

Project Information

2005 Proposal Number: 0079

Proposal Title: **Scaling up riparian restoration; generating more cost-effective protocols**

Applicant Organization Name: **Davis, California University of**

Total Amount Requested: **\$101,220**

ERP Region: Sacramento Region

Short Description

This project proposes to restore four agricultural riparian areas and conduct an assessment of restoration techniques to develop cost-effective restoration practices and distribute to stakeholders.

Executive Summary

Executive summary: Scaling up riparian restoration; generating more cost-effective protocols for restoration. The project proposed here will: 1) Restore four agricultural riparian areas with a diversity of native woody plants. 2) Provide the experimental data and analysis of the costs and benefits of common but expensive restoration techniques, and provide new protocols for more cost-effective restoration practices. 3) Widely distribute this information to relevant stakeholders through outreach, field days, and publications. Current restoration techniques for degraded riparian areas consist primarily of planting trees and shrubs from container stock (plants initially grown in a nursery). Planting trees and shrubs from container stock can be prohibitively costly, time-consuming (an additional cost), and logistically difficult for large-scale restoration projects, especially those implemented by private landowners. Previous research has demonstrated that establishing trees and shrubs directly from seed can be more cost effective than using container stock. Other costly restoration interventions include irrigation,

protective tubing, and weed control. Our goal now is to develop a detailed cost benefit analysis of direct seeding in combination with these other common restoration techniques. This adaptive management feedback loop will allow greater effectiveness in scaling-up restoration projects and in encouraging landowners and land managers to engage in greater restoration efforts. In collaboration with a variety of local partners including RCD, NRCS, Audubon California, and the Center for Land-Based Learning, we will implement four restoration/research projects in Butte and Yolo Counties. Our restoration/research projects provide a two-fold benefit, as both scientific and ecologically viable implementations. We will focus the proposed research on quantifying how best to implement direct seeding as a restoration technique. We propose to examine a variety of restoration techniques (irrigation, tubing, and weed control) in two valley and two foothill riparian sites in order to test twelve woody riparian plant species. At each site we will set up a two-way fully factorial design with 8 different management treatments combinations. Species include twelve native woody plants: Mexican Elderberry (*Sambucus mexicana*), California Buckeye (*Aesculus californica*), Coyote Brush (*Baccharis pilularis*), Foothill Pine (*Pinus sabiniana*), Mountain Mahogany (*Cercocarpus betuloides*), Toyon (*Heteromeles arbutifolia*), Coffeeberry (*Rhamnus californica*), Buckbrush (*Ceanothus cuneatus*), Oregon Ash (*Fraxinus latifolia*), White Alder (*Alnus rhombifolia*), Box Elder (*Fraxinus latifolia*), and Western Redbud (*Cercis occidentalis*). Along with answering critical restoration questions this project will create four ecologically sound projects that can serve as demonstrations to landowners, government agencies, and non-profit organizations involved in restoration. These projects will also provide critical riparian habitat for endangered and threatened species such as the Valley Elderberry Longhorn Beetle, Swainson's Hawk, and the black rail. The prescriptions derived from this experiment can be used directly by landowners and land managers to implement larger, more cost-effective, restoration projects. We will disseminate our findings through a manual describing our recommended practices, and hold educational field days for stakeholders.

Scaling Up Riparian Restoration: generating more cost-effective protocols.

Section A. Project Description

The project proposed here will:

- 1) Restore four agricultural riparian areas with a diversity of native woody plants.
- 2) Provide the experimental data and analysis of the on costs and benefits of common but expensive restoration techniques, and provide new protocols for more cost-effective restoration practices.
- 3) Through outreach, field days, and publications, widely distribute this information to relevant stakeholders.

1. Problem:

Restoration on agricultural land is often concentrated in riparian and wetland areas, both because of their hydrological and biodiversity value, and because these ecosystems are some of the most endangered in the United States (Mander et al. 2005, Stromberg et al. 2005). Riparian restoration projects are expensive, and are often implemented with the assistance of government agencies and non-profit organizations that can offer cost-share funding, time, and expertise. **Even with this assistance, the scope and scale of these projects is limited by the cost of implementation.** In order for restoration projects to be more feasible for landowners and for larger-scale projects, the costs in materials, time, and labor must be reduced.

The planting of native woody plants is a cornerstone of riparian habitat restoration. A variety of costly interventions are typical, but these are rarely examined for their cost effectiveness. These interventions include irrigation, protective tubing, various forms of weed control, and the use of container stock (as opposed to direct seeding). Each of these interventions can increase the success of individual plants, but at costs that may not justify their benefits. For example, if irrigation doubles planting costs, but only increases tree survival by 50%, it may be far more cost effective to simply plant 50% more seeds, and forego the irrigation. This kind of analysis, and the data in support of such analysis, is completely lacking for riparian restoration.

Current techniques of revegetating disturbed or reclaimed areas consist primarily of planting trees and shrubs from container stock (plants initially grown in a nursery). Planting trees and shrubs from container stock can be prohibitively costly, time-consuming (an additional cost), and logistically difficult for large-scale restoration projects, especially those implemented by private landowners (Benayas and Camacho-Cruz 2004). The difficulty of establishing trees from nursery-grown plants is especially evident in harsh or remote sites where irrigation may be unreliable and adequate site preparation (digging or augering holes) may not be possible. Moreover, the logistical difficulty in insuring that container stock is planted correctly by hired crews or volunteers in remote or large scale projects can lead to low survival rates. In addition, there are rooting problems with container stock that may limit their efficacy in restoration settings (McCreary 1996; reviewed in Young and Evans 2001).

Establishing trees and shrubs directly from seed may offer a more cost effective, efficient, and ultimately more successful restoration strategy. Direct seeding also could more effectively mimic natural processes of seed dispersal and seedling recruitment ultimately resulting in a more ecologically sound project. Direct seeding has been demonstrated to be far more cost-effective than container stock in the establishment of Valley Oak (*Quercus lobata*) (Young and Evans, 2005). Initial results from our work in 2004 suggest that direct seeding can be similarly effective with other native California woody species (Palmerlee, in prep.). Because of this and other research, there is increasing evidence that restoration practitioners should move towards techniques of direct seeding. This change alone would result in substantially reducing costs for riparian restoration.

We now seek to build on this early work to examine several other common interventions (**irrigation, protective tubing, weed control**) which are both costly and effective, but not previously the subject of cost-effectiveness analysis. For example, Young and Evans (2005) demonstrated that Valley Oaks planted as seeds established well even without irrigation, but only if protected from herbivory.

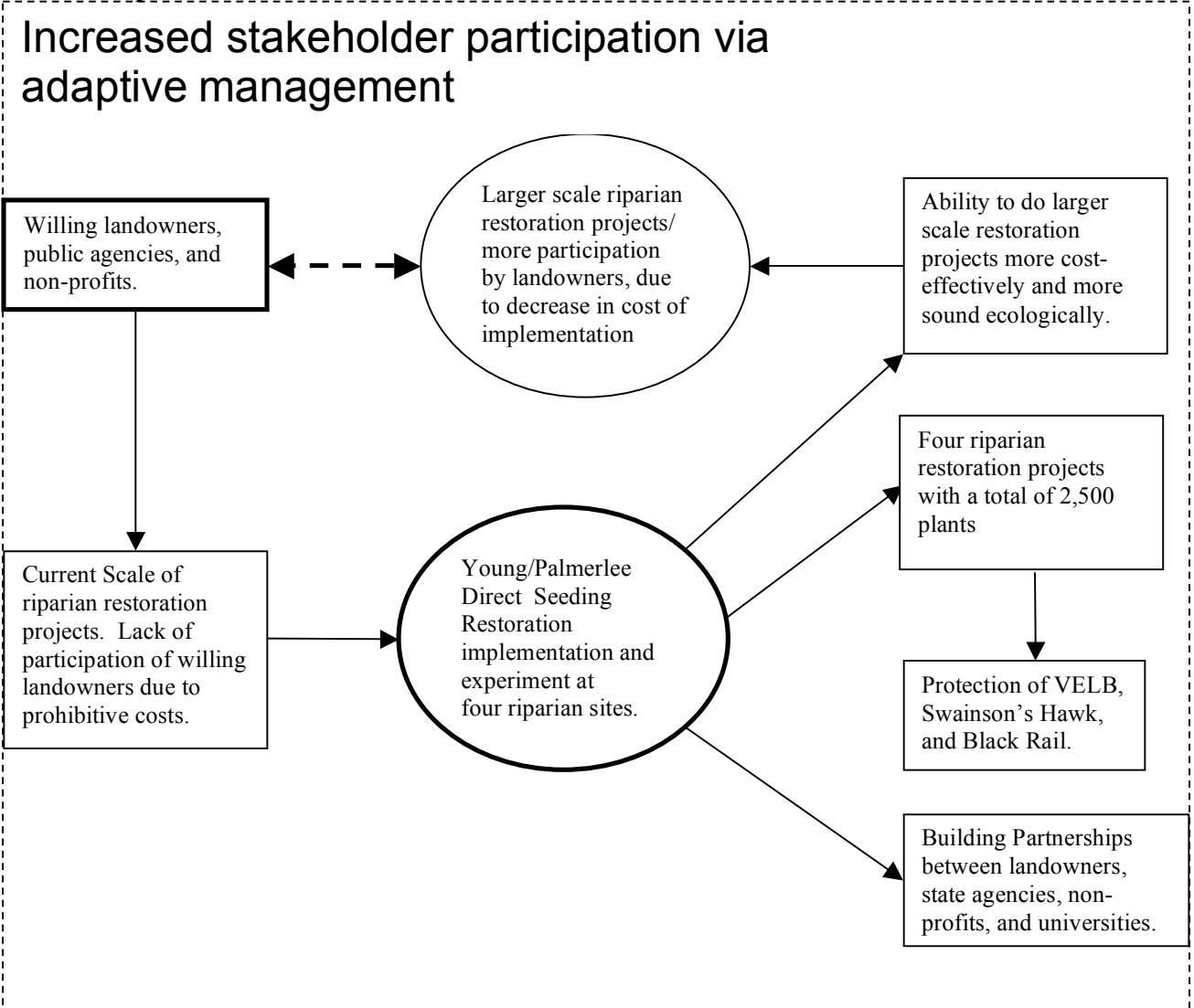
2. Goals and Objectives:

Our restoration/research projects provide a two-fold benefit, as both scientific and ecologically viable implementations. We propose to examine the variety of restoration techniques (irrigation, tubing, and weed control) in two valley and two foothill riparian sites in order to test 12 woody riparian plant species. Because of the breadth of our planting palette, and the fact that these projects will be carried out within restoration plans, these studies will not only answer critical restoration questions but will also create viable and diverse habitat.

The development of more cost-efficient planting techniques can reduce costs and produce more affordable restoration protocols. The 2004 preliminary experiment paired direct seeded plants with container stock of the same species at a single riparian site. Both container stock and direct seed were protected with a plastic tube (Tubex) and controlled for weeds. Each pair received the same amount of water via drip irrigation. These results clearly showed the cost-effectiveness of direct-seeding (Palmerlee, in prep.). We now wish to expand that pilot study to include an appropriately replicated full study at a variety of riparian restoration sites that test the value of these latter costly restoration techniques. This research is not only unique in carrying out explicit cost-effectiveness analyses, but is also unique in involving 12 species of riparian woody plants and multiple restoration sites.

This project will work with, among other species, Elderberry (*Sambucus mexicana*) which is the sole habitat of the endangered Valley Elderberry Longhorned Beetle (*Desmocerus californicus dimorphus*) (VELB). Valley restoration sites will support Swainson's hawk (*Buteo swainsoni*) habitat. At least one Butte County foothill site will provide habitat for the threatened Black Rail (*Laterallus jamaicensis coturniculus*). Providing more cost-effective methods of restoration will allow more acreage per dollar be dedicated to protection of these and other threatened species. Providing information directly to landowners, government agencies, and non-profits will help to disseminate the information of our findings. We will thus produce a manual describing our recommended practices, and hold educational field days for these stakeholders (see outreach and public involvement).

3. Conceptual Model



This model shows how the proposed research will use an adaptive management approach to improving riparian restoration, along with additional project benefits. The current willingness/eagerness of landowners, government agencies, and non-profits to implement restoration projects is not being met by the current high cost of the projects. Our proposed projects will serve as demonstrations, and will provide a scientific basis for new cost-effective recommendations for implementation of restoration projects. These findings will be disseminated to the various stakeholders, ultimately leading to the opportunity for larger restoration projects. This will also allow participation of willing landowners for whom previous projects were cost prohibitive. Not only however will this project provide valuable information to stakeholders, it will create four ecologically viable restoration projects that will provide habitat to a broad range of wildlife, including endangered and threatened species such as VELB, Swainson's hawk, and the Black rail.

4. Approach and Scope of Work:

We will focus the proposed research on quantifying how best to implement direct seeding as a restoration technique, in the context of various costly planting interventions. We will test the following hypotheses:

1. Direct seeding can be made more cost-effective on a large scale by:
 - 1.a. Testing the effectiveness measures such as labor, tubes, management, and irrigation, across different riparian species, and riparian sites differing in herbivore species presence
 - 1.b. Compensating for seed viability and seedling mortality by increased seeding rates.
- We expect that the answers will be both species-specific and site specific, allowing for detailed cost-effective restoration prescriptions.

Experimental design:

We are in the process of identifying several agricultural riparian sites suitable for restoration, and that differ in the presence or key riparian herbivores (cattle and beavers). At each site we will set up a four-way fully factorial design with eight different management treatments encompassing all combinations of three planting interventions: irrigation, protective tubing, and weed control. Species include twelve native woody plants:

Table 1.

Species	Common Name	Type	Maximum Ht (m)
<i>Aesculus californica</i>	California Buckeye	Tree	15
<i>Alnus rhombifolia</i>	White Alder	Tree	20
<i>Baccharis pilularis</i>	Coyote Brush	Shrub	5
<i>Ceanothus cuneatus</i>	Buckbrush	Shrub	4
<i>Cercis occidentalis</i>	Western Redbud	Shrub	7
<i>Cercocarpus betuloides</i>	Mountain Mahogany	Shrub	5
<i>Fraxinus latifolia</i>	Oregon Ash	Tree	20
<i>Fraxinus latifolia</i>	Box Elder	Tree	20
<i>Heteromeles arbutifolia</i>	Toyon	Shrub	5
<i>Pinus sabiniana</i>	Foothill Pine	Tree	30
<i>Rhamnus californica</i>	Coffeeberry	Shrub	4
<i>Sambucus mexicana</i>	Mexican Elderberry	Shrub	6

The Valley and Foothill sites will contain different combinations of ten of the twelve species, based on their appropriateness. All seed will be collected on site and scarified or stratified as necessary. **Treatments will include all eight combinations of 1) herbicide treatment, 2)tubing, and 3) irrigation, in a random-stratified, fully factorial split-plot design.** There will be eight treatment combinations. Each plot will have a control in the areas between the planting lines where we will monitor for natural seedling recruitment. Each treatment will be replicated 10 times per site at four valley and foothill riparian sites, for a total of 2400 individuals.

Prior to planting, 100m x 100m plots will receive spring burns with the help of local CDF fire crews in order to remove vegetative cover and reduce weed seed bank. Plantings will be laid out within these burned areas. Half of all plantings will have a 1m buffer area sprayed with a post-emergent herbicide (glyphosate) just before planting. Half of the plantings will receive a

1m x 10cm blue translucent tube, staked above the planted seed(s). Half of the plantings will be drip irrigated for the first two summers.

At each stage of the restoration process, detailed notes will be kept for each treatment combination of materials costs, time costs. Time costs will be assessed by focal sampling of planting crews, working on one treatment combination at a time. We will monitor success over a three-year period (see below).

5. Performance Evaluation:

The monitoring component of this project will provide a quantitative assessment of the cost-effectiveness and efficacy of these restoration techniques. Every three months, all planted individuals will be surveyed for growth and mortality. We will measure height, stem number, and stem diameters at 30 cm and 150cm (dbh). We will also score plants for herbivore damage and reproduction. Site factors will be recorded as well (slope, aspect, shade). In addition, natural recruitment will be monitored within each treatment between the planting areas as a control.

When combined with the cost estimates (above), we will then calculate the cost per surviving seedling of each treatment combination, including multiple cost scenarios for potential changes in labor and materials costs. We will also calculate the costs for seedlings attaining different sizes, and estimate times to reach target sizes.

6. Feasibility:

The proposed restoration research will take place on four private agricultural properties. Two properties will be in rangeland riparian systems, and two in valley riparian systems. Each project will take place on farms and ranches where active restoration has been taking place for at least one year. The proposed projects will fill in gaps of connectivity on these properties creating more complete habitat corridors. A total of approximately 2,500 plants will be plant at these four sites. Because the plantings consist of planting from seed and not from containers there are great savings in time and labor, thus making it feasible for to implement the project. There are no foreseen problems in plant or restoration materials acquisition. In years two and three, if necessary, replanting will augment sites to ensure the ecological viability of each site.

There is also support from agencies such as RCD and NRCS, and non-profits such as Audubon California and the Center for Land-Based Learning. These entities will assist in augmenting these project areas with a more diverse palette of plants including willows, cottonwoods, native grasses, sedges, rushes, and nest boxes. Both Dr. Young and Mr. Palmerlee have close working relationships with all partner organizations having collaborated on previous projects. Our final project sites have not yet been chosen, from among several potential sites already identified. They will be selected in agreement with the respective landowners, RCD, NRCS, and cooperating non-profit agencies. Letters of support from our partners, including potential landowners, are attached to demonstrate their commitment to working with us and the assurance of viable project sites.

7. Data Handling, Storage and Analysis:

Data will be entered the same day as collected into an Excel data file backed up regularly. These data will later be imported into statistical packages (SAS, JMP) for formal analysis. Data will be collected for three years and analyzed using three-way MANOVA for inter-correlated measures of plant success (height, diameter, growth rate and LOGIT for categorical variables, such as mortality).

Using project records, we will calculate the propagation, planting, and management costs of each species and each management combination, and compare these with field success to produce an estimate of cost-effectiveness.

All data and analysis will be continually archived and available to CalFed, and all relevant stakeholders.

8. Information Value:

This study will provide a detailed cost-benefit analysis for direct seeding for multiple woody species in combination with various combinations for planting interventions, and will provide additional useful information about the restoration techniques that can maximize success of plantings. This information will be communicated through field days to land managers engaged in habitat restoration including: non-profit organizations, federal agencies, and private landowners. We will also disseminate this information to landowners, agencies, and non-profits in the form of a descriptive manual, and through individual contacts (see below). **We anticipate that this information will substantially decreased the costs of riparian conservation projects, allowing for more efficient scaling-up to larger project sizes, and encouraging a greater number of agricultural landowners to participate in restoration projects.**

9. Public Involvement and Outreach:

1. Locally Based Partnerships:

This project relies upon locally-based partnerships with government agencies, and non-profit organizations that benefit private landowners. Because all projects will be implemented on private lands that have received cost-share funding we will work with the RCD and NRCS in each county to coordinate the projects. We also work closely with the Center for Land-Based Learning (CLBL) at each of these sites. CLBL provides hands-on place-based education for high school students. High school students will be actively involved in restoration projects at each of our sites. We are partnering with Audubon California's Landowner Stewardship Program (Audubon California), who works in the Putah and Willow Slough watersheds with farmers interested in implementing restoration projects on their farm. Finally we are partnering with four separate private landowners who are committed to restoration and are hopeful for more cost-effective techniques that can increase the scope and scale of their projects.

2. Disseminating Information:

We will hold two education field days per year for landowners, agencies, and student volunteers, where we will explain the processes of seed treatment, planting, and follow-up maintenance. In the third year of the project we will produce a manual for landowners, agencies, and non-profits describing the details of these techniques and our recommendations. We will also continue to submit results for publication in the peer reviewed journals (*Restoration Ecology, Environmental Management, Ecological Applications*), and in trade outlets such as *California Agriculture*

Section B: Applicability to CALFED Bay-Delta Program and ERP Goals and priorities for this solicitation.

1. ERP Priorities

The project will address the following ERP priorities and priority management practices:

- ***ERP priorities***
- Projects that contribute to understanding the relative effectiveness of different conservation-based farming practices and systems, and their contribution to larger restoration efforts.
 - The proposal is specifically designed to facilitate scaling-up conservation-based farming practices by making restoration more cost-effective.
- Projects that develop and implement agricultural activities that benefit MSCS-covered species.
 - The restoration/research projects proposed will provide critical riparian habitat for Valley Elderberry Longhorn Beetle, Swainson’s hawk, and the black rail.
- ***Priority Management Practices (From Table 1 in the RFP).***
 - Riparian and floodplain restoration in agricultural landscape.
 - This proposal includes the implementation of four riparian restoration projects with over 2,000 native species of trees and shrubs. Projects will also consist of native grass, willow, and cottonwood plantings.
 - Tailwater ponds, filter strips, hedgerows, and other wildlife buffers.
 - The research in this proposal will provide critical information to assist more cost-effective planting of wildlife buffers, hedgerows, tail-water ponds, and ditches.

2. Relationship to Other Ecosystem Restoration Actions or Program investments:

This project will partner with local stakeholders including landowners and programs such as NRCS, RCD, Audubon Ca, and the Center for Land-Based Learning that assist landowners in implementing habitat restoration projects. All stakeholders are actively involved in restoration projects both at the sites where our project will be installed, and also in the wider watersheds around our projects. Partners will provide matching funds that will support the implementation of the proposed restoration/research projects.

3. N/A

Section C. Qualifications and Organization

This project encompasses both real restoration implementation as well as focused scientific research. Dr. Truman Young is a Professor and Restoration Ecologist in the Department of Plant Sciences of the University of California, Davis. He has many years of experience examining the direct seeding of native species of oaks (Young and Evans 2001, 2005, Hobbs and Young 2001). Alex Palmerlee is a graduate student in Restoration Ecology at UC Davis, with over three years of restoration experience on over 30 projects in both Butte and Yolo Counties, and has considerable experience collaborating on restoration projects with landowners, RCD, NRCS, Audubon California, and the Center for Land-Based Learning. He designed, implemented, and monitored the direct seeding project from 2004 that showed the viability of direct-seeding for a wide array of woody riparian species.

Section D. Budget

1. Budget:

We recommend that this project be funded in full as it is a relatively small, yet cohesive project. Please see attached budget justification (Appendix A.).

2. Cost Share

- **Cost Sharing Funds:**

- The University of California, Davis will provide \$7,000 annually as a percentage of Truman Young's salary for time committed to project oversight (total, \$21,000).

- **Matching Funds:**

- Approximately \$15,000 from RCD, NRCS, and Audubon California in the form of fencing of project sites already installed for current restoration practices within which our projects will be implemented. Approximately \$5,000 from the Center for Land-Based Learning for coordination of SLEWS education field days at all four sites.

Section E. Compliance with Standard Terms and Conditions

The University of California is appending their standard exception letter. Please see attached letter (Appendix B.).

Section H. n/a

Section G. Literature Cited

- Benayas, J.M.R. & A. Camacho-Cruz. 2004. Performance of *Quercus ilex* saplings planted in abandoned Mediterranean cropland after long-term interruption of their management. *Forest Ecology & Management* **194**:223-233.
- Brown, J. H. & W. McDonald. 1995. Livestock grazing and conservation on southwestern rangelands. *Conservation Biology* **9**:1644-1647.
- Correll, D.L. 2005. Principles of planning and establishment of buffer zones. *Ecological Engineering* **24**:433-439.
- Fleischner, T.L. 1995. Ecological costs of livestock grazing in western North America. *Conservation Biology* **8**:629-644.
- Hobbs, T. and T.P. Young. 2001. Growing Valley Oak. *Ecological Restoration* **19**:165-171.
- Kuusemets, U.V., & Y. Hayakawa. 2005 Purification processes, ecological functions, planning and design of riparian buffer zones in agricultural watersheds. *Ecological Engineering* **24**:421-432.
- McCreary, D.D. 1996. The effects of stock type and radicle pruning on blue oak morphology and field performance. *Annales des Sciences Forestieres* **53**: 641-648.
- McLeod, K.W. 2000. Species selection trials and silvicultural techniques for the restoration of bottomland hardwood forests. *Ecological Engineering* **15**:S35-S46.

- Palmer, M.A., R.F. Ambrose, & N.L. Poff. 1997. Ecological theory and community restoration ecology. *Restoration Ecology* **5**:291-300.
- Sarr, D.A. 2002. Riparian livestock enclosure research in the western United States: a critique and some recommendations. *Environmental Management* **30**:516-526.
- Stromberg, J.C., K.J. Bagstad, J.M. Leenhouts, S.J. Lite & E. Makings. 2005. Effects of stream flow intermittency on riparian vegetation of a semiarid region river (San Pedro River, Arizona). *River Research & Applications* **21**:925-938.
- Young, T.P. & R.Y. Evans. 2001. Container stock versus direct seeding for woody species in restoration sites. *Comb. Proc. Intl. Plant Propagation Soc.* **50**: 577-582.
- Young, T.P. & R.Y. Evans. 2005. Growth and survivorship of valley oaks (*Quercus lobata*) planted from seed and containers. *Native Plants Journal* **6**:83-90.

Appendix A.

Budget justification

Personnel:

Will pay for three years of salary, fees, and benefits for one graduate student to design, implement and monitor the project. The official University of California designation for this graduate student is GSR I at 50 percent time. First year twelve months, second and third years 9 months, plus tuition and fees.

Overhead:

The University of California has an agreement with the state of California to have 25% overhead. This overhead does not include tuition and fees.

Project supplies:

\$2,000 for purchase of laptop computer and statistics software. The use of the laptop will be for collection and storage of photo monitoring records and for collection, storage, and analysis of data.

Experiment supplies:

Fencing at \$2.00/ft. x 1,000ft. for protection of plants against herbivory. Only at sites that don't have matching funds.

Irrigation at \$50.00/1,000 ft plus \$.50/plant for emitters.

Herbicide at \$20.00/gallon

Plastic (Tubex) tree protectors at \$2.00/plant for 2,400 plants.

Travel:

Pays vehicle maintenance and gas costs for travel to and from professional meetings/conferences and field sites. Field sites average 140 miles from Davis round trip. Travel costs calculated at \$0.485 per mile with an average of two visits to each site per \$500 travel allocation to task.

Appendix B.

UNIVERSITY OF CALIFORNIA, DAVIS

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO



SANTA BARBARA • SANTA CRUZ

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Letter in Support of Project Entitled
“Scaling up riparian Restoration: generating more cost-effective protocols for restoration”
Project Director – Dr. Truman Young

It is our pleasure to forward institutional support and approval of the referenced research project to the California Bay-Delta Authority in response to the “Ecosystem Restoration Program” Solicitation.

Please note as outlined in Section E “Compliance with Standard Terms and Conditions” and Attachment 3 “Sample Grant Agreement” we would like to provide notification that UCD takes exception to the following proposed standard clauses:

- Exhibit B – Define the term “satisfactory” throughout this Exhibit as being completed in accordance with the attached Scope of Work
- Exhibit B, Section F – State Travel & Per Diem Expenses Guidelines (Delete)
- Exhibit C – General Terms and Conditions for ERP Grant Agreements (Replace with GIA 101)
- Exhibit D – Special Terms and Conditions for ERP Grants Agreements Article 10 (Replace Article with UC IP Clause on next page)

Please note the above has previously been negotiated with CBDA legal/GCAPS on behalf of the University and agreeable language has been included in current interagency agreements with UC Davis.

Should CALFED make an award to the University, we would anticipate negotiating terms that comply with University and federal guidelines as they pertain to the higher learning institutions and retention of intellectual property rights.

Sincerely,

Alyssa Bunn
Contracts & Grants Analyst

cc: Dr. Truman Young

Replace Article 10 Rights in Data with the following:

Copyright, Patents, Rights in Data, and Notification of Project Progress

A. Copyright: The Cooperator may copyright any work that is subject to copyright and was developed, or for which ownership was purchased, under an award. The Federal and State awarding agencies reserve a royalty-free, nonexclusive, and irrevocable right to reproduce, publish, or otherwise use the work required to be delivered for Federal or State purposes, and to authorize others to do so on their behalf. For computer software, the Cooperator grants to the Federal and State awarding agencies and others acting on their behalf, a paid up, nonexclusive, irrevocable worldwide license for all such computer software to reproduce, prepare derivative works, and perform publicly and display publicly, by or on behalf of the awarding government(s). The Cooperator shall have the right to disclose, disseminate and use such work, subject to inclusion of appropriate acknowledgment of credit to the awarding agency or agencies, and if any, all other cost sharing partners for their financial support. Except for publication of results or dissemination of materials for education or research purposes, the Cooperator shall not sell or grant rights to such copyright works required to be delivered under this agreement to the awarding agency or agencies to a third party who intends to sell such works as a profit-making venture.

B. Patents: Cooperator is subject to applicable regulations governing patents and inventions, including government-wide regulations issued by the Department of Commerce at 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements." Pursuant to such regulation, with respect to any subject invention in which the Cooperator retains title, the Federal government shall have a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced by or on behalf of the United States the subject invention throughout the world. Pursuant to any agreement funded by the State of California and not subject to such regulation, the State of California shall have a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced such invention by or on behalf of the State of California throughout the world.

C. Rights in Data: The Federal and State Government has the right to:
(1) obtain, reproduce, publish or otherwise use the data first produced under an award; and
(2) authorize others to receive, reproduce, publish, or otherwise use such data by or on behalf of the Federal or State government(s).

D. Notification of Project Progress: The Cooperator shall keep the awarding agency, CALFED, and other cost sharing partners informed of the progress of the project through communication with the Project Officer. Copies of reprints of articles or presentation of project results will be provided to the Project Officer. Where the project scope of work specifies a deliverable that will be disseminated by the awarding agency, CALFED, or other partners, such as a brochure or video, drafts of such deliverables will be submitted for review.

Tasks And Deliverables

Task ID	Task Name	Start Month	End Month	Personnel Involved	Deliverables
1	administrative	1	36	Young, Truman Palmerlee, Alex	Administrative work will include cost-share funding from UC Davis for oversight, cost verification, and environmental compliance. Data will be collected regularly and stored after installation is complete. Information in quarterly reports regarding these activities, including sample data sheets. Additionally we will hold a minimum of two field days per year for local high school students, and farmers. Field days will include participation in implementation

					and demonstration of restoration techniques. Information in quarterly and annual reports regarding these activities.
2	site preparation	1	7	Palmerlee, Alex	Site preparation will include burning, fencing, and spraying (as necessary). Information in quarterly and annual reports regarding these activities.
3	Project installation	4	6	Palmerlee, Alex	Project installation will include planting, tubing, and setting up irrigation. Information in quarterly and annual reports regarding these activities.
4	Re-planting	16	28	Palmerlee, Alex	Replanting at sites that require additional planting to either support research or efficacy of restoration. Re-planting

				would include deliverables in tasks 1-3. Information in quarterly and annual reports regarding these activities.
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BUDGET FOR TASK ONE (Administrative)	TOTAL AMOUNT TASK 1 All Years	Year 1			Year 2			Year 3		
		Amount per hour	Number of Hours	Total Amount for Year 1	Amount per hour	Number of Hours	Total Amount for Year 2	Amount per hour	Number of Hours	Total Amount for Year 3
Personnel										
Research assistant support (UC Davis graduate student)	\$ 18,011.00	\$ 15.77	250	\$ 3,942.00	\$ 16.24	350	\$ 5,684.00	\$ 16.77	500	\$ 8,385.00
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Personnel Subtotal	\$ 18,011.00			\$ 3,942.00			\$ 5,684.00			\$ 8,385.00
^{1/} Benefits as percent of salary	3%			\$118.26			\$170.52			\$251.55
Personnel Total (salary + benefits)	\$18,551.33			\$4,060.26			\$5,854.52			\$8,636.55
Other Costs	Total All Years			Total Year 1			Total Year 2			Total Year 3
Operating Expenses: (ex: seed, plant materials, irrigation supplies, software, office supplies, etc)	\$ 2,500.00			\$ 2,000.00			\$ -			\$ 500.00
2/ Travel and Per Diem	\$ 1,500.00			\$ 500.00			\$ 500.00			\$ 500.00
3/ Equipment	\$ -			\$ -			\$ -			\$ -
4/ Tuition/fees (not subject to overhead)	\$ 12,183.00			\$ 2,509.00			\$ 3,845.00			\$ 5,829.00
4/ Sub-Contractor	\$ -			\$ -			\$ -			\$ -
4/ Sub-Contractor	\$ -			\$ -			\$ -			\$ -
4/ Sub-Contractor	\$ -			\$ -			\$ -			\$ -
4/ Sub-Contractor	\$ -			\$ -			\$ -			\$ -
Other Costs Subtotal	\$ 16,183.00			\$ 5,009.00			\$ 4,345.00			\$ 6,829.00
^{5/} Overhead Percentage (Applied to Personnel & Other Costs)	25%			\$ 1,640.07			\$ 1,588.63			\$ 2,409.14
Other Costs Total (subtotal + overhead)	\$ 21,820.83			\$ 6,649.07			\$ 5,933.63			\$ 9,238.14
Total Costs for Task One	\$ 40,372.16			\$ 10,709.33			\$ 11,788.15			\$ 17,874.69

- 1/ Indicate your rate, and change formula in column immediately to the right of this cell
- 2/ Travel expenses and per diem must be at rates specified by the Department of Personnel Administration. The contractor is required to maintain travel receipts and records for auditing purposes.
- 3/ Please provide a list and cost of major equipment (\$5,000 or more) to be purchased, and complete "Equipment Detail" Worksheet
- 4/ Please list each subcontractor and amounts (if subcontractor not selected yet, use function like "ditch construction subcontractor")
- 5/ Indicate rate in column immediately to the right of this cell; and provide a description of what expenses are covered by overhead. If overhead is > 15% must provide justification

BUDGET FOR TASK TWO	TOTAL AMOUNT TASK 2 All Years	Year 1			Year 2			Year 3		
		Amount per hour	Number of Hours	Total Amount for Year 1	Amount per hour	Number of Hours	Total Amount for Year 2	Amount per hour	Number of Hours	Total Amount for Year 3
Personnel										
Research assistant support (UC Davis graduate student)	\$ 3,942.50	\$ 15.77	250	\$ 3,942.50	\$ -		\$ -	\$ -		\$ -
	\$ -	\$ -		\$ -	\$ -		\$ -	\$ -		\$ -
	\$ -	\$ -		\$ -	\$ -		\$ -	\$ -		\$ -
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	\$ -	\$ -		\$ -	\$ -		\$ -	\$ -		\$ -
	\$ -	\$ -		\$ -	\$ -		\$ -	\$ -		\$ -
Personnel Subtotal	\$ 3,942.50			\$ 3,942.50			\$ -			\$ -
^{1/} Benefits as percent of salary	3%			\$118.28			\$0.00			\$0.00
Personnel Total (salary + benefits)	\$4,060.78			\$4,060.78			\$0.00			\$0.00
Other Costs	Total All Years			Total Year 1			Total Year 2			Total Year 3
Operating Expenses: (ex: seed, plant materials, irrigation supplies, software, office supplies, etc)	\$ 1,500.00			\$ 1,500.00			\$ -			\$ -
2/ Travel and Per Diem	\$ 500.00			\$ 500.00			\$ -			\$ -
3/ Equipment	\$ -			\$ -			\$ -			\$ -

4/Tuition/fees (not subject to overhead)	\$	2,509.00	\$	2,509.00	\$	-	\$	-
4/ Sub-Contractor	\$	-	\$	-	\$	-	\$	-
4/ Sub-Contractor	\$	-	\$	-	\$	-	\$	-
4/ Sub-Contractor	\$	-	\$	-	\$	-	\$	-
4/ Sub-Contractor	\$	-	\$	-	\$	-	\$	-
Other Costs Subtotal	\$	4,509.00	\$	4,509.00	\$	-	\$	-
⁵ Overhead Percentage (Applied to Personnel & Other Costs)		25%	\$	1,515.20	\$	-	\$	-
Other Costs Total (subtotal + overhead)	\$	6,024.22	\$	6,024.22	\$	-	\$	-
Total Costs for Task Two	\$	10,084.98	\$	10,084.98	\$	-	\$	-

- 1/ Indicate your rate, and change formula in column immediately to the right of this cell
2/ Travel expenses and per diem must be at rates specified by the Department of Personnel Administration. The contractor is required to maintain travel receipts and records for auditing purposes.
3/ Please provide a list and cost of major equipment (\$5,000 or more) to be purchased, and complete "Equipment Detail" Worksheet
4/ Please list each subcontractor and amounts (if subcontractor not selected vet. use function like "ditch construction subcontractor")
5/ Indicate rate in column immediately to the right of this cell; and provide a description of what expenses are covered by overhead. If overhead is > 15% must provide justification

BUDGET FOR TASK THREE	TOTAL AMOUNT TASK 3 All Years	Year 1		Year 2		Year 3				
		Amount per hour	Number of Hours	Total Amount for Year 1	Amount per hour	Number of Hours	Total Amount for Year 2	Amount per hour	Number of Hours	Total Amount for Year 3
Personnel										
Research assistant support (UC Davis graduate student)	\$ 7,096.50	\$ 15.77	450	\$ 7,096.50	\$ -		\$ -		\$ -	
	\$ -	\$ -		\$ -	\$ -		\$ -		\$ -	
	\$ -	\$ -		\$ -	\$ -		\$ -		\$ -	
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	\$ -	\$ -		\$ -	\$ -		\$ -		\$ -	
Personnel Subtotal	\$ 7,096.50			\$ 7,096.50	\$ -		\$ -		\$ -	
¹ Benefits as percent of salary	3%			\$212.90		\$0.00			\$0.00	
Personnel Total (salary + benefits)	\$7,309.40			\$7,309.40		\$0.00			\$0.00	
Other Costs	Total All Years			Total Year 1		Total Year 2			Total Year 3	
Operating Expenses: (ex: seed, plant materials, irrigation supplies, software, office supplies, etc)	\$ 10,000.00			\$ 10,000.00					\$ -	
2/ Travel and Per Diem	\$ 1,000.00			\$ 1,000.00					\$ -	
3/ Equipment	\$ -			\$ -		\$ -			\$ -	
4/Tuition/fees (not subject to overhead)	\$ 4,438.00			\$ 4,438.00		\$ -			\$ -	
4/ Sub-Contractor	\$ -			\$ -		\$ -			\$ -	
4/ Sub-Contractor	\$ -			\$ -		\$ -			\$ -	
4/ Sub-Contractor	\$ -			\$ -		\$ -			\$ -	
4/ Sub-Contractor	\$ -			\$ -		\$ -			\$ -	
Other Costs Subtotal	\$ 15,438.00			\$ 15,438.00		\$ -			\$ -	
⁵ Overhead Percentage (Applied to Personnel & Other Costs)	25%			\$ 4,577.35		\$ -			\$ -	
Other Costs Total (subtotal + overhead)	\$ 20,015.35			\$ 20,015.35		\$ -			\$ -	
Total Costs for Task Three	\$ 27,324.75			\$ 27,324.75		\$ -			\$ -	

- 1/ Indicate your rate, and change formula in column immediately to the right of this cell
2/ Travel expenses and per diem must be at rates specified by the Department of Personnel Administration. The contractor is required to maintain travel receipts and records for auditing purposes.
3/ Please provide a list and cost of major equipment (\$5,000 or more) to be purchased, and complete "Equipment Detail" Worksheet
4/ Please list each subcontractor and amounts (if subcontractor not selected vet. use function like "ditch construction subcontractor")
5/ Indicate rate in column immediately to the right of this cell; and provide a description of what expenses are covered by overhead. If overhead is > 15% must provide justification

BUDGET FOR TASK FOUR	TOTAL AMOUNT TASK 4 All Years	Year 1		Year 2		Year 3				
		Amount per hour	Number of Hours	Total Amount for Year 1	Amount per hour	Number of Hours	Total Amount for Year 2	Amount per hour	Number of Hours	Total Amount for Year 3
Personnel										
Research assistant support (UC Davis graduate student)	\$ 9,038.00	\$ -		\$ -	\$ 16.24	350	\$ 5,684.00	\$ 16.77	200	\$ 3,354.00
	\$ -	\$ -		\$ -	\$ -		\$ -	\$ -		\$ -
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Personnel Subtotal	\$	9,038.00	\$	-	\$	-	\$	-	\$	5,684.00	\$	-	\$	3,354.00
^{1/} Benefits as percent of salary		3%			\$0.00				\$170.52				\$100.62	
Personnel Total (salary + benefits)		\$9,309.14			\$0.00				\$5,854.52				\$3,454.62	
Other Costs	Total All Years		Total Year 1		Total Year 2		Total Year 3							
Operating Expenses: (ex: seed, plant materials, irrigation supplies, software, office supplies, etc)	\$	3,000.00	\$	-	\$	2,000.00	\$	1,000.00						
2/ Travel and Per Diem	\$	1,500.00	\$	-	\$	1,000.00	\$	500.00						
3/ Equipment	\$	-	\$	-	\$	-	\$	-						
4/Tuition/Fees (not subject to overhead)	\$	6,177.00	\$	-	\$	3,845.00	\$	2,332.00						
4/ Sub-Contractor	\$	-	\$	-	\$	-	\$	-						
4/ Sub-Contractor	\$	-	\$	-	\$	-	\$	-						
4/ Sub-Contractor	\$	-	\$	-	\$	-	\$	-						
4/ Sub-Contractor	\$	-	\$	-	\$	-	\$	-						
Other Costs Subtotal	\$	10,677.00	\$	-	\$	6,845.00	\$	3,832.00						
^{5/} Overhead Percentage (Applied to Personnel & Other Costs)		25%			\$	-	\$	2,213.63	\$	1,238.66				
Other Costs Total (subtotal + overhead)	\$	14,129.29	\$	-	\$	9,058.63	\$	5,070.66						
Total Costs for Task Four	\$	23,438.43	\$	-	\$	14,913.15	\$	8,525.28						

1/ Indicate your rate, and change formula in column immediately to the right of this cell

2/ Travel expenses and per diem must be at rates specified by the Department of Personnel Administration. The contractor is required to maintain travel receipts and records for auditing purposes.

3/ Please provide a list and cost of major equipment (\$5,000 or more) to be purchased, and complete "Equipment Detail" Worksheet

4/ Please list each subcontractor and amounts (if subcontractor not selected yet, use function like "ditch construction subcontractor")

5/ Indicate rate in column immediately to the right of this cell; and provide a description of what expenses are covered by overhead. If overhead is > 15% must provide justification

Note: This budget summary **automatically links** to the costs and totals on the "**Budget Detail**" worksheet.
DO NOT CHANGE FORMULAS OR ENTER NUMBERS INTO ANY CELLS EXCEPT THE SHADED CELLS for "Cost Share" and "Other Matching Funds"

BUDGET SUMMARY	Total Amount for Year 1	Total Amount for Year 2	Total Amount for Year 3	Total Amount for All Years
Total Costs for Task One	\$ 10,541.29	\$ 11,855.00	\$ 17,975.76	\$ 40,372.06
Total Costs for Task Two	\$ 10,085.00	\$ -	\$ -	\$ 10,085.00
Total Costs for Task Three	\$ 27,324.75	\$ -	\$ -	\$ 27,324.75
Total Costs for Task Four	\$ -	\$ 14,893.11	\$ 8,545.24	\$ 23,438.35
Total Costs for Task Five	\$ -	\$ -	\$ -	\$ -
Total Costs for Task Six	\$ -	\$ -	\$ -	\$ -
Total Costs for Task Seven	\$ -	\$ -	\$ -	\$ -
Total Costs for Task Eight	\$ -	\$ -	\$ -	\$ -
Total Costs for Task Nine	\$ -	\$ -	\$ -	\$ -
Total Costs for Task Ten	\$ -	\$ -	\$ -	\$ -
Total Costs for Task Eleven	\$ -	\$ -	\$ -	\$ -
Total Costs for Task Twelve	\$ -	\$ -	\$ -	\$ -
Total Costs for Task Thirteen	\$ -	\$ -	\$ -	\$ -
Total Costs for Task Fourteen	\$ -	\$ -	\$ -	\$ -
Total Costs for Task Fifteen	\$ -	\$ -	\$ -	\$ -
Total Costs for Project Tasks	\$ 47,951.04	\$ 26,748.11	\$ 26,521.00	\$ 101,220.15
1/ Cost Share	\$ 7,000.00	\$ 7,000.00	\$ 7,000.00	\$ 21,000.00
2/ Other Matching Funds	\$ 20,000.00	\$ -	\$ -	\$ 20,000.00

1/ *Cost share funds* are specifically dedicated to your project and can include private and other State and Federal grants. Any funds listed in this line must be further described in the text of your proposal (see Chapter 3, Section D, of the PSP document)

2/ *Other matching funds* include other funds invested consistent with your project in your project area for which the ERP grant applicant is not eligible. Any funds listed in this line must be further described in the text of your proposal (see Chapter 3, Section D, of the PSP document)

Environmental Compliance

CEQA Compliance

Which type of CEQA documentation do you anticipate?

none *Skip the remaining questions in this section.*

negative declaration or mitigated negative declaration

EIR

categorical exemption *A categorical exemption may not be used for a project which may which may cause a substantial adverse change in the significance of a historical resource or result in damage to scenic resources within an officially designated state scenic highway.*

If you are using a categorical exemption, choose all of the applicable classes below.

Class 1. Operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination. The types of "existing facilities" itemized above are not intended to be all-inclusive of the types of projects which might fall within Class 1. The key consideration is whether the project involves negligible or no expansion of an existing use.

Class 2. Replacement or reconstruction of existing structures and facilities where the new structure will be located on the same site as the structure replaced and will have substantially the same purpose and capacity as the structure replaced.

Class 3. Construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures; and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure. The numbers of structures described in this section are the maximum allowable on any legal parcel, except where the project may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies.

Class 4. Minor public or private alterations in the condition of land, water, and/or vegetation which do not involve removal of healthy, mature, scenic trees except for forestry or agricultural purposes, except where the project may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies.

- Class 6. Basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource, except where the project may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies. These may be strictly for information gathering purposes, or as part of a study leading to an action which a public agency has not yet approved, adopted, or funded.

- Class 11. Construction, or placement of minor structures accessory to (appurtenant to) existing commercial, industrial, or institutional facilities, except where the project may impact on an environmental resource of hazardous or critical concern where designated, precisely mapped, and officially adopted pursuant to law by federal, state, or local agencies.

Identify the lead agency.

Please write out all words in the agency title other than United States (Use the abbreviation "US".) and California (Use the abbreviation "CA".).

Is the CEQA environmental impact assessment complete?

If the CEQA environmental impact assessment process is complete, provide the following information about the resulting document.

Document Name

State Clearinghouse Number

If the CEQA environmental impact assessment process is not complete, describe the plan for completing draft and/or final CEQA documents.

NEPA Compliance

Which type of NEPA documentation do you anticipate?

none *Skip the remaining questions in this section.*

- environmental assessment/FONSI

- EIS

- categorical exclusion

Identify the lead agency or agencies.

Please write out all words in the agency title other than United States (Use the abbreviation

"US".) and California (Use the abbreviation "CA").

If the NEPA environmental impact assessment process is complete, provide the name of the resulting document.

If the NEPA environmental impact assessment process is not complete, describe the plan for completing draft and/or final NEPA documents.

Successful applicants must tier their project's permitting from the CALFED Record of Decision and attachments providing programmatic guidance on complying with the state and federal endangered species acts, the Coastal Zone Management Act, and sections 404 and 401 of the Clean Water Act.

Please indicate what permits or other approvals may be required for the activities contained in your proposal and also which have already been obtained. Please check all that apply. If a permit is *not* required, leave both Required? and Obtained? check boxes blank.

Local Permits And Approvals	Required?	Obtained?	Permit Number (If Applicable)
conditional Use Permit	-	-	
variance	-	-	
Subdivision Map Act	-	-	
grading Permit	-	-	
general Plan Amendment	-	-	
specific Plan Approval	-	-	
rezone	-	-	
Williamson Act Contract Cancellation	-	-	
other	-	-	

State Permits And Approvals	Required?	Obtained?	Permit Number (If Applicable)
scientific Collecting Permit	-	-	
CESA Compliance: 2081	-	-	

CESA Compliance: NCCP	-	-	
Lake Or Streambed Alteration Agreement	-	-	
CWA 401 Certification	-	-	
Bay Conservation And Development Commission Permit	-	-	
reclamation Board Approval	-	-	
Delta Protection Commission Notification	-	-	
state Lands Commission Lease Or Permit	-	-	
action Specific Implementation Plan	-	-	
SWRCB Water Transfer Approval	-	-	
other	-	-	

Federal Permits And Approvals	Required?	Obtained?	Permit Number (If Applicable)
ESA Compliance Section 7 Consultation	-	-	
ESA Compliance Section 10 Permit	-	-	
Rivers And Harbors Act	-	-	
CWA 404	-	-	
other	-	-	

Permission To Access Property	Required?	Obtained?	Permit Number (If Applicable)
permission To Access City, County Or Other Local Agency Land Agency Name	-	-	
permission To Access State Land Agency Name	-	-	
permission To Access Federal Land Agency Name	-	-	
permission To Access Private Land Landowner Name	-	-	

If you have comments about any of these questions, enter them here.

Land Use

Does the project involve land acquisition, either in fee or through easements?

No. *Skip to the next set of questions.*

Yes. *Answer the following questions.*

How many acres will be acquired by fee?

How many acres will be acquired by easement?

Describe the entity or organization that will manage the property and project activities, including operation and maintenance.

Is there an existing plan describing how the land and water will be managed?

No.

Yes. *Cite the title and author or describe briefly.*

Will the applicant require access across to or through public or private property that the applicant does not own to accomplish the activities in the proposal?

No. *Skip to the next set of questions.*

Yes. *Answer the following question.*

Describe briefly the provisions made to secure this access.

Of our four private properties slated for restoration, two have already granted access, one is pending, and the fourth site has not yet been chosen (from among several).

Do the actions in the proposal involve physical changes in the current land use?

No. *Skip to the next set of questions.*

Yes. *Answer the following questions.*

Describe the current zoning, including the zoning designation and the principal permitted uses permitted in the zone.

Describe the general plan land use element designation, including the purpose and uses allowed in the designation.

Describe relevant provisions in other general plan elements affecting the site, if any.

Is the land mapped as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, or Farmland of Local Importance under the California Department of Conservation's Farmland Mapping and Monitoring Program?

No. *Skip to the next set of questions.*

Yes. *Answer the following questions.*

Land Designation	Acres	Currently In Production?
Prime Farmland		-
Farmland Of Statewide Importance		-
Unique Farmland		-
Farmland Of Local Importance		-

Is the land affected by the project currently in an agricultural preserve established under the Williamson Act?

No. *Skip to the next set of questions.*

Yes. *Answer the following question.*

Is the land affected by the project currently under a Williamson Act contract?

No. *Skip to the next set of questions.*

Yes. *Answer the following question.*

Why is the land use proposed consistent with the contract's terms?

Describe any additional comments you have about the projects land use.