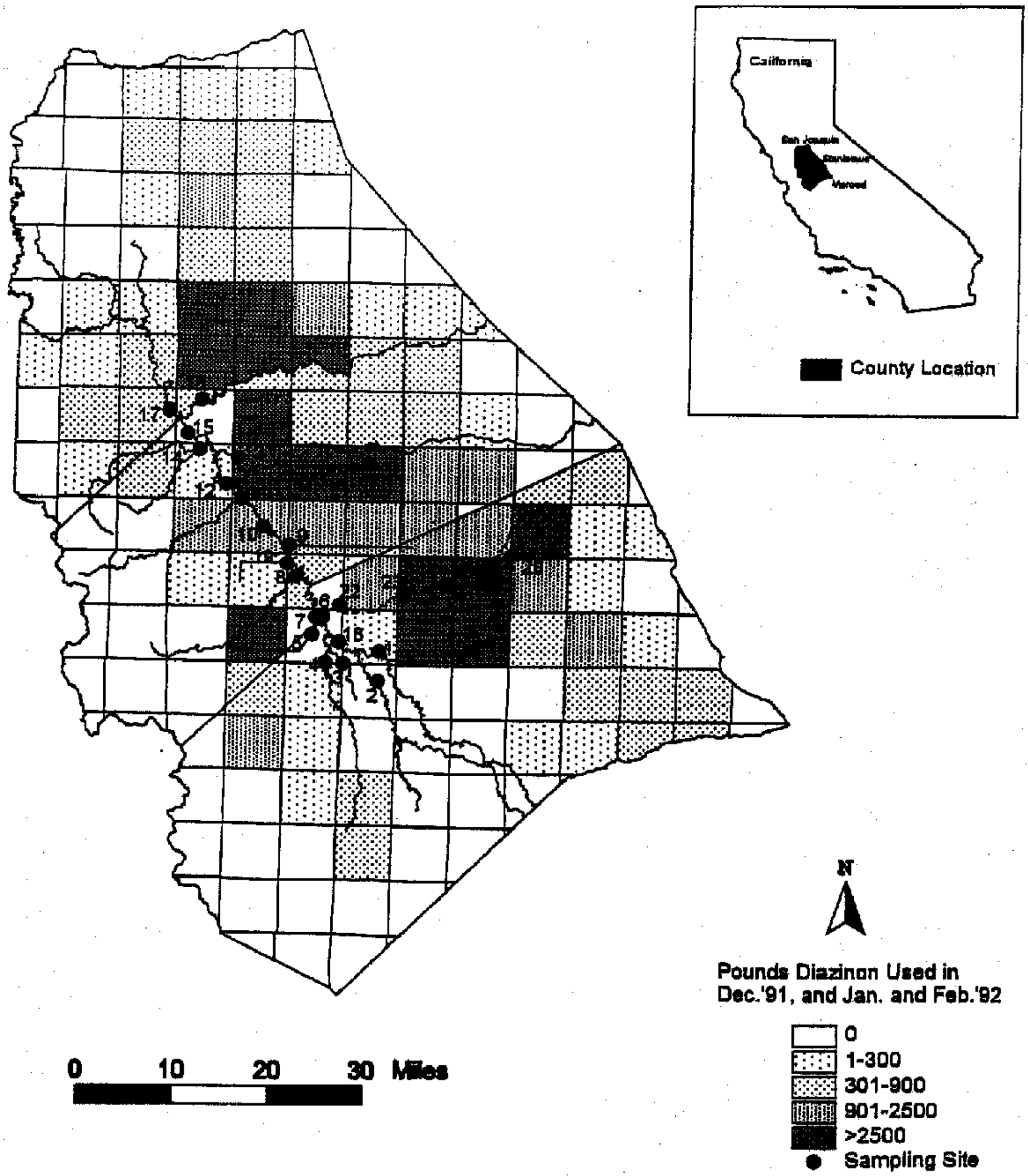

Figure 3. Diazinon use (lbs) during the 1991-92 dormant spray season.

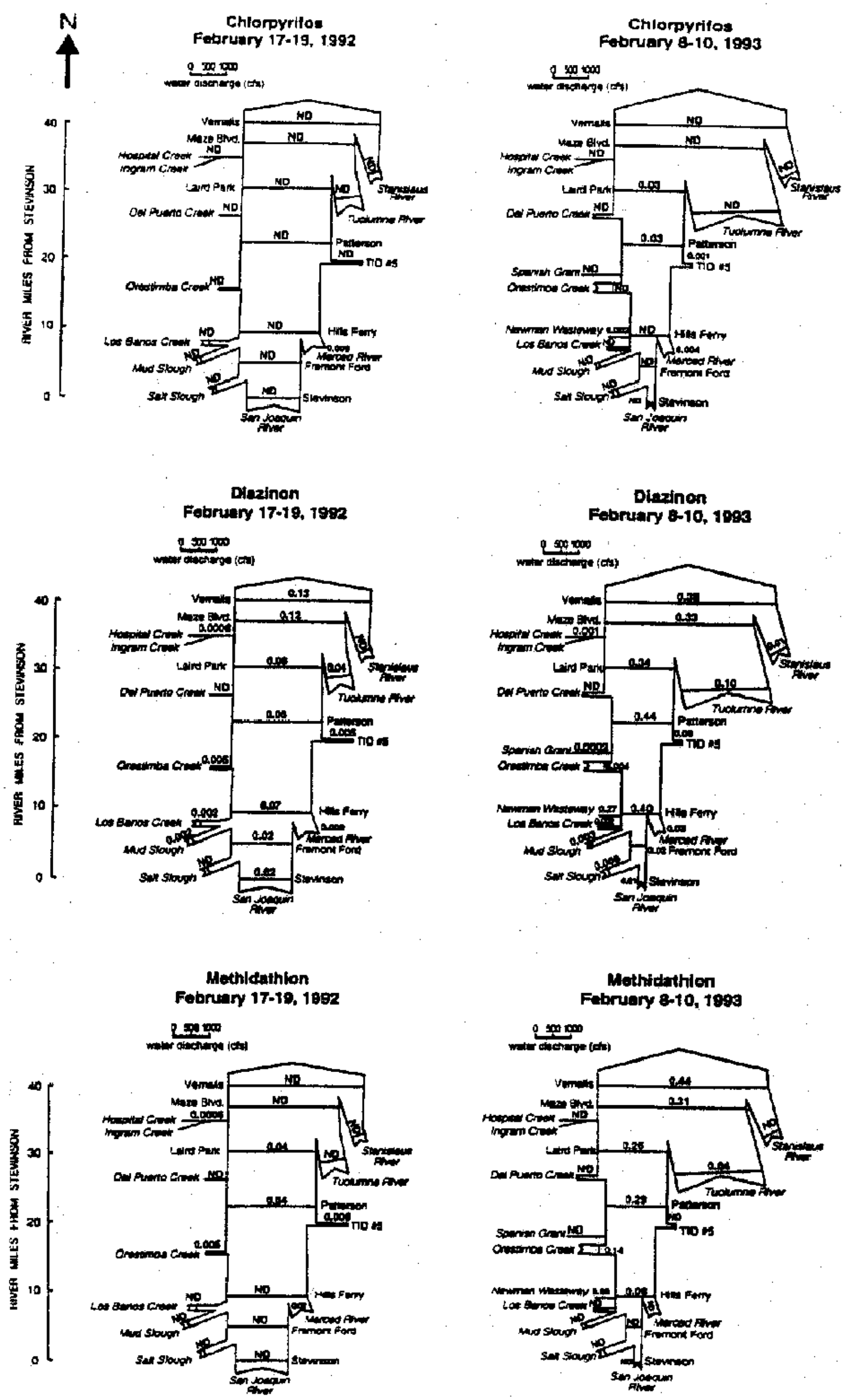

Figure 4. Insecticide loads (lbs/hour) in the San Joaquin River during rain events in February 1992 and February 1993. Water flow is from south to north.

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Subject: LETTER OF SUPPORT
Date: Thu, 15 Apr 1999 08:08:38 -0500
From: Michael McElhiney <michael.mcelhiney@ca.usda.gov>
To: Lisa Ross <lross@cdpr.ca.gov>
CC: "Michael.Mcelhiney" <Michael.Mcelhiney@ca.usda.gov>

CALFED Bay-Delta Program1416 Ninth St., Ste. 1155
Sacramento, Ca. 95814

Re: Letter of Support for California Department of Pesticide Regulation
1999 Grant Proposal
REDUCTION OF INSECTICIDE LOADS IN THE SAN JOAQUIN RIVER WATERSHED

The West Stanislaus Resource Conservation District Board of Directors met April 14, 1999 and unanimously voted to support the grant proposal application from the California Department of Pesticide Regulation as stated above. The RCD has been actively engaged in finding and implementing solutions to water quality concerns in the lower San Joaquin River for over 15 years.

The RCD has worked cooperatively with a number of Local, State and Federal agencies, including Cal-EPA and the Department of Pesticide Regulation to reduce pesticide runoff from agricultural fields in Western Stanislaus County. We believe the type of work proposed by Lisa Ross and collaborators will result in new methods of reducing pesticides that presently impact the San Joaquin River.

We are presently implementing the USDA Natural Resources Conservation Service's Environmental Quality Incentives Program that provides incentives to farmers for implementing Best Management Practices. We believe that more on-farm practices will be adopted if this grant is funded. Soluble pesticide runoff is a critical resource concern in this area.

The West Stanislaus RCD agrees to assist DPR in their outreach efforts to farmers in our District. The RCD will also assist in identifying cooperator growers for demonstration farms.

As the District Conservationist, I fully support the efforts identified in this grant proposal.

Michael McElhiney
District Conservationist
USDA Natural Resources Conservation Service
3800 Cornucopia Way, Ste. E.
Modesto, Ca. 95358

(209) 491-9320
FAX 491-9331

michael.mcelhiney@ca.usda.gov

KATHY L

Department of Pesticide Regulation

830 K Street • Sacramento, California 95814-3510 • www.cdpr.ca.gov

Winston H. Hickox
Secretary for Environmental Protection

Gray Davis
Governor

April 16, 1999

Board of Supervisors President Keith Carson
County Administrative Building
1221 Oak Street, Suite 536
Oakland, California 94612

Dear Honorable Keith Carson:

As required by the CALFED Bay Delta Program, the California Department of Pesticide Regulation (DPR) is hereby notifying you that we are submitting four proposals in response to the recent CALFED Proposal Solicitation package. The projects that DPR are proposing may either be performed in your county, or may involve collection of data related to activities in your county.

The proposed projects are:

DPR Pesticide Use Data on an Internet Site
A project to make the DPR Pesticide Use Report Database available to users through the Internet. Work will be performed in Sacramento and Yolo counties; however, data encompasses all counties in the CALFED area.

Reduction of Insecticides Loads in the San Joaquin Watershed
A project to evaluate best management practices to reduce surface water contamination from insecticides used in almonds. Work may be performed in Stanislaus, San Joaquin, and/or Merced counties. Work may also be performed in one or more counties in the Sacramento Valley. Final identification of counties will depend on identification of cooperating growers.

Adaptive Development of a Watershed Specific Pesticide Use Monitoring Strategy
Project will assess pesticide use, chemistry, and toxicological data for use in the developing a comprehensive monitoring strategy for CALFED. Work will be performed in Sacramento county, however, data may be collected and assessed concerning any county within the CALFED area.

Implementation of Management Practices that Prevent Offsite Movement of Chlorpyrifos from Alfalfa
A project to evaluate best management practices to reduce surface water contamination from insecticides used in almonds. Work will be performed in Stanislaus, San Joaquin, and/or Merced counties. Final identification of counties will depend on names of cooperating growers.

Unless we hear otherwise, DPR will consider the Alameda County agricultural commissioner, Mr. Earl G. Whitaker as our contact person for projects in your county. If you have any questions please feel free to contact me, or your staff may contact Ms. Kathy Brunetti, of my staff, at (916) 324-4100. You can also reach Kathy by fax, at (916) 324-4088 or by e-mail, at <kbrunetti@cdpr.ca.gov>.

Sincerely,

Douglas Y. Okumura, Acting Assistant Director
Division of Enforcement, Environmental
Monitoring, and Data Management
(916) 324-4100

cc: Ms. Kathy Brunetti
Mr. Daniel J. Merkley
CALFED Bay Delta Program
CAC

A similar letter was sent to:

Board of Supervisors President Keith Carson
County Administrative Building
1221 Oak Street, Suite 536
Oakland, California 94612

Board of Supervisors Chair Chris Gansberg
PO Box 158
Markleeville, California 96120

Board of Supervisors Chair Edward T. Bamert
500 Argonaut Lane
Jackson, California 95642

Board of Supervisors Chair Fred C. Davis
25 County Center Drive
Oroville, California 95965

Board of Supervisors Chair Terri Bailey
Government Center
891 Mountain Ranch Road
San Andreas, California 95249

Board of Supervisors Chair Nathaniel L. McCoy
County Courthouse
546 Jay Street
Colusa, California 95932

Board of Supervisors Chair Mark DeSaulnier
County Administration Building
651 Pine Street, Room 106
Martinez, California 94553

Board of Supervisors Chair John E. Upton
330 Fair Lane
Placerville, California 95667

Board of Supervisors Chair Stan Oken
2281 Tulare Street, Hall of Records, Room 300
Fresno, California 93721

Board of Supervisors Chair Dick Mudd
526 West Sycamore Street
Willows, California 95988

Board of Supervisors Chair Joe Neves
County Government Courthouse
1400 West Lacy Boulevard
Hanford, California 93230

Board of Supervisors Chair Carl M. Larson
255 North Forbes Street
Lakeport, California 95453

Board of Supervisors Chair Lyle Lough
221 South Roop Street
Susanville, California 96130

Board of Supervisors Chair Gail H. Mcintyre
209 West Yosemite Avenue
Madera, California 93637

Board of Supervisors President Harry Moore
3501 Civic Center Drive
San Rafael, California 94903

Board of Supervisors Chair Patti Reilly
PO Box 784
Mariposa, California 95338

Board of Supervisors Chair Joe Rivero
2222 M Street
Merced, California 95340

Board of Supervisors Chair Ben Zandstra
County Courthouse
PO Box 131
Alturas, California 96101

Board of Supervisors Chair Mike Rippey
1195 3rd Street, Room 310
Napa, California 94559

Board of Supervisors Chair Rene Antonson
950 Maidu Avenue
Nevada City, California 95959

Board of Supervisors Chair Rex Bloomfield
175 Fulweiler Avenue
Auburn, California 95603

Board of Supervisors Chair Phillip Resciani
County Courthouse
PO Box 10207
Quincy, California 95971

Board of Supervisors Chair Donald Nottoli
700 H Street, Suite 2450
Sacramento, California 95814

Board of Supervisors President Barbara Kaufman
City Hall
San Francisco, California 94102

Board of Supervisors Chair Edward A. Simas
Courthouse
222 East Weber, Room 701
Stockton, California 95202

Board of Supervisors President Mike Nevin
401 Marshall Street
Redwood City, California 94063

Board of Supervisors Chair Dianna McKenna
County Government Courthouse
70 West Hedding Street
San Jose, California 95110

Board of Supervisors Chair Richard Dickerson
1815 Yuba Street
Redding, California 96001

Board of Supervisors Chair Richard Luchessi
County Courthouse
PO Drawer D
Downieville, California 95936

Board of Supervisors Chair Bill Hoy
PO Box 338
Yreka, California 96097

Board of Supervisors Chair Gordon Gojkovich
Old Court House
580 Texas Street
Fairfield, California 94533

Board of Supervisors Chair Thomas Mayfield
1100 H Street
Modesto, California 95354

Board of Supervisors Chair Cornelis Casey Kroon
1160 Civic Center Boulevard
Yuba City, California 95993

Board of Supervisors Chair Charles Willard
PO Box 250
Red Bluff, California 96080

Board of Supervisors Chair Matt Leffler
County Courthouse
PO Box 1258
Weaverville, California 96093

Board of Supervisors Chair Bill Maze
Administration Building
2800 West Burrel
Visalia, California 93291

Board of Supervisors Chair Larry Rotelli
2 South Green Street
Sonora, California 95370

Board of Supervisors Chair Dave Rosenberg
625 Court Street, Room 204
Woodland, California 95695

Board of Supervisors Chair Al Amaro
215 5th Street
Marysville, California 95901

I-018759

Winston H. Hickox
Secretary for Environmental Protection

Department of Pesticide Regulation

830 K Street • Sacramento, California 95814-3510 • www.cdpr.ca.gov

Gray Davis
Governor

April 16, 1999

Bay Conservaion and Development Commission
30 Van Ness Avenue, Room 2011
San Francisco, California 94102

Dear Commission Members:

As required by the CALFED Bay Delta Program, the California Department of Pesticide Regulation (DPR) is hereby notifying you that we are submitting four proposals in response to the recent CALFED Proposal Solicitation package. The projects that DPR are proposing may either be performed in your region, or may involve collection of data related to activities in your county.

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If you have any questions, please contact Ms. Kathy Brunetti, of my staff, at (916) 324-4087. You can also reach her by e-mail, at <kbrunetti@cdpr.ca.gov>.

Sincerely,

Douglas Y. Okumura, Acting Assistant Director
Division of Enforcement, Environmental

I-018761

Department of Pesticide Regulation

Winston H. Hickox
Secretary for Environmental Protection

830 K Street • Sacramento, California 95814-3510 • www.cdpr.ca.gov

Gray Davis
Governor

April 16, 1999

Delta Protection Commission
P.O. Box 530
Walnut Grove, California 95690

Dear Commission Members:

As required by the CALFED Bay Delta Program, the California Department of Pesticide Regulation (DPR) is hereby notifying you that we are submitting four proposals in response to the recent CALFED Proposal Solicitation package. The projects that DPR are proposing may either be performed in your region, or may involve collection of data related to activities in your region.

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If you have any questions, please contact Ms. Kathy Brunetti, of my staff, at (916) 324-4087. You can also reach her by e-mail, at <kbrunetti@cdpr.ca.gov>.

Sincerely,

Douglas Y. Okumura, Acting Assistant Director
Division of Enforcement, Environmental
Monitoring, and Data Management
(916) 324-4100

cc: Ms. Kathy Brunetti
CALFED Bay Delta Program

Per Table D-1. The Department of Pesticide Regulation, a State Agency, is not submitting state contract forms with this proposal