

Attachment H

COVER SHEET (PAGE 1 of 2)

May 1998 CALFED ECOSYSTEM RESTORATION PROPOSAL SOLICITATION

Proposal Title: Monitoring Tidal Wetland Restorations in the North San Francisco Bay  
 Applicant Name: John Takekawa  
 Mailing Address: P. O. Box 2012, Vallejo, CA 94592  
 Telephone: (707) 562-2000  
 Fax: (707) 562-3001

Amount of funding requested: \$ 225,301 for 3 years

Indicate the Topic for which you are applying (check only one box). Note that this is an important decision: see page \_\_ of the Proposal Solicitation Package for more information.

- Fish Passage Assessment
- Floodplain and Habitat Restoration
- Fish Harvest
- Watershed Planning/Implementation
- Fish Screen Evaluations - Alternatives and Biological Priorities
- Fish Passage Improvements
- Gravel Restoration
- Species Life History Studies
- Education

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

- Sacramento River Mainstem
- Delta
- Suisun Marsh and Bay
- San Joaquin River Mainstem
- Landscape (entire Bay-Delta watershed)
- Sacramento Tributary: \_\_\_\_\_
- East Side Delta Tributary: \_\_\_\_\_
- San Joaquin Tributary: \_\_\_\_\_
- Other: \_\_\_\_\_
- North Bay: Cullinan Ranch, Tolay Creek, Tubbs Island

Indicate the primary species which the proposal addresses (check no more than two boxes):

- San Joaquin and East-side Delta tributaries fall-run chinook salmon
- Winter-run chinook salmon
- Late-fall run chinook salmon
- Delta smelt
- Splittail
- Green sturgeon
- Migratory birds
- Spring-run chinook salmon
- Fall-run chinook salmon
- Longfin smelt
- Steelhead trout
- Striped bass



COVER SHEET (PAGE 2 of 2)

May 1998 CALFED ECOSYSTEM RESTORATION PROPOSAL SOLICITATION

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

- |  |  |
|--|--|
| <input type="checkbox"/> State agency                    | <input checked="" type="checkbox"/> Federal agency |
| <input type="checkbox"/> Public/Non-profit joint venture | <input type="checkbox"/> Non-profit                |
| <input type="checkbox"/> Local government/district       | <input type="checkbox"/> Private party             |
| <input type="checkbox"/> University                      | <input type="checkbox"/> Other: _____              |

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

- |  |   |
|--|---|
| <input type="checkbox"/> Planning              | <input type="checkbox"/> Implementation |
| <input checked="" type="checkbox"/> Monitoring | <input type="checkbox"/> Education      |
| <input type="checkbox"/> 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 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 II.K) 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.

  
\_\_\_\_\_  
(Signature of Applicant)

- Albertson, J. 1995. Habitat use of California clapper rails in the south San Francisco Bay. Unpubl. Master's Thesis. California State University. San Francisco. (Thesis Graduate Advisor).
- Accurso, L. M. 1992. Distribution and abundance of wintering waterfowl on San Francisco Bay, 1988-1990. Unpubl. Master's Thesis. Humboldt State University. Arcata, CA. 252pp. (Research Graduate Advisor).
- Takekawa, J. Y. 1987. Energetics of canvasbacks staging on an upper Mississippi River pool during fall migration. Ph.D. Dissertation. Iowa State University. Ames, IA. 189pp.

### **B. Michael L. Saiki**

MKS has successfully completed several field projects on fish communities during the past 15 years. His studies include abundance and distribution of fishes in rivers or small estuaries in which fish populations were documented and related to the food supply, water quality, or other environmental variables.

### **Selected Publications**

- Jennings, M.R., and M.K. Saiki. 1990. Establishment of red shiner, *Notropis lutrensis*, in the San Joaquin Valley, California. *California Fish and Game* 76:46-57.
- Saiki, M.K. 1984. Environmental conditions and fish faunas in low elevation rivers on the irrigated San Joaquin Valley floor, California. *California Fish and Game* 70:145-157.
- Saiki, M.K. 1997. Survey of small fishes and environmental conditions in Mugu Lagoon, California, and tidally influenced reaches of its tributaries. *California Fish and Game* 83:153-167.
- Saiki, M.K., and C.J. Schmitt. 1985. Population biology of bluegills, *Lepomis macrochirus*, in lotic habitats on the irrigated San Joaquin Valley floor. *California Fish and Game* 71:225-244.
- Saiki, M.K., and J.C. Tash. 1978. Unusual population dynamics in largemouth bass, *Micropterus salmoides* (Lacepede), caused by a seasonally fluctuating food supply. *American Midland Naturalist* 100:116-125.

### **C. Glenn D. Wylie**

GDW research specialties include wetlands and limnology. For the past 6 years, he has worked in California on wetland issues and conservation.

### **Selected Publications**

- Wylie, G.D. 1987. Decomposition and nutrient dynamics of litter of *Quercus palustris* and *Nelumbo lutea* in a wetland complex of southeast Missouri. *Arch Hydrobiol.* 111: 95-106.
- Wylie, G.D., and J.R. Jones. 1986. Limnology of a wetland complex in the Mississippi alluvial valley of southeast Missouri. *Arch. Hydrobiol. Suppl.* 74: 288-314.
- Wylie, G.D. and J.R. Jones. 1987. Diel and seasonal changes of dissolved oxygen and pH in relation to community metabolism of a shallow reservoir in southeast Missouri. *J. Freshwater Ecol.* 4(1): 115-125.

## **VII. Compliance with Standard Terms and Conditions**

See attached documents

Research Excellence Award (top 10% of graduate research). Iowa State University. Ames, IA. May 1987.

Prestigious Award for Career Excellence. Iowa State University. Ames, IA. 1982.

Graduate with Honors Cum Laude (top 2%). University of Washington, Seattle. March 1979.

### Selected Publications

- Hui, C. A., J. Y. Takekawa, V. V. Baranyuk, and K. V. Litvin. 1998. Trace element concentrations in two subpopulations of Lesser Snow Geese from Wrangel Island, Russia. *Arch. Environ. Contam. Toxicol.* 34:197-203.
- Kuznetsov, S. B., V. V. Baranyuk, and J. Y. Takekawa. 1998. Lack of genetic differentiation between wintering populations of lesser snow geese from Wrangel Island, Russia. *Auk* 115:00-00. (*In press*).
- J. Y. Takekawa and N. Warnock. 1998. The Long-billed Dowitcher (*Limnodromus scolopaceus*). *Birds of North America*. (*In press*).
- Whitworth, D. L., J. Y. Takekawa, H. R. Carter, and W. R. McIver. 1997. A night-lighting technique for at-sea capture of Xantus' Murrelets. *Colonial Waterbirds* 20:525-531.
- Ely, C. R., D. C. Douglas, A. C. Fowler, C. A. Babcock, D. V. Derksen, and J. Y. Takekawa. 1997. Migration behavior of tundra swans from the Yukon-Kuskokwim Delta, Alaska. *Wilson Bull.* 109:679-692.
- Ely, C. R., and J. Y. Takekawa. 1996. Geographic variation in migratory behavior of greater white-fronted geese (*Anser albifrons*). *Auk* 113:889-901.
- Sabano, Y., S. Uemura, S. Iwabuchi, M. Kurechi, A. V. Andreev, A. V. Kondratyev, E. V. Syroechkovsky, K. E. Litvin, V. V. Baranyuk, J. Y. Takekawa, and D. L. Orthmeyer. 1996. Restoration of lesser snow geese *Anser caerulescens* to East Asia, an international conservation project. *Gibier Faune Sauvage* 13:1181-1190.
- Warnock, S. E., and J. Y. Takekawa. 1996. Wintering site fidelity and movement patterns of western sandpipers *Calidris mauri* in the San Francisco Bay estuary. *Ibis* 138:160-167.
- Hohman, W. L., G. M. Haramis, D. G. Jorde, C. E. Korschgen, and J. Y. Takekawa. 1995. Canvasback ducks. Pages 40-43 in E. T. LaRoe, G. S. Farris, C. F. Puckett, P. D. Doren, and M. J. Mac (eds.). *Our living resources*. U. S. Dep. Int., Nat. Biol. Serv., Washington, D. C.
- Kurechi, M. Y., Sabano, S. Iwabuchi, E. Syroechkovsky, V. V. Baranyuk, A. Andreev, A. Kondratyev, J. Y. Takekawa, and N. Mita. 1995. Study on the restoration of snow geese to northeast Asia using a miniature satellite transmitter. *Telecommunication Advancement Foundation Res.* 9:518-541 (*in Japanese*).
- Orthmeyer, D. L., J. Y. Takekawa, C. R. Ely, M. L. Wege, and W. E. Newton. 1995. Morphological differences in Pacific coast populations of greater white-fronted geese. *Condor* 97:123-132.
- Warnock, S. E., and J. Y. Takekawa. 1995. Habitat preferences of wintering shorebirds in a temporally changing environment: western sandpipers in the San Francisco Bay estuary. *Auk* 112:920-930.
- Brault, S., S. Boyd, F. Cooke, and J. Y. Takekawa. 1994. Population models as tools for research cooperation and management: the Wrangel Island snow geese. *Trans. N. Am. Wildl. Natur. Resour. Conf.* 59:79-90.
- Takekawa, J. Y., M. Kurechi, E. Syroechkovsky, V. V. Baranyuk, A. Andreev, D. L. Orthmeyer, Y. Sabano, and K. Litvin. 1994. Restoration of lesser snow geese to East Asia: a North Pacific Rim conservation project. *Trans. N. Am. Wildl. Natur. Resour. Conf.* 59:132-145.

## **VI. Applicant Qualifications**

### **A. John Y. Takekawa**

JYT research specialty is on ecology of migratory waterbirds. For the past 12 years, his studies have focused on the Pacific Rim, California and San Francisco Bay. He is the station chief of the San Francisco Bay Estuary Field Station located on San Pablo Bay.

### **Relevant Work Experience**

*August 1995 to present.* Wildlife Biologist (Research), Department of Interior, U. S. Geological Survey, Biological Resources Division, Western Ecological Research Center, San Francisco Bay Estuary Field Station, Vallejo, CA.

*October 1993 to August 1995.* Wildlife Biologist (Research), U. S. Department of Interior, National Biological Survey, California Pacific Science Center, Dixon, CA.

*October 1986 to October 1993.* Wildlife Biologist (Research), U. S. Department of Interior, FWS, Northern Prairie Wildlife Research Center, Pacific States Ecology Station, Dixon, CA.

*August 1992 to September 1986.* Wildlife Biologist, U. S. Department of the Interior, FWS, Northern Prairie Wildlife Research Center, Upper Mississippi River Station, LaCrosse, WI.

### **Education**

**B.S.** 1979, University of Washington, Seattle, Washington  
Wildlife Science/Forestry

**M.S.** 1982, University of Idaho, Moscow, Idaho  
Wildlife Resources

**Ph.D.** 1987, Iowa State University, Ames, Iowa  
Animal Ecology, Statistics minor

### **Honorary Societies and Professional Organizations**

The Wildlife Society

British Ornithologist's Union

American Institute of Biological Sciences

### **Awards**

Taking Wing Award: Investigations. U. S. Forest Service. Washington, D. C. March 1998.

Star Excellence Award. U. S. Geological Survey. Vallejo, CA. January 1998.

Star Excellence Award. U. S. Geological Survey. Davis, CA. September 1996.

Special Service Award. National Biological Service. Dixon, CA. July 1994.

Taking Wing Award: Investigations. U. S. Forest Service. Washington, D. C. March 1994.

Dennis G. Raveling Award. California Waterfowl Association. Sacramento, CA. June 1992.

Special Act Award. U. S. FWS, San Francisco Bay National Wildlife Refuges. Newark, CA.  
December 1991.

Special Achievement Award. U. S. Dep. Interior, FWS, Northern Prairie Wildlife Research Center. Jamestown, ND. October 1991.

Special Achievement Award. U. S. Dep. Interior, FWS, Northern Prairie Wildlife Research Center. Jamestown, ND. September 1987.

Best Ph.D. Research Presentation. Ecology and Management of Breeding Waterfowl Symposium. Winnipeg, Manitoba. August 1987.

Sudman, R. S. 1981. The bay and the delta. West. Water (January-February):4-5. U. S. Fish and Wildlife Service. 1990. Cullinan Ranch preacquisition environmental contaminants survey. Dept. of Int., U. S. Fish and Wildl. Serv., Unpubl. Report. Sacramento, CA. 16pp.

White, G. C., D. R. Anderson, K. P. Burnham, and D. L. Otis. 1982. Capture-recapture and removal methods for sampling closed populations. Dept. of Energy, Los Alamos Nat. Lab., LA-87-87-NERP, Los Alamos, NM. 235pp.

Zar, J. H. 1996. Biostatistical analysis. Prentice-Hall, Englewood Cliffs, New Jersey.

## V. Costs and Schedule to Implement Proposed Project

### A. Budget Costs

The total cost is \$225,301. Specific costs and funding source for each project task are provided in Table 1. CalFed funding is currently the only source of funding available to carry out this project. Incremental funding is potentially feasible.

**Table 1. Project Cost Summary by Task.**

Project Phase and Task	Direct Labor Hours	Direct Salary and Benefits	General Labor (General, Admin, and fee)	Service Contracts	Material and Acquisition Contracts	Miscellaneous and other Direct Costs	Total Cost
Task 1	2,835	45,360	9,371	3,240	3,978	22,680	87,464
Task 2	1,324	21,060	4,295	864	1,857	10,584	39,984
Task 3	1,100	18,000	3,580	720	1,547	8,820	33,767
Task 4	2,126	34,020	6,866	1,080	2,984	17,010	64,086

### B. Schedule of Milestones

FY 98      Prepare Draft Environmental Assessment for restoration from existing data.  
             Develop biological monitoring program.

FY 99      Continue biological monitoring program studies.  
             Initiate studies of site colonization.

FY 00      Continue biological monitoring program studies.  
             Continue studies of site colonization.

FY 01      Data analysis and report preparation.

### C. Third Party Impacts

There are no third party impacts associated with this project.

- coastal scrub breeding bird community. *Studies in Avian Biol.* 6: 177-185.
- Dodge, W. E., and A. J. Steiner. 1986. XYLOG: a computer program for field processing locations of radio-tagged wildlife. U. S. Dep. Int., Fish Wildl. Serv., Fish Wildl. Tech. Rep. No. 4. 22pp.
- Dodge, W. E., D. S. Wilkie, and A. J. Steiner. 1986. UTMTEL: a laptop computer program for location of telemetry "finds" using Loran-C. U. S. Dep. Int., Fish Wildl. Serv., Massachusetts Cooperative Res. Unit Rep. 21pp.
- Evens, J. G., G. W. Page, S. A. Laymon, and R. W. Stallcup. 1991. Distribution, relative abundance and status of the California black rail in western North America. *Condor* 93:952-966.
- Green, R.H., and G.L. Vascotto. 1978. A method for the analysis of environmental factors controlling patterns of species composition in aquatic communities. *Water Research* 12:583-590.
- Hand, D. J., and C. C. Taylor. 1987. *Multivariate analysis of variance and repeated measures.* Chapman and Hall, New York, NY.
- Harvey, T. E., K. J. Miller, R. L. Hothem, M. J. Rauzon, G. W. Page, and R. A. Keck. 1992. Status and trends report on wildlife of the San Francisco Estuary. U. S. Dep. Int., Fish Wildl. Serv. Rep. Sacramento, CA. 283pp.
- Johnson, R. A., and D. W. Wichern. 1998. *Applied multivariate statistical analysis.* Prentice Hall, Upper Saddle River, NJ. 816pp.
- Josselyn, M. 1983. The ecology of San Francisco Bay tidal marshes: a community profile. U. S. Fish and Wildl. Serv. FWS/OBS-83/23. 102 pp.
- Laake, J. L., S. T. Buckland, D. R. Anderson, and K. P. Burnham. 1991. *Distance user's guide* Colo. Coop. Fish and Wildl. Res. Unit Publ., Fort Collins, CO. 53pp.
- LES (Lewis Environmental Associates, Inc.) and Wetlands Research Associates, Inc. 1992. *Napa salt ponds biological resources.* Unpublished final report prepared for Cargill Salt, Newark, California. 59 pp.
- Marion, W. R., T. E. O'Meara, and D. S. Maehr. 1981. Use of playback recordings in sampling elusive or secretive birds. *Studies of Avian Biol.* 6:81-85.
- Morejko, A. 1989. *Environmental Assessment. Cullinan Ranch: a proposed addition to San Pablo Bay National Wildlife Refuge, Solano and Napa Counties, California.* U. S. Dep. Int., Fish Wildl. Serv., Unpubl. Rep. Region 1, Portland, OR.
- Nichols, F. H., J. E. Cloern, S. N. Luoma, and D. H. Peterson. 1986. The modification of an estuary. *Science* 231 :567-573.
- Repking, C. F., and R. D. Ohmart. 1977. Distribution and density of Black Rail populations along the lower Colorado River. *Condor* 79:486-489.
- Roeder, K., B. Dennis, and E. O. Garton. 1987. Estimating density from variable circular plot censuses. *J. Wildl. Manage.* 51:224-230.
- Samuel, M. D., and E. O. Garton. 1985. Home range: a weighted normal estimate and tests of underlying assumptions. *J. Wildl. Manage.* 49:513-519.
- Samuel, M. D., and R. E. Green. 1988. A revised test procedure for identifying core areas within the home range. *J. Anim. Ecol.* 57:1067-1068.
- SAS Institute. 1985. *SAS User's Guide: Statistics. Version 5 Edition.* Cary, NC: SAS Institute Inc. 956-pp.
- Stenzel, L. E., and G. W. Page. 1988. Results of the 16-18 April 1988 shorebird census of San Francisco and San Pablo Bays. Point Reyes Bird Observatory unpubl. rep. 18 pp.

framework and plan for each area, determine features which enhance use by shorebirds and waterfowl and other target species experimentally, and examine colonization and successional patterns of the biological resources.

This project addresses several topics in the CALFED Ecosystem Restoration Program Plan. It is located in the North Bay zone (V. II, p. 75). Elements of the project address saline emergent wetland restoration (V. I, p. 9), and it may aid recovery and information on several species of importance including Delta smelt (V. I, p. 10), Splittail (V. I, p. 10), resident fishes (V. I, p. 11), Red-legged frogs (V. I, p. 11), California Clapper Rail (V. I, p. 12), California Black Rail (V. I, p. 12), Suisun Song Sparrow (V. I, p. 12), Salt Marsh Harvest Mouse (V. I, p. 12), Shorebird and Wading Birds (V. I, p. 12), and Waterfowl (V. I, p. 12), Levees and bank protection (V. I, p. 13), Invasive Aquatic Plants (V. I, p. 13), Invasive Aquatic Organisms (V. I, p. 14), and Invasive Riparian and Salt Marsh Plants (V. I, p. 14). Habitats addressed included Natural Sediment Supply (V. I, p. 27), Floodplains and Processes (V. I, p. 38), Tidal Perennial Aquatic Habitat (V. I, p. 75), Saline Emergent Wetlands (V. I, p. 88). Finally, this project is a strong basis for establishing adaptive management (V. III, p. 11) and biological monitoring (V. III, p. 35) in wetland restoration.

## **F. Monitoring and Data Evaluation**

Data will be evaluated and analyzed using standard parametric and nonparametric techniques as appropriate. Annual progress reports will be submitted during the study, with a final report at the end of the study. Results will be submitted to a peer reviewed journal for one or more publications.

## **G. Implementability**

The project is fully implementable with permits obtained through the U. S. Fish and Wildlife Service and California Department of Fish and Game held by the Biological Resources Division of the U.S. Geological Survey.

## **H. References**

- Bates, L. A. 1977. Soil survey of Solano County, California. U. S. Dep. Agriculture, Soil Cons. Serv.
- Burnham, K. P., D. R. Anderson, and J. L. Laake. 1980. Estimation of density from line transect sampling of biological populations. *Wildl. Monogr.* 72.
- Cheng, R. T., and J. W. Gartner. 1984. Tides, tidal and residual currents in the San Francisco Bay, California. U. S. Geological Survey Water Res. Invest. Rep. 84-4339. 72pp.
- Conomos, T. J. (ed.). 1979. San Francisco Bay: the urbanized estuary. Pac. Div., Am. Assoc. Advance. Sci., San Francisco, CA. 493 pp.
- Custer, T. W., and J. C. Franson. 1988. Field euthanasia chamber is humane and easy to assemble. U. S. Dep. Int., Fish Wildl. Serv., Res. Info. Bull. 88-39. 2pp.
- Dedon, M., and R. H. Barrett. 1982. An inventory system for assessing wildlife habitat relationships in forests. *Cal-Neva. Wildl. Trans.* (1982):55-60.
- DeSante, D. F. 1981. A field test of the variable circular-plot censusing technique in a California

petroleum and chemical transport, and freshwater diversions.

Despite extensive habitat loss and degradation, the SFE is a critical ecosystem for Pacific Flyway migratory birds and many rare endemic species. The population of shorebirds in the SFE is estimated to be 1 million birds (Stenzel and Page 1988), and the SFE supports nearly 700,000 waterfowl in the Pacific Flyway during winter (USFWS, midwinter surveys, unpubl. data). Several animal species of the SFE are currently listed as federal or state threatened or endangered, under consideration for listing, or of state special concern (Harvey et al. 1992). These species include the California least tern (*Sterna antillarum browni*), western snowy plover (*Charadrius alexandrinus nivosus*), California black rail (*Lateralis jamaicensis corturniculus*), long-billed curlew (*Numenius americanus*), San Pablo song sparrow (*Melospiza melodia samuelis*), saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*), American peregrine falcon (*Falco peregrinus anatum*), San Pablo vole (*Microtus californicus sanpabloensis*), salt marsh wandering shrew (*Sorex vagrans halicoetes*), Suisun ornate shrew (*S. ornatus sinuosus*), salt marsh harvest mouse (*Reithrodontomys raviventris*), and California clapper rail (*Rallus longirostris obsoletus*).

The North San Francisco Bay area comprises the largest remaining expanse of undeveloped land on the Bay edge. San Pablo Bay National Wildlife Refuge (SPBNWR) manages a large number of the wetlands in this area and is actively rehabilitating the natural processes found in tidal wetlands from previously converted agricultural land. Many endemic species, such as Delta Smelt, Splittail, California Red-legged Frog, California Clapper Rail, California Black Rail, Suisun Song Sparrow, and Salt Marsh Harvest Mouse would benefit from restoration of tidal wetlands with their characteristic *Spartina* and *Salicornia* plant communities. In addition, management for specific elements within restorations may enhance their value for migratory shorebirds and waterfowl or reduce the invasion of nonindigenous invasive species.

In cooperation with several local community groups, three tidal wetland restoration projects are currently being initiated by the refuge: Cullinan Ranch (606 ha), Tolay Creek (176 ha), and Tubbs Island (28 ha). Located west of Vallejo between San Pablo Bay to the south and former salt evaporation ponds to the north, these areas are included within the historic salt marsh that was diked and drained for agriculture (hay and oats) in the late 1800s (Mozejko 1989). Tubbs Island and Tolay Creek sites also were areas inundated and damaged by the flooding of 1997. Drainage and farming has caused the surface elevation to subside more than 2 m below sea level, although contaminants used in farming have not caused widespread contamination. The marsh soil has been significantly altered by drainage and alteration, and oxidation of marsh sulfides has created an acidic, saline condition (Bates 1977).

Biological monitoring to document results of wetland restoration projects is a required step of restoration, a fact identified by CALFED in their requirements for recent wetland restoration and rehabilitation projects. Yet, few guidelines exist which indicate how monitoring should be conducted for adaptive management of projects and whether specific features within restoration projects may enhance target species. Thus, the goal of this project is to establish baseline information and to monitor the change in the biological resources on these three tidal wetland restoration projects. We propose to document baseline biological data, develop a monitoring

annually. Each bird will be banded, weighed, measured, and radio-marked.

Radio-marked individuals will be tracked daily by observers with handheld antennas on the ground or from small tower telemetry systems. Data will be entered daily into a laptop computer after locations are determined (Dodge and Steiner 1986, Dodge et al. 1986).

2. **Home Range and Movements:** Radio telemetry will be used to examine movements of rails and voles. Locations will be recorded at high and low tides, each day for 30 days. A regression analysis (Zar 1996) will be used to compare distances moved by individuals between locations with relation to their distance from slough channels. Home range areas (Samuel and Garton 1985) and core areas (Samuel and Green 1988) of the radio-marked animals will be documented. Well-developed slough channel systems have been suggested as critical components of natural or restored salt marsh habitats. We will use ANOVA tests to determine if home range sizes of individuals in slough channel areas are smaller and probable source areas compared with individuals in marsh plain areas.

### **C. Location and/or Geographic Boundaries of the Project**

**Primary Site:** Three refuge areas will be examined in this study plan. The primary restoration site is the newly acquired 606 ha Cullinan Ranch, located 6 km west of Vallejo, California on the northern edge of San Pablo Bay north of Highway 37. The Cullinan Ranch has been cultivated for oat and hay production since the late 1800s, but water pumping on the Cullinan Ranch was discontinued in 1994. Preliminary surveys will be conducted on the Cullinan Ranch site prior to the restoration to document existing seasonal wetland conditions. The Tolay Creek site (176 ha) is located 16 km west of Vallejo on the south side of Highway 37, and the Tubbs Island site (28 ha) is located adjacent to San Pablo Bay 18 km west of Vallejo. Pre-project data also is available for the Tubbs Island area in the adjacent wetland.

### **D. Expected Benefits**

Although many wetland restorations have been initiated, few have included detailed monitoring plans to confirm wetland restoration success through establishment of target species. This project will develop designs to accomplish this task and apply these designs in three North Bay wetland restoration sites. These data will confirm whether restoration of diked farmland to tidal salt marsh is achieving the desired goal of supporting target species. The project will determine whether specific features may enhance the value of restorations and will show how colonization occurs at these restoration sites.

### **E. Background and Ecological/Biological/Technical Justification**

San Francisco Bay and the delta of the Sacramento and San Joaquin Rivers form one of the largest estuaries in the world (Conomos 1979, Sudman 1981). Two-thirds of the remaining salt marsh ecosystems and tidal flat habitats on the Pacific Coast are located in the San Francisco Estuary (SFE) (Josselyn 1983). However, 95% of wetlands in the SFE have been lost to filling and dredging for urban development or agricultural purposes (Nichols et al. 1986). The quality of remaining wetlands is endangered by accumulation of toxins from agricultural and urban runoff, introduction of contaminants from industrial and municipal discharge, accidental spills from

evaluate sedimentation rates. These samples will provide a database showing levels prior to the restoration, and in both units at 1-year after project initiation with resampling at least at annual intervals through the development of the marsh.

- B. **WATER QUALITY**: Water samples will be taken and analyzed for water quality each year during the first 3 years of the restoration project and every 3 years thereafter. Samples will be collected during both winter and summer seasons at each study plot in the slough channels.
- C. **PLANTS**: Plant sampling will be conducted on an annual basis. The procedure will follow Obj. 2.1, but the total area of slough channels and upland types will change as the project proceeds. Plots may be added to sample the slough channels as they develop during restoration. The extent of the vegetation types will be mapped to the GIS system from low-level aerial photographs taken annually.
- D. **INVERTEBRATES**: Invertebrate sampling will follow the initial study design (Task 2.1) on a semiannual basis for the first 3 years followed by sampling every 3 years..
- E. **FISHES**: Surveys will be conducted semiannually to examine changes in abundance and species diversity.
- F. **BIRDS**: Surveys will be conducted semiannually to examine changes in bird abundance and species diversity. Intensive airboat or call count surveys will be added to examine Rallidae populations as the restoration proceeds.
- G. **MAMMALS**: Mammal trapping will follow Task 1.2.E on a semiannual basis. If initial samples provide inadequate numbers to estimate densities, the number of capture grids or traps at a location will be increased.

### ***Task 3: Experimental Features to Enhance Use by Shorebirds and Waterfowl***

The recent San Francisco Bay Regional Wetland Ecosystem Goals Project indicated that information was needed to identify features which enhance wetland restoration projects for shorebirds, waterfowl, and other target species such as splittail. We will work with the project designers to create experimental islets, levees, and subsurface structures to examine the feasibility and value of certain design elements. Each feature will be replicated in at least three locations. Abundance of species will be examined at these features seasonally, and compared with samples taken in the standard surveys (*Task 2*) using nonparametric univariate statistical tests to determine whether enhanced features in wetland restorations may enhance target species.

### ***Task 4: Successional and Colonization Patterns***

These restorations provide a unique opportunity to examine successional and colonization patterns. Surveys (*Task 2*) will be analyzed for visual patterning (Cleveland 1993) and landscape metrics (Program Fragstats, U. S. Forest Service). Home range, movements, and colonization will be determined for representative salt marsh avian species (see below). Home ranges of species such as black rails and shorebirds will be examined at the 2 existing salt marsh units for 2 years. Comparable studies will be undertaken after the tidal plain becomes established in the restoration unit to examine movements and colonization of a new area.

- I. **Samples**: Ten individuals of selected species will be captured in existing salt marsh units

identified by project personnel, voucher specimens will be submitted to taxonomic specialists for positive identification. Fish species assemblages and their relation to environmental variables will be identified and tested for significance by using cluster analysis and discriminant analysis (e.g., Green and Vascotto 1978) or other appropriate multivariate statistical procedures and graphical techniques.

- F. **BIRDS:** Variable circular plots (DeSante 1981) will be used to sample birds in summer and winter at the center of each sample plot. The plots will be sampled from 0.5 - 3.0 h after sunrise with a settling period of 2 minutes followed by a survey period of 8 minutes. Species and distance from the plot center will be recorded. Variable line transect statistics (Burnham et al. 1980) adjusted for circular plot areas (Roeder et al. 1987) will be calculated from program DISTANCE to estimate seasonal densities of common species. If numbers of certain species are inadequate to produce density estimates, an index of average number of birds per plot will be reported. Playback recordings will be tested on a subsample of plots to augment surveys and improve counts of secretive rail species (Evens et al. 1991, Marion et al. 1981, Repking and Ohmart 1977). Mistnetting also will be tested as a method to sample subspecies of local songbird populations, especially the San Pablo song sparrow which must be identified in the hand. Nets will be monitored hourly and birds will be extracted as quickly as possible, but injured birds will be euthanized with approved cervical dislocation techniques. Counts and location of larger species (waterfowl, shorebirds) will be completed during a single census of each site in each season (6 surveys), supplemented by an aerial survey if needed.
- G. **MAMMALS:** Small mammal work will be conducted from a random sample of 3 plots in each unit x type x section combination (54 total plots). A rectangular capture grid with Sherman live traps (48) separated by 10 m will be placed at a random point 30 m from each plot center. Traps will be baited each evening within 3 hours of sunset and checked during 3 consecutive mornings within 3 hours of sunrise (144 trap-nights/plot) once during summer and winter seasons. Six pitfall traps and short barrier fences also will be used to sample shrews. At least 3 grids will be sampled simultaneously, requiring a maximum of 54 days to complete sampling during each season. Species will be identified and individuals will be labeled with nonpermanent markers (codes will be shaved in their fur with a moustache trimmer) to record recaptures. Mark-recapture analyses (White et al. 1982: Program CAPTURE) will be used to estimate small mammal densities or an index of catch per trap night will be reported. Traps will be provided with extra food and cotton insulation, and individuals which are inadvertently injured during trapping will be euthanized with humane methods of carbon dioxide asphyxiation (Custer and Franson 1988) or cervical dislocation. Trapping permits to capture small mammals in the salt marsh will be coordinated with the SPBNWR.

2. **RESTORATION MONITORING DATA:** As the restoration project progresses, data will be collected to monitor characteristics of marsh development for the first 3 years. The methods will follow those listed in Task 2.1 above. A monitoring design will be developed for the projects with a practical number and arrangement of plots on the basis of data collected in baseline surveys. Comparisons will be made to examine changes in variables through time from analysis of variance procedures with time as a repeated measure (Hand and Taylor 1987).

- A. **SEDIMENTS:** Initial samples will be used to design a continued monitoring program to

(Johnson and Wichern 1998) or univariate analysis of variance (ANOVA) tests (Zar 1996) will be used to compare most biophysical variables by unit, type, and section. Several biophysical variables will be measured and are listed below. Most measurements will be taken simultaneously with single visits to plots to limit observer effects on the plots.

- A. **SEDIMENTS**: Sedimentation pins will be established across the units to examine the rate of sedimentation for the restoration. In addition, ground surveys will be conducted with GPS survey equipment to verify elevational contours.
- B. **WATER QUALITY**: Total hardness, temperature, pH, turbidity, salinity, and dissolved oxygen will be determined on site from 3 integrated water column samples taken at each plot in the slough channel type. These samples will be taken at high tide in conjunction with other monitoring samples on each plot monthly. Three-way analysis of variance tests will be used to characterize water quality of each site and examine differences by unit, section, and season.
- C. **PLANTS**: An east-west (roughly parallel to the Bay edge) transect of 18 m will be established from the center of each marsh plain plot to determine the composition (percent occurrence) of plant species. A 0.5 m<sup>2</sup> grid will be examined at 3 m intervals on the transects (6 grids/transect) to estimate mean stem density, height, and percent cover of plants. Transects in the slough channel type will parallel the slough channels. Six 0.5 m<sup>2</sup> grid squares also will be sampled on slough channel sites, but these will be selected at random locations near the transects in channel (2), levee (2), and tidal flat (2) areas. Differences in the plant community by unit, type, and section will be examined in 3-way MANOVA tests with percent occurrence as the response variable, although transformation of percentages may be required.
- D. **INVERTEBRATES**: A core sample (10 cm diameter, 10 cm depth) will be taken to enumerate benthic invertebrates at each sampling plot. Samples will be screened (0.5 mm) and frozen prior to sorting. The invertebrates will be identified to family or genus, counted, dried, and weighed to the nearest 0.1 mg. MANOVA tests will be conducted on total weight and percent occurrence by invertebrate family to examine unit, type, and section differences.
- E. **FISHES**: Fish species assemblages will be surveyed at monthly intervals from sample sites or transects used by collaborating scientists in their studies of water quality and fish-forage organisms (net plankton and benthic macroinvertebrates). Specific locations of sample sites will be selected according to a stratified random procedure that considers major habitat types in salt ponds and the reference tidal marshes. Multiple gear types will be used to assess the distribution and relative abundance of juvenile and adult fishes, with special emphasis on small species likely to occur initially in the study area (e.g., rainwater killifish, *Lucania parva*; topmelt, *Atherinops affinis*; yellowfin goby, *Acanthogobius flavimanus*; LES 1992). As a minimum, throw nets and experimental (variable mesh) gill nets will be fished at all sites. At sites that can be waded, fish will also be sampled with bag seines. Fishing effort for each gear type will be standardized and replicated to allow for statistical comparisons of fish catch among dates and sites. At each site, captured fish will be identified to species and counted, then the first 25 individuals of each species will be measured for total length and weight. In addition, as many as 25 individuals from selected species will be fixed in 10% formalin for subsequent analysis of gut contents to determine their use of invertebrates. If fishes or fish-forage organisms cannot be reliably

## IV. PROJECT DESCRIPTION

### A. Project Description and Approach

The goal of this project is to use three tidal wetland restoration projects to develop procedures for monitoring the colonization and succession of biological resources when changing a diked, farmed wetland to a tidal marsh. We propose to document baseline biological data, develop a monitoring framework and plan for each area, determine features which enhance use by shorebirds and waterfowl and other target species experimentally, and examine colonization and successional patterns of the biological resources.

### B. Proposed Scope of Work

#### *Task 1: Document baseline data*

1. **DIGITAL MAP** A digital base map (1 inch=40 feet) including elevational contours (1 foot), soil types, and existing structures will be generated from orthophotography and existing data. A geographic information system (GIS) will be used to display the base map and data layers in ARC/INFO format.
2. **HYDROGEOMORPHOLOGY** Monitoring will track the physical wetland restoration, and on the Cullinan Ranch project, examine the modeling predictions based on water movement, water control structures, and sediment deposition on marsh development (M. Johnson et al., Univ. Calif. at Davis, Civil and Environ. Engr., unpubl. rep.). Measurements of hydrogeomorphology will include documenting the sedimentation rate, tidal datum, elevational changes, channel network, and levee changes. These will include aerial photography and *in situ* meters.
3. **BIOPHYSICAL VARIABLES** Ecological characterization of existing salt marshes will be used to develop goals for the restoration project. Information will be gathered for several variables including water quality, invertebrates, plants, and target fish and wildlife species from field surveys. Several different survey techniques will be tested within a plot-based sampling scheme (see Obj. 2, below). All sample locations will be georeferenced to the nearest meter in a horizontal plane with a global positioning system (GPS) and all data will be entered into ARC/INFO.

#### *Task 2: Develop a monitoring framework*

1. **BASELINE DATA:** Each refuge unit will be stratified into marsh plain and slough channel habitat types because the less available slough channels will be used heavily by fish and wildlife species. The units also will be divided into 3 polygonal sections of equal size based on distance from salt water inflow to examine effects of channel size, decreased waterflow, and decreased salinity. Section boundaries will be mapped prior to sampling with a GPS and recorded in the ARC/INFO database prior to locating sample plots. A representative sample (random start, uniform grid) of 10 circular plots (0.25 ha) will be used to monitor changes for each unit (3) x type (2) x section (3) combination (up to 180 total plots). Three-way multivariate (MANOVA)

### III. TITLE PAGE

## Monitoring Tidal Wetland Restorations in the North San Francisco Bay

*Floodplain Management and Habitat Restoration*

A Proposal to the CALFED Bay-Delta Program  
2 July 1998

Principal Investigator:

John Takekawa, PhD  
U.S.G.S – Biological Resources Division  
Western Ecological Research Center  
San Francisco Bay Estuary Field Station  
P.O. Box 2012, Vallejo, CA 94592  
707/562-2000; 707/562-3001 f; john\_takekawa@usgs.gov

Type of Organization: Federal Government

Tax Status: Tax Exempt

Collaborators:

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Glenn Wylie, PhD, Wetland Ecologist  
U. S. G. S. -- Biological Resources Division  
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Sacramento, CA 95670  
916/852-2000; 916/852-2200 fax

## II. EXECUTIVE SUMMARY

### Monitoring Tidal Wetland Restorations in the North San Francisco Bay

John Y. Takekawa

U. S. Geological Survey – Biological Resources Division  
Western Ecological Research Center, San Francisco Bay Estuary Field Station

The San Francisco Bay-Delta forms one of the largest and most urbanized estuaries in the world. Two-thirds of the remaining salt marsh ecosystems and tidal flat habitats on the Pacific coast are located in the San Francisco Bay estuary. However, more than 90% of wetlands in the estuary have been lost to human development. Despite extensive habitat loss and degradation, the estuary is a critical resource for many proposed or listed endemic fish, wildlife, and plant species as well as a major wintering area for migratory waterbirds in the Pacific Flyway.

The North San Francisco Bay area comprises the largest remaining expanse of undeveloped land on the Bay edge. San Pablo Bay National Wildlife Refuge (SPBNWR) manages a large number of the wetlands in this area and is actively rehabilitating the natural processes found in tidal wetlands from previously converted agricultural land. Many endemic species, such as Delta Smelt, Splittail, California Red-legged Frog, California Clapper Rail, California Black Rail, Suisun Song Sparrow, and Salt Marsh Harvest Mouse would benefit from restoration of tidal wetlands with their characteristic *Spartina* and *Salicornia* plant communities. In addition, management for specific elements within restorations may enhance their value for migratory shorebirds and waterfowl or reduce the invasion of nonindigenous invasive species.

In cooperation with several local community groups, three tidal wetland restoration projects are currently being initiated by the refuge: Cullinan Ranch (606 ha), Tolay Creek (176 ha), and Tubbs Island (28 ha). Located west of Vallejo between San Pablo Bay to the south and former salt evaporation ponds to the north, these areas are included within the historic salt marsh that was diked and drained for agriculture (hay and oats) in the late 1800s. Tubbs Island and Tolay Creek sites also were areas inundated and damaged by the flooding of 1997. Drainage and farming has caused the surface elevation to subside more than 2 m below sea level, although contaminants used in farming have not caused widespread contamination. The marsh soil has been significantly altered by drainage and alteration, and oxidation of marsh sulfides has created an acidic, saline condition.

Biological monitoring to document results of wetland restoration projects is a critical step for proper restoration, a fact identified by CALFED in their requirements for recent wetland restoration and rehabilitation projects. Yet, few guidelines exist which indicate how monitoring should be conducted for adaptive management of projects and whether specific features within restoration projects may enhance target species. Thus, the goal of this project is to establish baseline information and to monitor the change in the biological resources on these three tidal wetland restoration projects. It will document baseline biological data, develop a monitoring framework and plan for each area, determine features which enhance use by shorebirds and waterfowl and other target species experimentally, and examine colonization and successional patterns of the biological resources.

## U.S. Department of the Interior

**Certifications Regarding Debarment, Suspension and  
Other Responsibility Matters, Drug-Free Workplace  
Requirements and Lobbying**

Persons signing this form should refer to the regulations referenced below for complete instructions:

**Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions - The prospective primary participant further agrees by submitting this proposal that it will include the clause titled, "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions. See below for language to be used or use this form for certification and sign. (See Appendix A of Subpart D of 43 CFR Part 12.)**

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions - (See Appendix B of Subpart D of 43 CFR Part 12.)**

**Certification Regarding Drug-Free Workplace Requirements - Alternate I. (Grantees Other Than Individuals) and Alternate II. (Grantees Who are Individuals) - (See Appendix C of Subpart D of 43 CFR Part 12)**

Signature on this form provides for compliance with certification requirements under 43 CFR Parts 12 and 18. The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of the Interior determines to award the covered transaction, grant, cooperative agreement or loan.

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**PART A: Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions**

---

*CHECK  IF THIS CERTIFICATION IS FOR A PRIMARY COVERED TRANSACTION AND IS APPLICABLE.*

- (1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency;
  - (b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
  - (c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
  - (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
- (2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

---

**PART B: Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions**

---

*CHECK  IF THIS CERTIFICATION IS FOR A LOWER TIER COVERED TRANSACTION AND IS APPLICABLE.*

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

DI-2016  
June 1996  
(This form replaces DI-1963, DI-1964,  
DI-1966, DI-1968 and DI-1963)

## U.S. Department of the Interior

**Certifications Regarding Debarment, Suspension and  
Other Responsibility Matters, Drug-Free Workplace  
Requirements and Lobbying**

Persons signing this form should refer to the regulations referenced below for complete instructions:

**Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions - The prospective primary participant further agrees by submitting this proposal that it will include the clause titled, "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions. See below for language to be used or use this form for certification and sign. (See Appendix A of Subpart D of 43 CFR Part 12.)**

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions - (See Appendix B of Subpart D of 43 CFR Part 12.)**

**Certification Regarding Drug-Free Workplace Requirements - Alternate I. (Grantees Other Than Individuals) and Alternate II. (Grantees Who are Individuals) - (See Appendix C of Subpart D of 43 CFR Part 12)**

Signature on this form provides for compliance with certification requirements under 43 CFR Parts 12 and 18. The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of the Interior determines to award the covered transaction, grant, cooperative agreement or loan.

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**PART A: Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions**

---

*CHECK  IF THIS CERTIFICATION IS FOR A PRIMARY COVERED TRANSACTION AND IS APPLICABLE*

- (1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency;
  - (b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
  - (c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
  - (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
- (2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

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**PART B: Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions**

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*CHECK  IF THIS CERTIFICATION IS FOR A LOWER TIER COVERED TRANSACTION AND IS APPLICABLE*

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

DI-2010  
June 1996  
(This form replaces DI-1863, DI-1864,  
DI-1968, DI-1969 and DI-1993)

**Figure 1**  
**Standard Form 424**

OMB Approval No. 0348-0043

**APPLICATION FOR  
FEDERAL ASSISTANCE**

1. TYPE OF SUBMISSION: Application <input type="checkbox"/> Preapplication <input type="checkbox"/> <input type="checkbox"/> Construction <input type="checkbox"/> Construction <input type="checkbox"/> <input checked="" type="checkbox"/> Non-Construction <input type="checkbox"/> Non-Construction	2. DATE SUBMITTED 7/27/98	Applicant Identifier N/A
	3. DATE RECEIVED BY STATE N/A	State Application Identifier N/A
	4. DATE RECEIVED BY FEDERAL AGENCY	Federal Identifier

**5. APPLICANT INFORMATION**

Legal Name: John Y. Takekawa	Organizational Unit
Address (give city, county, state, and zip code): U. S. G. S. P. O. Box 2012 Vallejo, Solano, CA 94592	Name and telephone number of person to be contacted on matters involving this application (give area code)

6. EMPLOYER IDENTIFICATION NUMBER (EIN): N/A - [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]	7. TYPE OF APPLICANT: (enter appropriate letter in box) <input checked="" type="checkbox"/> N
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8. TYPE OF APPLICATION: <input checked="" type="checkbox"/> New <input type="checkbox"/> Continuation <input type="checkbox"/> Revision If Revision, enter appropriate letter(s) in box(es) [ ] [ ] A. Increase Award B. Decrease Award C. Increase Duration D. Decrease Duration Other (specify):	A. State B. County C. Municipal D. Township E. Interstate F. Intermunicipal G. Special District H. Independent School Dist. I. State Controlled Institution of Higher Learning J. Private University K. Indian Tribe L. Individual M. Profit Organization N. Other (Specify) <u>Federal</u>
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9. NAME OF FEDERAL AGENCY: U. S. G. S.
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10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER: [ ] [ ] - [ ] [ ] [ ] [ ] TITLE: N/A	11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT: Monitoring Tidal Wetland Restorations in the North San Francisco Bay
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12. AREAS AFFECTED BY PROJECT (Cities, Counties, States, etc.): Napa, Sonoma, California
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13. PROPOSED PROJECT	14. CONGRESSIONAL DISTRICTS OF:
----------------------	---------------------------------

Start Date: 10/99	Ending Date: 09/02	a. Applicant: John Y. Takekawa	b. Project: Biological Monitoring
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15. ESTIMATED FUNDING:		16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS? a. YES. THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON: DATE _____ b. NO. <input checked="" type="checkbox"/> PROGRAM IS NOT COVERED BY E.O. 12372 <input type="checkbox"/> OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW
a. Federal	\$ .00	
b. Applicant	\$ .00	
c. State	\$ .00	
d. Local	\$ .00	
e. Other	\$ .00	
f. Program Income	\$ .00	
g. TOTAL	\$ .00	
17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT? <input type="checkbox"/> Yes If "Yes," attach an explanation <input checked="" type="checkbox"/> No		

18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT, THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED.

a. Type Name of Authorized Representative John Y. Takekawa	b. Title Station Chief	c. Telephone Number (707) 562-2000
d. Signature of Authorized Representative 		e. Date Signed 7/27/98

**Meeting Notice**  
**Economic Evaluation of Water Management Alternatives**  
**Stakeholder Meeting**  
Friday, March 12, 1999  
10:00 a.m. - 12:00 p.m.

**LOCATION**  
Resources Building  
1416 Ninth Street, Room 1142  
Sacramento, CA

**AGENDA**

- I) Introduction/CALFED Update
- II) Update on Methodology and Policy Assumptions and Preferences
  - Remarks
- III) Raw Supply Data at Source
- IV) Demand Functions
- V) Supply and Demand Screening Analysis
- VI) Update on CVPTM and Spreadsheet Analysis
- VII) Analysis Issues
- VIII) General Discussion