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United States Department of the Interior
Geological Survey

Coastal and Marine Geology Team
345 Middlefield Road, MS 999
Menlo Park, California 94025



July 28, 1997

Kate Hansel
CALFED Bay-Delta Program
1416 Ninth Street, Suite 1155
Sacramento, CA 95814

Dear Ms. Hansel:

Enclosed please find 10 copies of a proposal from USGS entitled " A Framework for Risk Communication to Evaluate Ecosystem Restoration and Hazard-Loss Avoidance" for consideration for funding by the CALFED Bay-Delta Program.

The enclosed proposal is one of three proposals from USGS addressing the risk of catastrophic failure to the levee system in the Sacramento Delta. The proposed work will provide a framework to communicate the results of the complementary proposals from the USGS entitled "Strong Ground Motion Maps for Evaluation of Potential Catastrophic Levee Collapse from Strong Earthquakes" and Liquefaction Potential of Levee Foundations: Implications for Catastrophic Levee Failure". Together these three proposals will provide CALFED with the ability to incorporate the risk of levee foundation failure into their future planning.

Please contact me should you have any questions concerning the proposed work and the requested budget for the enclosed proposal.

Sincerely yours,

Herman A. Karl

cc: Tom Brocher
Mike Carr
Tom Casadevall
Jim Dietrich
Tom Holzer
Alan Mikuni
Carl Wentworth

## I. Executive Summary

*a. Project Title and Applicant Name*

A FRAMEWORK FOR RISK COMMUNICATION TO EVALUATE ECOSYSTEM RESTORATION AND HAZARD-LOSS AVOIDANCE

Herman A. Karl and Richard L. Bernknopf
U.S. Geological Survey, MS-999, 345 Middlefield Road, Menlo Park, CA 94025
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*b. Project Description and Primary Biological/Ecological Objectives*

Current pressures for balanced land and water management and concerns about recovery from natural disasters and protection of environmental quality demand a new role for scientific information. Interdisciplinary research and information derived from earth, life, and social science data and associated process models can contribute to both policy analysis and decision making. The goal of this project is to develop models and products that will reduce the uncertainty involved with management decisions concerning complex and conflicting land-use and ecosystem issues in the Bay/Delta. This project focuses on the overall risk of catastrophic levee failure from a variety of causes (e.g., earthquake, flooding, hydrologic flow, subsidence) and the negative impact inundation of Delta islands would have on land-use and associated economic activities, water supply, infrastructure, and the ecosystem.

*c. Approach/Tasks/Schedule*

The approach we propose will integrate scientific information, economic information, and social and political values to help reach a balanced solution to the four main problems in the Bay-Delta: uncertain water supplies, aging levees, declining habitat, and threatened water quality. The integration of scientific, social, and economic factors within a geographic framework seemingly describes an ecosystems approach. However, our methodology, developed by scientists of the USGS Center for Earth Science Information Research (CESIR) project, differs significantly from a conventional qualitative ecosystems approach. We apply a methodology that is a statistical integration of a variety of scientific attributes to estimate the probability of a physical change. Each grid cell on a map (geographic unit) is assigned a quantitative value (probability) based on the combination of physical attributes of that cell. The resulting regional environmental risk maps can be used to communicate the level of hazard and prioritize the need for loss-reduction measures. The USGS will provide a GIS facility, the Geo-Risk Decision Center, where disciplinary experts, working with stakeholders, will build process models that describe environmental risk problems from scientific, policy, and economic perspectives. These models will be used to construct and test policy scenarios as alternatives. The first project task is to compile, evaluate, and digitze existing geologic, topographic, and other physical data. In task 2, these data will be combined with other information as input to the environmental risk maps that show the probability of a physical change, e.g. the failure of a levee, over a wide region. Task 3 is to build process models that describe the environmental risk problem from scientific, policy, and economic perspectives. Tasks 4 and 5 are to develop a management tool that incorporates cost/benefit analysis as an aid to decision making and as an estimator of the net benefits to society of a policy decision. Task, which is overarching, is to convene an oversight and advisory committee that will help define specific, measurable goals to evaluate the effectiveness of this project. Task 7 is to assemble stakeholder and other participant to arrive at a consensus decision as to the best policy concerning a given issue. The project will span 2 years. However, it is anticipated that the Geo-Risk Decision Center will become a public resource to help stakeholders resolve issues in the Bay/Delta.

*d. Justification for Project and Funding by CALFED*

The 1994 Bay-Delta accord calls for a comprehensive series of steps to restore and protect the Bay-Delta ecosystem while providing a reliable water supply to ensure the long-term economic heath of the State. Under the Accord, CALFED has been charged with finding a balanced solution to the four main problems in the Bay-Delta described above. This project addresses directly those problems and proposes a method to aid in finding a balanced solution to the environmental and land-use issues in the Bay-Delta. While the policy goals of the CALFED Bay-Delta Program are to develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system, when the expenditure of public funds is involved, it also is a desirable objective to ensure that policies and regulations are implemented in an efficient manner. A map-based method will be applied that integrates cost-benefit analysis (CBA) and physical process models to examine and to prioritize expenditures for specific program initiatives and to evaluate whether these expenditures are an improvement in the allocation of resources.

*e. Budget Costs and Third Party Impacts*

The duration of the proposed project is 2 years. A total of $619,434 is requested from CALFED. USGS is making a contribution-in-kind of $153,509 to the total project cost. Additional USGS cost sharing is provided by use of the physical facility and personnel at the USGS Geo-Risk Decision Center. No known third party impacts.

*f. Applicant Qualifications*

The applicants and collaborators are a multi-disciplinary team that include cartographers, computer specialists, economists, hydrologists, GIS specialists, geologists, mathematicians, physical scientists, and stochastic modelers. All are experienced and recognized experts in their fields. The project coordinator is skilled at managing a diverse group of specialists in a systems approach to a problem.

*g. Monitoring and Data Evaluation*

Methodologies that will be applied to this project have been through a rigorous peer-review process. Project coordinators, assisted by an oversight and advisory committee of experts from government, academia, nongovernmental organizations, and the private sector, will monitor and evaluate the effectiveness of implemented policy alternatives. An integral component of the success of this project is the active involvement of stakeholders. Products derived from this project will go through an internal USGS peer review process and an external peer review process as appropriate.

*h. Local Support/Coordination with other Programs/Compatibility with CALFED Objectives*

Planning for this project will be integrated by coordinating with stakeholders that represent local, state, and federal government agencies, nongovernmental organizations, and the private sector. The project will coordinate with other USGS CALFED proposals; in particular, the proposals, entitled "Strong Ground Motion Maps for Evaluation of Potential Catastrophic Levee Collapse from Strong Earthquakes" and "Liquefaction Potential of Levee Foundations". An important collaboration is with scientists and affiliates of the USGS CESIR project and the Stanford University Center for Earth Science Information Research. A broader collaborative effort is with the Institute of Environmental Education of the Geological Society of America. The project is compatible with CALFED objectives to restore the ecological health of the Bay-Delta, and to assess and reduce the risk of catastrophic levee failure. The project is in accord with goals of the USGS and Department of Interior Strategic Plans.

## II. Title Page

*a. Title of Project*

A FRAMEWORK FOR RISK COMMUNICATION TO EVALUATE ECOSYSTEM RESTORATION AND HAZARD-LOSS AVOIDANCE

*b. Applicant Information*

Herman A. Karl and Richard L. Bernknopf
U.S. Geological Survey, 345 Middlefield Road, MS-999, Menlo Park, CA 94025
Phone (415) 329-5280, FAX (415) 329-5299, hkarl@octopus.wr.usgs.gov

*c. Tax Status: Federal Agency, tax exempt*

*d. Tax Identification Number*: N/A

*e. Technical and Financial Contact person(s)*

Technical: Herman A. Karl, at address and phone number above

Financial: William Adams, at address above; phone (415) 329-5018

*f. Participants/Collaborators in Implementation*

Participants: Douglas Aitken; Brian Bennett, Pat S. Chavez, Jr., John Chin, Russell Graymer, Robert Lugo, Alan Mikuni, Florence Wong; Thomas Sturm

Collaborators: John Sutter (chief, USGS Center for Information Research project), David Soller (associate chief for science applications, USGS Center for Earth Science Information project), Keith Loague (co-director, Stanford University Center for Earth Science Information), Daniel Sarewitz (program manager, Institute for Environmental Education, Geological Society America), Richard Johnson (economist, Biological Resources Division, USGS), Thomas M. Brocher (geophysicist, USGS), Carl Wentworth (Geologist, USGS), Jack Boatwright (seismologist, USGS), Thomas L. Holzer (engineering geologist, USGS), Robert Kayen (civil engineer, USGS), John Tinsley (geologist, USGS)

*g. RFP Project Group*

Type III. Services





I-006466

## III. Project Description

*a. Project Description and Approach*

The purpose of the proposed project is to evaluate and to communicate the societal risks of specific policy initiatives and incentives to restore the Bay/Delta ecosystem and to avoid natural and man-made hazards losses. The approach we propose will integrate scientific information, economic information, and social and political values to help reach a balanced solution to the four main problems in the Bay-Delta: uncertain water supplies, aging levees, declining habitat, and threatened water quality. We will focus, in particular, on the problems of aging levees and declining habitat, and address three specific issues related to these CALFED Program objectives.

- Subsidence -- subsidence of land upon which levees are built is a major cause of levee instability and failure; subsidence also impacts infrastructure.
- Contamination -- catastrophic levee failure would lead to contamination of agricultural lands and wildlife habitats by saline waters and toxicants; saline intrusion would also threaten drinking water supplies.
- Restoration -- relocation of levees to create/restore wetland and tidal marsh vs. taking marginal agricultural land out of production and reduced costs of levee maintenance.

These issues relate directly to the near-term funding needs and priorities of CALFED Category III funding, in general, and, specifically, to the example restoration actions listed on page 5 of the table, "Stressors and Example Restoration Actions", prepared as part of the CALFED technical team summary. For example, issue 3 speaks directly to the example restoration actions: "Establish setback levees to create shallow water habitat and other priority habitat types. Consider possible adverse trade-offs between habitat types that may be created with setback levees.", and "Increase area of flooded agricultural lands. Combine with no net loss of agricultural wetlands that provide foraging habitat for migratory birds." These specific policy issues can be analyzed in a framework within which benefits and costs are identified and examined from society's perspective.

While the policy goals of the CALFED Bay-Delta Program are to develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system, it also is a desirable objective to ensure that policies and regulations are implemented in an efficient manner. There are conflicting interests as to the appropriate public policy. We propose a method for resolving these policy issues using scientific and economic information. We apply a methodology that is a statistical integration of a variety of scientific attributes to estimate the probability of a physical change. Each grid cell on a map (geographic unit) is assigned a quantitative value (probability) based on the combination of physical attributes of that cell. The resulting regional environmental risk maps can be used to communicate the level of hazard and prioritize the need for loss-reduction measures. This map-based method of environmental hazards provides the basis for discussion among the various stakeholders. Stakeholders will meet at a facility provided by USGS to use these maps to help resolve conflicting points of view, and arrive at a consensus decision as to the best policy concerning a given issue. This consensus environmental risk map will be integrated with cost-benefit analysis (CBA) to examine, to prioritize, and to evaluate whether expenditures are an improvement in the allocation of resources (Bernknopf and others, 1993). Using this approach, potential gains and losses for a proposed initiative are identified, converted and expressed in dollars, and compared using decision criteria to evaluate whether the particular initiative should be undertaken.

In addressing these issues and policy goals, we ask and answer the following questions: What types, scales, and quantities of earth-science information contribute to effective natural hazard and environmental risk management? How does the earth science information reduce the uncertainty associated with societal decisions regarding environmental hazards? How should this information be communicated to arrive at a policy to best mitigate environmental damage and reduce the risk to land-use and associated economic activities, infrastructure, water quality, water supply, and the ecosystem?

Background and Approach

Current pressures for balanced land and water management and concerns about recovery from natural disasters and protection of environmental quality demand a new role for scientific information. Interdisciplinary research and information derived from earth, life, and social science data and associated process models can contribute to both policy analysis and decision making. However, there are often no clear and unequivocal answers to land-use and environmental issues, owing both to the uncertainties inherent in the scientific information and the need to consider economic, political, social, and aesthetic values. Most scientific information is not in a form readily usable by non-scientists. Applications require adapting scientific information to a decision-oriented framework. The necessary components of an integrated assessment are:

- Identify physical processes that affect a societal issue and develop a conceptual physically-based stochastic model,
- Develop a map-based linkage of the human-physical environmental interface, i.e., an estimation of environmental risk. Implement the approach by integrating and analyzing spatial information in a Geographic Information System (GIS) environment,
- Develop a conceptual model for decision making under uncertainty,
- Develop a management model that incorporates a CBA, i.e., an estimation of the net benefits to society.

This study will provide a map-based probabilistic method (an analytical Geographic Information System) to identify people, property, and environmental resources at risk. These environmental risk maps are an integration of earth and life science, economic, and engineering information that can be used to communicate the level of hazard and prioritize the need for loss-reduction measures.

The primary input for the evaluation of a policy issue includes, among other things, existing geologic and topographic data. Use of existing earth science data will allow cost effective development of the environmental risk maps and will help guide decisions related to the acquisition of additional field data. If additional field data is necessary, this project will coordinate with other USGS proposals (pending acceptance and funding) submitted to CALFED; in particular, the proposals, entitled "Strong Ground Motion Maps for Evaluation of Potential Catastrophic Levee Collapse from Strong Earthquakes" and "Liquefaction Potential of Levee Foundations: Implications for Catastrophic Levee Failure". These related projects focus on catastrophic levee failure triggered by a damaging earthquake. Our approach examines the consequences of levee failure from any source (e.g., flooding, high water, and hydrologic flow intensity). We believe, however, that existing data should be generally sufficient to permit development of useful models.

The ultimate goal of this project is to assist in the resolution of environmental conflicts. To realize that goal, the products that result from the integrated assessment described above must be used as a component part of the decision process that leads to policy. USGS Center for Earth

Science Information (CESIR) project scientists have been working with the project manager of the Institute for Environmental Education of the Geological Society of America to develop and establish a process that brings together stakeholders, decision-makers, and scientists to resolve complex "geo-risk" issues and conflicts. Our collaborative effort is an endeavor to develop and establish a process that facilitates interaction among private and public sector decision makers, other stakeholders, and scientific experts to mitigate conflict among competing interests and to reduce the uncertainties associated with a policy decision. This process allows the application of scientific information to solving complex "geo-risk" problems. USGS intends to provide a facility, at the Western Region Mapping Center, where participants can meet to work with experts to build and interactively refine the environmental risk maps in an analytical GIS to describe and resolve issues. Recent methodological developments in the Biological Resources Division of the USGS will allow us to include models for ecosystem restoration programs that have incorporated the use of adaptive management techniques. It must be noted, however, that the U.S. Geological Survey Geo-Risk Decision Center is only in the earliest stages of feasibility study and development. A policy committee is being formed to advise and guide the development of the Center. The project proposed herein is one of two land-use issues under consideration as the Center's inaugural project. With the establishment of the Geo-Risk Decision Center, we will construct and test policy scenarios and alternatives. Participants and stakeholders in conflict resolution exercises will represent the private sector, non-governmental organizations, local, state, and federal governments, and interested individuals. Other participants will include scientists and technical experts from government, academia, and the private sector, who will provide technical support for the project.

*b. Location and/or geographic boundaries of project*

The project data base incorporates information from a thirteen quadrangle area of the Delta that overlaps parts of Alameda, Contra Costa, Sacramento, San Joaquin, and Sacramento counties (see map). This area was selected, in part, owing to the quality of the existing data bases. Our approach emphasizes a region-wide stochastic analysis, however, consultation with stakeholders and coordination with other CALFED projects will define more specific study sites, appropriate for sampling and deterministic modeling, within the geographic area of this proposal.

*c. Expected benefits*

This project is designed to estimate the primary societal benefits of decisions that impact the productive and environmental resources in the region. These primary benefits are a reduction in the uncertainty of a specific development/preservation decision and hence an increase in the efficiency of the allocation of resources in the Bay/Delta region. For example, we will conduct a CBA of land-use changes that include restoration of tidal marsh and wetland habitats by relocating levees to reconnect the marginal agricultural land to the water channel. Derivative to this effort are the secondary benefits of integrating scientific information into the decision process. This constitutes a derived demand for scientific information. Another secondary benefit is the identification of the cumulative watershed impacts of management decisions in the Eldorado National Forest and their impacts on water quality in the Bay/Delta. This is a parallel analysis getting underway among a variety of federal agencies and the Center for Earth Science Information Research at Stanford University.

*d. Background and Biological/Technical Justification*

This is a new project that will apply the methodology developed by the USGS Center for Earth Science Research project (Bernknopf and others, 1993). We are not aware of any existing mechanism to evaluate and to communicate the societal risks of specific policy initiatives and incentives to restore the Bay/Delta ecosystem and to avoid natural and man-made hazards losses that employs a regional approach as proposed by us. Because the integrated approach proposed herein is unique, it expands upon adaptive management concepts by introducing environmental risk maps as a communication device.

*e. Proposed Scope of Work*

The proposed project is for 2 years. In the development of the following 7 tasks, this project will collaborate with scientists and affiliates of both the USGS CESIR project and Stanford University Center for Earth Science Information Research, and with economists and scientists of the Biological Resources Division of the USGS.

Task 1: Compile and digitize where necessary existing earth science data.
Compile existing geologic, topographic, and hydrologic data. Digitize these data to use as inputs to construct the environmental risk maps. Existing data include Quaternary geologic maps (e.g., Atwater, 1983, Helley and Gramer, 1997), and topographic elevations. We will use the topographic data to evaluate amounts of subsidence over time and construct 10-meter Digital Elevation Models.

Task 2: Identify physical processes and develop a conceptual physically-based stochastic model for each of the issues identified in this proposal.
Levees will fail if the ground they rest on fails either from an earthquake, or a flood, or from subsidence. Factors involved in estimating the probability of the above physical changes are the age and content of surficial deposits, elevation of the ground surface, depth to ground water, water height, hydrologic flow intensity, and distance from streams to produce an initial map of a physical change, e.g., a ground failure probability. If necessary, additional data will be collected in the field in collaboration with other proposals.

Task 3 Develop a map-based linkage of the human-physical environmental interface. Estimate the space-time environmental risk in a GIS. The geo-risk problem is a combination of scientific, policy, and economic perspectives. Participants working in the project will integrate the physical and social science models at the USGS Geo-Risk Decision Center located in Menlo Park to construct and test policy scenarios and alternatives.

Task 4: Develop a conceptual model for decision making under uncertainty.
To decide on the worth of a project involving public expenditure, it is necessary to weigh the advantages and disadvantages. In this project, CBA will be used as a prospective tool to provide an estimate of the risks of a policy decision relative to other potential public projects (Bernknopf and others, 1997).

Task 5: Develop a management model that incorporates a CBA, i.e., an estimation of the net benefits to society. CBA methodology has evolved as a decision tool for the evaluation of public policy issues (Nas, 1996). The rationale for CBA is economic efficiency; it aims to ensure that scarce resources are put to their most valuable use (Stokey and Zeckhauser, 1978). The process of using CBA will help decide in what form and at what scale policy and regulatory initiatives and programs should be implemented, and whether they can generate the expected societal payoffs.

Task 6: Convene workshop(s) of an oversight and advisory committee. A workshop will be convened at the beginning of the project to identify relevant stakeholders and other participants and to advise on the development of the Geo-Risk Decision Center. Participants at this workshop will help define specific, measurable goals to evaluate the effectiveness of this project.





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A second workshop will be convened mid-way through the project to assess effectiveness of the project and to advise on any necessary mid-course modifications.

Task 7: Assemble stakeholders and other participants at USGS Geo-Risk Decision Center. Stakeholders will meet to use the environmental risk maps to help resolve conflicting points of view, and arrive at a consensus decision as to the best policy concerning a given issue. This consensus environmental risk map will be integrated with cost-benefit analysis (CBA) to examine, to prioritize, and to evaluate whether expenditures are an improvement in the allocation of resources.

*f. Monitoring and Data Evaluation*

Methodologies that will be applied to this project have been through a rigorous peer-review process. Project coordinators, assisted by an oversight and advisory committee of experts from government, academia, and the private sector, will monitor and evaluate the effectiveness of implemented policy alternatives. An integral component of the success of this project is the active involvement of stakeholders. Stakeholder participation provides a continuing evaluation process. Products derived from this project will go through an internal USGS peer review process and an external peer review process as appropriate.

*g. Implementability*

Full implementation of Tasks 3 and 7 is dependent upon the independent development of the GIS hardware and software at the proposed USGS Geo-Risk Decision Center.

Bibliography:

Atwater, B.F., 1983, Geologic maps of the Sacramento-San Joaquin Delta, California, scale 1:24,000, U.S. Geological Survey MF-1401.

Bernknopf, R.L., Brookshire, D.S., McKee, M.J., and Soller, D.R., 1997, Estimating the social value of geologic map information: A regulatory application: Jour. Environmental Economics and Management, v. 32, p. 204-218.

Bernknopf, R.L., Brookshire, D.S., Soller, D.R., McKee, M.J., Sutter, J.F., Matti, J.C., and Campbell, R. H., 1993, Societal Value of Geologic Maps, U.S. Geological Survey Circular 1111, 53 p.

Helley, E.J., and Graymer, R.W., 1997, Quaternary geology of Alameda County, and surrounding parts of Contra Costa, San Mateo, San Francisco, Stanislaus, and San Joaquin Counties, California: A digital database: U.S. Geological Survey Open-File Report 97-97.

Helley, E.J., and Graymer, R.W., 1997, Quaternary geology of Contra Costa County, and surrounding parts of Alameda, Marin, Sonoma, Sacramento, and San Joaquin Counties, California: A digital database: U.S. Geological Survey Open-File Report 97-98.

Karl, H.A., Bernknopf, R.L., Soller, D.R., and Chavez, P.S., Jr., 1995, How can geoscientists help policy makers assess the impact of energy extraction on marine ecosystems?: U.S. Geological Survey Circular 1108, Energy and the Environment: Application of Geosciences to Decision Making, p. 33-34.

Nas, Tevfik F., 1996, Cost-benefit analysis: theory and application: SAGE publications, Thousand Oaks, 220 p.

Stokey, E., and Zeckhauser, R., 1978, A primer for policy analysis: W.W. Norton & Company, New York, 356 p.

## IV. Costs and Schedule to Implement Proposed Project

*a. Budget Costs*

**Table 1. Cost Breakdown**

**Fiscal Year 1998**

Salary and Benefits

| Staff | Hours | Direct Salary/Benefits($) | Task |
|---|---|---|---|
| Permanent | | | |
| Aitken | 320 | 10,344 | 1 |
| Bennett | 320 | 12,000 | 1,6,7 |
| Bernknopf | 640 | 39,224 | 2,3,4,5,6,7 |
| Chavez | 320 | 17,098 | 1,2,3 |
| Chin | 480 | 15,974 | 1,2,3,7 |
| Karl | 640 | 30,782 | 2,3,4,5,6,7 |
| Lugo | 320 | 10,382 | 1,2,3 |
| Mikuni | 80 | no cost | 6,7 |
| Sturm | 320 | 12,000 | 1,2,3,6,7 |
| Wong | 160 | 5,312 | 1,2,3 |
| Computer Spec. | 400 | 7,075 | 1,2,3 |
| Economist | 320 | 12,500 | 2,3,4,5,7 |
| GIS spec | 160 | 5,312 | 1,2,3 |
| Mathematician | 480 | 11,424 | 2,3,4,7 |
| Total (permanent) | 4880 | 189,427 | |
| USGS Contribution-in-Kind | | 75,771 | |
| CALFED Cost | | 113,656 | |
| Temporary | | | |
| Graymer | 240 | 13,500 | 1,2,3 |
| Technician | 640 | 8,307 | 1,2 |
| Technician | 1040 | 11,139 | 1 |
| Total (temporary) | 1920 | 32,946 | |

Total Salary Request FY98........................................................................146,602





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Miscellaneous and Other Direct Costs

| | ($) | Task |
|---|---|---|
| Miscellaneous travel/meetings | 5,000 | 1,2,3,4,5,6,7 |
| Oversight/advisory committee workshop | 12,000 | 6 |
| Topographic/geologic data, air photos, production costs | 26,790 | 1,2 |
| Computer processing, maintenance and support | 5,000 | 1,2,3,4,5 |
| Support for Stanford University graduate student | 35,000 | 2,3,4,5 |

Total Misc.......................................................................................................... 83,790

**FY98 Total Budget**

Direct Charges..............................................................................................$230,392
USGS overhead..............................................................................................$98,739
USGS Contribution-in-Kind..............................................................................$75,771
Total Cost.....................................................................................................$404,902

**Total Budget Request FY98...........................................................$329,131**

**Fiscal Year 1999**

Salary and Benefits

| Staff | Hours | Direct Salary/Benefits($) | Task |
|---|---|---|---|
| Permanent | | | |
| Aitken | 320 | 10,654 | 1 |
| Bennett | 320 | 12,360 | 1,6,7 |
| Bernknopf | 640 | 40.402 | 2,3,4,5,6,7 |
| Chavez | 160 | 17,508 | 1,2,3 |
| Chin | 400 | 16,357 | 1,2,3,7 |
| Karl | 640 | 31,522 | 2,3,4,5,6,7 |
| Lugo | 320 | 10,632 | 1,2,3 |
| Mikuni | 80 | no cost | 6,7 |
| Sturm | 320 | 12,288 | 1,2,3,6,7 |
| Wong | 160 | 5,440 | 1,2,3 |
| Computer Spec. | 400 | 7,245 | 1,2,3 |
| Economist | 320 | 12,800 | 2,3,4,5,7 |
| GIS spec. | 160 | 5,440 | 1,2,3 |
| Mathematician | 480 | 11,698 | 2,3,4,7 |

| | | | |
|---|---|---|---|
| Total (permanent) | 4640 | 194,346 | |
| USGS Contribution-in-Kind | | 77,738 | |
| CALFED Cost | | 116,608 | |

Temporary

| | | | |
|---|---|---|---|
| Graymer | 480 | 13,500 | 1,2,3 |
| Technician | 640 | 8,507 | 1,2 |
| Technician | 640 | 7,604 | 1 |
| Total (temporary) | 1760 | 29,604 | |

Total Salary Request FY99..........146,212

Miscellaneous and Other Direct Costs

| | ($) | Task |
|---|---|---|
| Miscellaneous travel/meetings | 5,000 | 1,2,3,4,5,6,7 |
| Oversight/advisory committee workshop | 12,000 | 6 |
| Computer processing, maintenance and support | 5,000 | 1,2,3,4,5 |
| Support for Stanford University graduate student | 35,000 | 2,3,4,5 |

Total Misc..........57,000

**FY99 Total Budget**

Direct Charges..........$203,212
Overhead..........$87,091
USGS Contribution-in-Kind..........$77.738
Total cost..........$368,041

**Total Budget Request FY99..........$290,303**

**TOTAL FUNDING REQUEST FOR 2 YEAR PROJECT**

Direct Charges..........$433,604
Overhead..........$185,830
USGS Contribution-in-Kind..........$153,509
Total cost..........$772,943

**TOTAL REQUEST..........$619,434**

Note that beyond the contribution-in-kind shown here, considerable cost sharing with USGS is provided by use of the proposed Geo-Risk Decision Center during the 2 years of the project and as a continuing potential resource to the CALFED program.

*b. Schedule Milestones*

Funding is requested for two years (Fiscal Years 1998 and 1999). For planning purposes, the project start date, predicated on funding authorization beginning Fiscal Year 1998, is October 1, 1997; the project will conclude September 30, 1999.

FY98
- 10/97 - 4/98: Compile and digitize geological and topographic data described in Task 1; convene first meeting of oversight/advisory committee described in Task 6.
- 3/98 - 10//98: Develop models and maps described in Tasks 2, 3,4, and 5. Collect additional field data if necessary in collaboration with other proposed projects.

FY99
- 10/98: Convene mid-course meeting of oversight/advisory committee as described in Task 6.
- 10/98: Continue to refine maps and models. Assemble stakeholders as appropriate at Geo-Risk Decision Center described in Task 7.
- 9/30/99: Conclude project. Provide final reports and maps, and evaluation of project objectives and accomplishments oversight/advisory committee and stakeholders.

*c. Third Party Impacts*

There are no known or anticipated third party impacts that would result from the implementation of this project.

**V. Applicant Qualifications (no more than three pages, including tables)**

**Doug Aitken** has many years of experience working in the creation of special thematic maps for the U.S. Geological Survey. He is one of a few acknowledged experts in our organization in the creation of these maps in graphic and digital forms. He is currently assigned to GIS Lab where he consults on map design and creation and works on a variety of special projects to assist with data base development.

**Brian Bennett** is the current Chief, National Mapping Division Western Region GIS Lab. Brian has many years of experience with GIS technology with special emphasis on applications and software development and data evaluation. His background is in field surveying, developing and prototyping our initial digital elevation model production software, and various other research and activities involving data analysis and software development.

**Richard Bernknopf**, Economist, Ph.D. George Washington University, 1980, has worked for the USGS for 24 years. He is co-director of the Stanford University Center for Earth Science Information Research and associate project chief for product development of the USGS Center for Earth Science Information Research project. He is a principal in development of the methodology proposed for this project, and has applied that methodology to cost benefit analysis of scientific information. These applications have gone through a rigorous peer review process.

**Pat S. Chavez, Jr.** has worked for the USGS for over 26 years and has degrees in mathematics. His expertise is in the application of remote sensing and digital image processing to extract earth science information. This includes surface mapping, temporal change detection, and 3-D mapping.

**John L. Chin**, Geologist, USGS 1978-present. M.S. in Geology, San Jose St. Univ. Experience in application of sedimentary geologic research to environmental and societal

issues, communication of geologic research to non-technical audiences, high resolution seismic stratigraphy, sedimentology, geologic and bathymetric mapping in coastal environments (in California, Texas, Florida, Washington, Alaska, Lake Michigan), and compilation mapping.

**Russell Graymer,** geologist, USGS 1974 to present, Ph.D. U.C. Berkeley, 1992; specializing in bedrock and Quaternary geology of the San Francisco Bay region, and in the preparation of digital geologic maps of the region. Experience includes bedrock mapping, Quaternary mapping, digital geologic databases, and structural geology.

**Herman Karl**, geologist, Ph.D., University of Southern California, 1977, has worked for the USGS for more than 20 years. Currently he is chief of a major project that provides scientific information relevant to resource management and ecosystems issues in the marine environment off the San Francisco Bay area. He has successfully managed this project through comprehensive but flexible planning incorporating long-term objectives and flexible implementation strategies adjusted to emerging customer requirements. He has a reputation for delivering products required by partner agencies on time and in formats that tailor science information directly to customer needs.

**Robert Lugo** has been assigned to the GIS Lab since coming to the USGS Western Region over eight years ago. He has many years of experience in the use of Arc/Info and has used that experience to develop a curriculum and teach many Arc/Info classes at the Western Region campus. Robert has experience in Web-page development and database management that have been put to use in the creation of Access USGS, the on-line database for the USGS SF Bay Ecosystem Project.

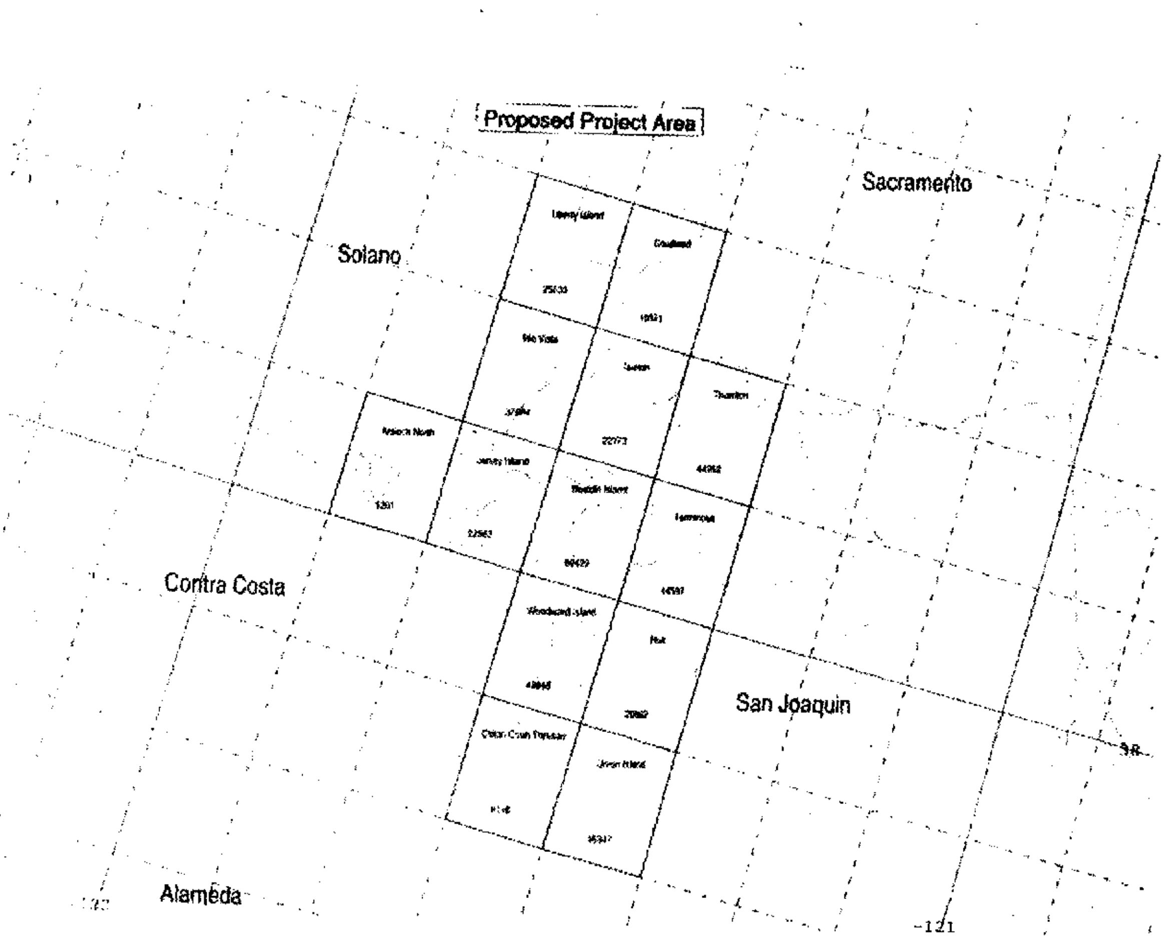
**Alan Mikuni** is the Chief of the National Mapping Division's Western Mapping Center in Menlo Park, CA. Prior to his current position Alan has held a variety of high-level staff positions at the Center including Assistant Mapping Center Chief and Assistant Program Management Branch Chief. Alan is a licensed engineer and has been very active in professional societies as an officer in the American Society for Photogrammetric Engineering and Remote Sensing and the Bay Area Automated Mapping Association.

**Tom Sturm** is a cartographer at the National Mapping Division Western Region office in Menlo Park, CA. He has experience in all phases of topographic map production. He managed a digital data production group in Menlo Park and has experience in contracting for data collection services. In his current position he represents the Mapping Division as a liaison person to Federal, state, and local government agencies in California, Oregon, and Washington for the purposes of program coordination, project development, and information dissemination.

**Florence Wong** has developed GIS analyses and solutions to coastal and marine geologic problems for almost ten years, working primarily with Arc/Info software for the past 6 years. Evolving from a background in sediment mineralogy, she has assumed the leadership for GIS applications in her team. In recent projects she has determined the volumetric distribution of sediment pollutants in the offshore Palos Verdes, CA, and Honolulu areas, and contributed to models of ocean currents in nearshore shelf areas.

**VI. Compliance with standard terms and conditions**

All terms and conditions consistent with a Federal Agency and RFP project group type (3:- Services) are agreeable to and are able to be complied with by the applicant.


Proposed Project Area
Sacramento
Solano
Contra Costa
San Joaquin
Alameda
38
-121


I-006478

# NONDISCRIMINATION COMPLIANCE STATEMENT

COMPANY NAME

U.S. Geological Survey

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unles specifically exempted, compliance with Government Code Section 12990 (a-f) and California Code o Regulations, Title 2, Division 4, Chapter 5 in matters relating to reporting requirements and th development, implementation and maintenance of a Nondiscrimination Program. Prospective contracto agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant fc employment because of sex, race, color, ancestry, religious creed, national origin, disability (includin HIV and AIDS), medical condition (cancer), age, marital status, denial of family and medical care leav and denial of pregnancy disability leave.

## CERTIFICATION

*I, the official named below, hereby swear that I am duly authorized to legally bind the prospectiv contractor to the above described certification. I am fully aware that this certification, executed on th date and in the county below, is made under penalty of perjury under the laws of the State of Californi*

OFFICIAL'S NAME

Michael V. Shulters

| DATE EXECUTED | EXECUTED IN THE COUNTY OF |
| --- | --- |
| July 25, 1997 | Sacramento, California |

PROSPECTIVE CONTRACTOR'S SIGNATURE

[signature]

PROSPECTIVE CONTRACTOR'S TITLE

District Chief

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME

U.S. Geological Survey

Address