

Application for Category III Funding

DWR WAREHOUSE

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I. EXECUTIVE SUMMARY**a. PROJECT TITLE AND APPLICANT NAME**

An Investigation of Seasonal Flooding as a Major Environmental Restoration, Flood and Water Resource Management Tool for the San Francisco Bay/Delta Watershed; presented by James Fryer, University of San Francisco (USF).

b. PROJECT DESCRIPTION AND PRIMARY BIOLOGICAL/ECOLOGICAL OBJECTIVES

The research project will investigate the feasibility of using widespread seasonal flood easements in agricultural, undeveloped, and lightly developed floodplains as part of a conjunctive groundwater recharge and revised reservoir management approach to improve instream flows, water quality, habitat, and overall environmental conditions for the priority species in the Bay/Delta system. The investigation will focus on the benefits that may result from linking water supply, flood management, and environmental restoration issues as problems that can be addressed with non-structural flood easement management options. The investigation will examine the possibility of reducing the cost of flood prevention policies while increasing water supply yields of groundwater and surface water simultaneously improving riparian corridors, and increasing seasonal wetland habitat. The project will identify opportunity areas for seasonal flood easements and assess the potential magnitude of the benefits. The economic value of seasonal floodplains and flood easements from an environmental enhancement, flood management, and water supply yield perspective will also be evaluated.

c. APPROACH/TASKS/SCHEDULE

The study will first examine the major technical, economic, legal, and policy issues associated with seasonal flooding in designated seasonal flood zones and associated revised reservoir management options. The geographical investigation will begin with an overview of Delta tributary waterways and floodplains and, using a series of screens, identify opportunity areas for seasonal flooding for habitat, flood management, and groundwater recharge benefits. Geographic Information System (GIS) technology will be used to identify and evaluate opportunity areas. GIS information will be collected from new and existing public domain sources and new data derived from other potential Category III funded projects. The research, analysis, and findings will be completed with GIS support. The project will then translate the key base maps and information layers into MARPLOT (a public domain, simplified GIS program that can be run on typical home computers) format for use as a widely accessible public domain educational tool that will assist widespread public understanding of environmental restoration, floodplain management, and water supply issues.

The Final Report on of the Research, Analysis, and Findings is scheduled for delivery September 1998. This will allow study of the watershed through the 1997/98 rainy season. The Marplot translation of the GIS data is expected to take up to an additional year, but could be accelerated if quality data are readily available in the early phases of the study.

d. JUSTIFICATION FOR PROJECT AND FUNDING BY CALFED

CALFED's mission includes developing solutions and implementation strategies and mechanisms for the San Francisco Bay/Delta's many problems. Category III funds are earmarked for environmental enhancement and research projects. This project is of broad-based value for the priority species and their stressors, and the development and implementation of a viable solution for the Bay/Delta. The research

seeks to address the stressors through developing a better understanding of how nonstructural measures that emphasize widespread habitat enhancement and restoration, and improved water quality can be applied to the watershed region. A university research project is the ideal forum for this type of research as it can be conducted in a politically neutral environment, with low overhead and at economical cost.

e. BUDGET COSTS AND THIRD PARTY IMPACTS

A total of \$89,250 is being requested. An in-kind cost sharing contribution of \$41,250, in addition to the requested amount, is provided as a part of the study. The research and analysis phase of the project is estimated to cost \$70,500 and the MARPLOT translation phase is estimated to cost \$19,250. The grant funds will primarily be utilized for computer expenses, data collection costs, materials, and salary.

No negative third party impacts are expected to occur. Beneficial third party impacts may be possible as a result of implementation of study recommendations.

f. APPLICANT QUALIFICATIONS

Project Manager and Principal Investigator

The Project Manager and Principal Investigator will be James Fryer who has a demonstrated track record of managing diverse water resource projects involving regional planning issues and development of innovative and practical solutions that are well received by the affected parties. His expertise includes integrated resources planning, watershed management, and water and land use planning in California. He has served on numerous water resource project advisory committees, and published numerous technical and policy papers. Mr. Fryer is currently completing his Master of Science in Environmental Management at University of San Francisco and will be supported in this project by USF faculty and other qualified professionals.

Project Advisory Committee

The project has a very highly qualified PAC with substantial professional experience and advanced degrees providing a broad range of technical, legal, economic, and policy expertise on the subject matter and the Bay/Delta system. PAC member expertise includes watershed ecology, biology, hydrogeology, geology, environmental engineering, environmental chemistry, economics, environmental law, land use planning, GIS systems technology, and California water resource issues.

g. MONITORING AND DATA EVALUATION

Monthly summary reports on the project's progress will be provided to CALFED. Ground truthing site visits will occur in the areas that pass the final GIS screening to assure the accuracy of the data collected and the appropriateness of the recommendations for the sites. Some degree of patience will be exercised in the GIS data collection to assure quality data are used as they become available at an economical cost.

h. LOCAL SUPPORT/COORDINATION WITH OTHER PROGRAMS/COMPATIBILITY WITH CALFED OBJECTIVES

Site visits for ground truthing will also include discussions with local citizens and landowners regarding flood easement acceptability and economic considerations in areas identified as opportunity areas. The GIS Data collection will be coordinated with other CALFED funded projects and other projects involved in the development of public domain GIS data. The project's results will be in the public domain and available for CALFED's use, and for educational program efforts included those required in the California Urban Water "Best Management Practices" and the Water Education Foundation materials. The project has the potential to play a key role as part of the overall solution to Bay/Delta environmental problems.

II. a. TITLE OF PROJECT:

An Investigation of Seasonal Flooding as a Major Environmental Restoration, Flood and Water Resource Management Tool for the San Francisco Bay/Delta Watershed

II. b. PRINCIPAL INVESTIGATOR/AFFILIATION:

James Fryer, University of San Francisco
P.O. Box 1323
Sausalito, CA 94966
415-332-2809 day
415-927-4953 fax
j-fryer@ix.netcom.com

II. c. ORGANIZATION AND STATUS: Private University, Non-profit, 501 (c)(3)

II. d. TAX IDENTIFICATION NUMBER: 94-1156628

II. e. TECHNICAL AND FINANCIAL CONTACT PERSON:

Primary Contact:

James Fryer, 415-332-2809 day, 415-927-4953 fax, j-fryer@ix.netcom.com

Alternative Contact:

Kathleen Ward Jennings, 415-422-2187 day, 415-422-6363 fax, JenningsK@usfca.edu

II. f. PARTICIPANTS/PROJECT ADVISORY COMMITTEE:

Dr. R. James Brown, USF, Biologist, Watershed Ecologist

Dr. Thomas MacDonald, USF, Hydrogeologist, Environmental Engineer

Dr. Robert Toia, USF, Environmental Chemist

Dr. Joe Nation, Economist, Marin Municipal Water District Director

Michael Carlin, USF, Biologist, Developed 1995 SF Basin Water Quality Control Plan

Robert Odland, Environmental Law, Land Use Planning

Kathleen Ward Jennings, USF, Biologist, Resource Ecologist

Betsy Riefsnieder, Friends of the River Executive Director

Erich Seamon, Geologist, GIS Specialist

California Agricultural Representative (to be announced)

II. g. PROJECT TYPE: Other Services, Research on Watershed Management Planning

III. a. PROJECT DESCRIPTION

The research project will investigate the feasibility of employing widespread seasonal flood easements in agricultural, undeveloped, and lightly developed floodplains as part of a conjunctive groundwater recharge and revised reservoir management approach to improve instream flows, water quality, habitat, and overall environmental conditions for the priority species. The investigation will focus on the benefits that may result from linking water supply, flood management, and environmental restoration issues as problems that can be addressed with non-structural flood easement management options. The investigation will examine the possibility of reducing the cost of flood prevention policies while increasing water supply yields of groundwater and surface water simultaneously improving riparian corridors, and increasing seasonal wetland habitat. The project will identify opportunity areas for seasonal flood easements and assess the potential magnitude of the benefits. The economic value of seasonal floodplains and flood easements from an environmental enhancement, flood management, and water supply yield perspective will also be evaluated.

The study will first examine the major technical, economic, legal, and policy issues associated with seasonal flooding in designated seasonal flood zones and associated revised reservoir management options. The study will also utilize Geographic Information System (GIS) technology to identify and evaluate opportunity areas for seasonal flooding within the Bay/Delta solution area. GIS information for the analysis will be collected from new and existing public domain sources, and new data derived from other potential Category III funded projects. The research, analysis, and findings will be completed with GIS support. Finally, the study will translate the key base maps and information layers into MARPLOT (a public domain, simplified GIS program that can be run on typical home computers) format for use as a widely accessible public domain educational tool that will assist widespread public understanding of environmental restoration, floodplain management, and water supply issues.

An effort will be made to coordinate this project with other CALFED projects and Bay/Delta studies to assure efficiency of information collection and synergistic benefits.

III. b. LOCATION AND/OR GEOGRAPHIC BOUNDARIES OF PROJECT

The project will begin with an overview of the entire solution area. The first screening will then narrow the selected geographic areas to smaller regions expected to largely be in the central valley and tributary alluvial fans as potential opportunity areas for seasonal flooding for habitat restoration, flood management, and groundwater recharge. The first screening will be permissive but designed to quickly remove clearly impractical areas from further consideration. As the study areas are narrowed, increasingly detailed information will be collected to further evaluate the areas remaining under consideration. Ground truthing site visits will occur in the areas identified after the final screening to assure the accuracy of the collected data and the appropriateness of the recommendations for the sites. Site visits will also include discussions with local citizens and landowners in areas affected by study recommendations.

III. c. EXPECTED BENEFITS

The project is of broad-based interest and value to resource managers and the priority species and their stressors. The research seeks to address the stressors through developing a better understanding of how nonstructural measures that emphasize widespread habitat enhancement and restoration and improved water quality can be applied to the watershed region. Rather than limiting the focus on one or two individual species, this project takes an overall ecosystem enhancement approach as an important component to restoring environmental conditions in the Bay/Delta and its floodplains. The result would be improved spawning and rearing grounds for splittail and salmon, foraging and nesting habitat for waterfowl and water-dependant wildlife species including the greater sandhill crane, giant garter snake, California clapper rail, and Canada goose. Improved water flow regimes and improved water quality would benefit winter and spring-

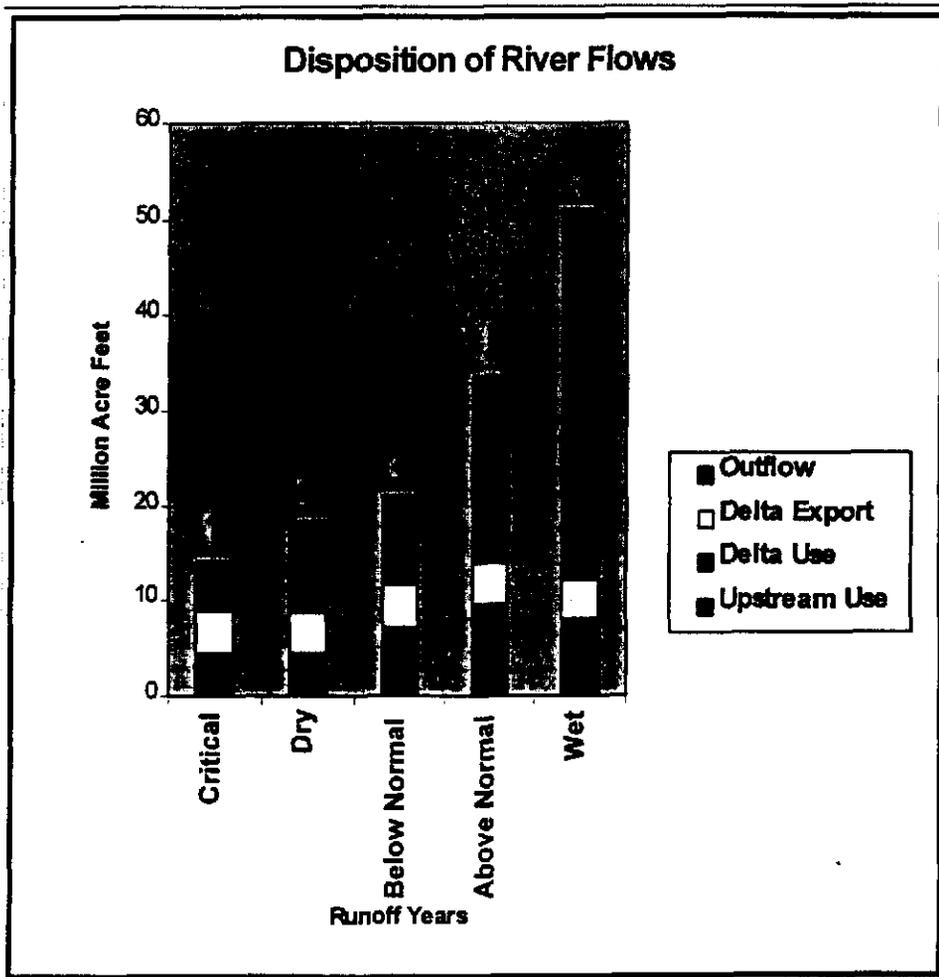
runs of chinook salmon, delta smelt, steelhead trout, green sturgeon and striped bass. Reducing the cost of flood control projects and flood disaster cleanups, and improving water supply yield would also help free up additional funds that could be used for additional environmental enhancement projects.

Since much of the solution for Bay/Delta problems may lie in the public recognizing its role in the problem and acting responsibly, the MARPLOT software will be a valuable educational tool. The MARPLOT software tool will also provide a viable alternative to Internet GIS information when online access for users is limited. Also, it is recognized that many users will be capable of downloading Internet data as they become available which could then be used in MARPLOT for developing new layers and additional analysis. With the MARPLOT software and information layers in the public domain, CALFED can make it available to land and water resource planners operating on a budget, schools, and even individuals who are interested but unable to invest in full privately maintained GIS technology. Simultaneously, these same parties would have the existing MARPLOT layers for the San Francisco Bay and Delta areas that are already in the public domain. Combined, these data sources will result in a very powerful and accessible tool for public use. The MARPLOT software would also make an ideal tool for use in the school educational programs including the programs required in the Urban Water "Best Management Practices" supported by the California Urban Water Conservation Council, or the Water Education Foundation programs.

III. d. BACKGROUND AND BIOLOGICAL/TECHNICAL JUSTIFICATION

Does it really make sense to continue attempting to channel flood waters to the ocean while environmental and water supply conditions continue to deteriorate? Seasonal flooding policies may provide the critical

"missing link" that could make a viable solution to Bay/Delta problems possible. The Yolo Bypass project near Sacramento, the Nature Conservancy's Cosumnes River Preserve, and the Stone Lakes Wildlife Refuge are examples that demonstrate many of the principles suggested are practical and benefit key species including salmon, splittail, and numerous waterfowl species. The 1997 New Year's floods have demonstrated that, while expensive, our present flood control infrastructure and policies are not entirely satisfactory. The ongoing negotiations in the Delta proceedings also suggests that to reach a viable solution, new approaches may need to be considered.



The stacked bar chart shown here, developed from data supplied by CALFED before the recent New Year's floods, shows the large amount of runoff in above normal and wet years that channeled through the Bay/Delta

and lost from creating season wetlands and groundwater recharge opportunities that could reduce dependence on surface flows in dry years. The increased water velocities from the wet year runoff also disturbs salmon spawning runs and undermines levee stability. The arrows above the stacked bars shows the potential effect of seasonal flooding on outflow in dry versus wet years. Basically, some leveling of the outflow bars could occur meaning more water would be available in dry years for improved water quality conditions and environmental enhancement.

A university research project is the ideal forum for this type of research as it can be conducted in a politically neutral environment. The project can also be conducted with low overhead and at a highly economical cost. In the recent Final Report of the Governor's Flood Emergency Action Team, dated May 10, 1997, increased University research is recommended for floodplain management issues including research on nonstructural measures. As noted by California Resources Secretary, Douglas Wheeler, at a conference sponsored by the Water Education Foundation in San Francisco on July 17, 1997, further investigation of nonstructural floodplain management measures is needed and better public understanding of the floodplain management and land use planning issues is necessary. And, as articulated in the California Department of Water Resources Bulletin 160-93, groundwater is a crucial component of California's water supply, is being seriously over drafted, and can be recharged in agricultural areas for conjunctive use programs.

Fundamentally, the power of floods may be a force that would be better utilized for environmental restoration and water supply benefits rather than constantly battled in what often appears to be a failing flood control policy. Just as resource managers have now learned that complete fire suppression is not always the best policy for forest and range management, perhaps, as a parallel, the use and management of seasonal flooding offers many benefits and is far less costly in the long run. However, it should be emphasized that the goal here is not to simply prove a preconceived position, but rather to conduct an unprejudiced investigation and determine if there are real long-term reasons why seasonal flooding policies will not work to the overall benefit of the Bay/Delta system, and identify potential seasonal flooding opportunity areas and specific issues surrounding these areas.

This research is not expected to provide a definitive answer for every possible question associated with this issue. Rather, it is intended to identify if there really are any insurmountable barriers to seasonal flooding policies as an important part of the solution for the Bay/Delta, identify what the barriers are, why they exist, and potential solutions. The project will also identify what magnitude of benefits may exist from seasonal flooding policies, if the benefits outweigh the barriers, and what additional research is needed to further investigate the barriers for solutions. The MARPLOT translation component will provide a very accessible tool for other interested parties to model scenarios on seasonal flooding and other environmental planning issues to gain a better understanding of the rivers and floodplains upstream of the Bay/Delta.

III. e. PROPOSED SCOPE OF WORK

The project will begin with an investigation of the issues listed in the Research and Analysis Phase section (III. e.). As the technical and policy issues are addressed, the geographical investigation will begin with an overview of Delta tributary waterways and floodplains and, using a series of less permissive screens, identify opportunity areas for seasonal flooding for habitat, flood relief, and groundwater recharge benefits. As the study areas are narrowed, GIS will be utilized and increasingly detailed information will be collected to further evaluate the areas remaining under consideration for their potential as opportunity areas. Ground truthing site visits will occur in the areas that pass the final screening to assure the accuracy of the data collected and the appropriateness of the recommendations for the sites. Site visits will also include discussions with local citizens and landowners regarding flood easement acceptability and economic considerations in areas

identified as opportunity areas. The identified opportunity areas will then be ranked according to their relative value for seasonal flooding easements.

Research and Analysis Phase

There are many issues that need to be evaluated to determine the viability of a seasonal flooding policy. Some of the immediately identifiable issues are noted below. Other issues may be investigated as they are identified in the course of the research. The PAC will play a crucial role in helping to identify issues and evaluating impacts and solutions.

- Benefits for riparian habitat
- Effect on seasonal wetlands in the central valley
- Benefits for spawning fish in the Bay/Delta from reduced high velocity peak flood flows in wet years
- Effect on fish spawning beds from diversion of flood sediments
- Impact on Bay/Delta flows and water temperatures resulting from revised reservoir management practices
- Benefits for pacific flyway habitat
- Impact on dredging costs of Bay/Delta navigation channels from flood sediments diverted to the central valley
- Environmental benefits from potentially reduced need for dredging
- Soil renewal benefits for central valley agriculture
- Appropriate crops and impact on crop growing seasons
- Impacts on agricultural tail water
- Effect on groundwater table levels and recharge rates
- Effect on water supply yield
- Cost savings estimates from reduced levee maintenance programs and discontinuing future repairs
- Cost estimates associated with relocating developments in designated flood areas
- Acceptability of a seasonal flooding policy by the general public and agricultural interests
- Economic value of designated seasonal flood zones and flood easements

It is recognized that a full evaluation each of these issues could comprise a large-scale study and, therefore, every consideration surrounding these issues will not be answered in the scope of this project. The approach will be to utilize information already developed as a part of the Bay/Delta proceedings, other research in the solution area, and the expertise of the PAC to evaluate these issues for their merits and problems. Issues that appear to present fatal flaws for a seasonal flooding policy will be further evaluated for potential solutions. Additional research on these specific issues by University undergraduate and graduate researchers will be encouraged and may be scheduled.

Geographic Analysis

The geographic analysis will utilize and build upon work already done and in the public domain, or currently underway and available as the project develops. Use of ArcView and ArcInfo GIS data from other Category III funded projects will be pursued for efficient data collection and use. The research phase will collect increasingly detailed GIS information as the study areas are narrowed. Once the research and analysis is completed using ArcView and ArcInfo, the critical overlays will be converted into a MARPLOT readable format along with a printable electronic user guide diskette with relevant information from the research and analysis report. When the MARPLOT overlays and user guide is completed, they will be released as public domain information and delivered to CALFED or other agency designated by CALFED for release and dissemination.

Overlays

The following map layers are expected to be developed for the project. Additional map layers may be identified and developed as the project progresses.

- Confined and unconfined aquifers
- Recharge zones
- Theoretical 100, 200, and 400 year flood zones
- Wetlands
- Levees
- Land use zoning
- Urban development and densities
- Existing refuge areas
- Soil types and horizons
- Topography/elevations
- Historic flood zones
- Rivers
- Dams/reservoirs/lakes
- Agricultural crops
- Habitat areas
- Wildland area

Specific Tasks	
Task 1	Conduct investigation and analysis on research items listed above in bullet format
Task 2	Geographic analysis of 100 year, 200 year and 400 year flood zones and overlays of known aquifers, recharge zones, rivers and streams, and levees
Task 3	1st Screen: elimination of low opportunity areas
Task 4	Collect more detailed information on remaining areas including zoning, current land use, soil horizon, etc.
Task 5	Compile and develop GIS information, develop criteria and conduct second screening to eliminate low opportunity areas
Task 6	Collect additional information on potential barriers to seasonal flooding and field analysis of areas remaining under consideration
Task 7	Conduct quantitative estimates of remaining study areas for magnitude of benefits
Task 8	Identify issues for future research
Task 9	Develop draft report on research and analysis phase
Task 10	Full PAC retreat for review of 1st draft
Task 11	Preparation of 2nd Draft Report for CALFED review
Task 12	Develop Final Report on research and analysis phase
Task 13	Presentation of final report to CALFED
Task 14	Identify priority base maps and layers for MARPLOT program
Task 15	Translate GIS layer databases for use in MARPLOT
Task 16	Develop electronic description and users guide for MARPLOT layers
Task 17	Develop draft MARPLOT program and electronic user guide to CALFED for review
Task 18	Present MARPLOT and electronic user guide to CALFED

Deliverables

1. Monthly Written Summary or E-mailed Updates.
2. Five (5) hardcopy and ten (10) CD-Rom copies of the Research Phase Draft and Final Reports.
3. One presentation of research and analysis report to CALFED.
4. Ten (10) CD-Rom and ten (10) Disk Copies of Mapping Phase Draft and Final MARPLOT Map layers and Electronic User Guide.
5. One presentation of MARPLOT translation phase results to CALFED.

IV. a. BUDGET

The research and analysis phase of the project is estimated to cost \$70,500 and the MARPLOT translation phase is estimated to cost \$19,250. Subconsultants will be engaged on a limited, as needed basis, and if the expected cost of the services warrants, state bidding requirements will be followed.

The proposed budget reflects access to ArcView and ArcInfo. Access to ArcView is secure within the budget presented below. If access to ArcInfo does not materialize as anticipated, additional computer costs of up to \$25,000 may occur. Cost allocation between categories shown below are estimates and may need adjustment as the project develops. This budget also reflects generous in-kind contributions by PAC members, if CALFED desires a more thorough analysis of issues associated with this project, additional funding may be warranted.

\$6,000	Computer hardware upgrades
\$5,000	Computer software
\$4,000	ArcInfo computer access fee
\$10,000	Computer consulting costs
\$10,000	PAC expenses, travel costs, fly overs, photos
\$2,500	Materials, Copying
\$750	Mailing
\$1,500	Long Distance Phone
\$45,000	Salary
<u>\$4,500</u>	<u>University Overhead on Salary</u>
\$89,250	Total Project Budget

Estimated Hours and Cost Per Hour

1000 hours at \$45/hr for Project Manager

250 hours Pro Bono by Project Manager (\$11,250 in-kind contribution).

200 total hours Pro Bono by PAC Members (\$30,000 in-kind contribution)

Monthly summaries will include a brief project update narrative and invoices with itemized costs along with copies of applicable receipts.

This budget relies on data becoming available through agencies including CALFED, USGS, DWR, USBR, Corp of Engineers, and other possible sources. If adequate data are not available for key high opportunity areas identified, additional funding may be necessary to collect primary data for use in this study.

This project could not be undertaken without the funding identified in this proposal.

IV. b. SCHEDULE

The research and analysis phase is scheduled to last 12 months from the start date. The MARPLOT translation phase is scheduled to last up to an additional 12 months. If data acquisition allows the GIS mapping and analysis to be accelerated, the MARPLOT translation may also be accelerated and the project may be completed sooner. However, some degree of patience will be exercised to assure quality data are used as they becomes available at an economical cost.

The data collection will begin and analysis of the background issues will occur this fall. The first screening will occur in November and December. Areas passing the first screen will then be more closely examined and monitored during the winter as the rainy season progresses (with the El Nino, the watershed may experience

V. APPLICANT QUALIFICATIONS

The project has a very highly qualified Project Manager and Project Advisory Committee with broad technical, legal, economic, and policy expertise on the subject matter and the Bay/Delta system. Summary qualification statement of PAC members and the Project Manager are included below.

Dr. R. James Brown 415-422-6415 415-422-6363 fax BrownR@usfca.edu
Chair of the Environmental Science Department and Director for Institute of Chemical Biology, University of San Francisco. Dr. Brown has directed numerous long-term aquatic monitoring projects including stream water quality and biological assessments, including fish surveys, bioaccumulation and biomagnification studies. Dr. Brown received his Ph.D. and an M.A. in Zoology from University of California, Davis, and a B.A. in Biology from Ottawa University, Kansas.

Dr. Robert Toia 415-422-5927 415-422-6363 fax ToiaR@usfca.edu
Dr. Toia is currently a Professor in the Department of Chemistry and Department of Environmental Science at the University of San Francisco. His expertise includes water chemistry, agricultural chemical use, and natural chemical cycles. He has conducted field research on stream water quality including physical, chemical, and biological characteristics. He has published numerous research papers on pesticide use and associated environmental impacts. Dr. Toia received his Ph.D. and B.S. in Organic Chemistry from the University of Western Australia.

Dr. Thomas MacDonald 415-422-5895 415-422-6363 fax MacdonaldT@usfca.edu
Dr. MacDonald is an Assistant Professor in the Environmental Science Department at the University of San Francisco. He was previously employed as an Associate Engineer at ENVIRON Corporation. His areas of expertise include hydrogeology, hazardous waste transport and natural attenuation, and remediation of hazardous waste. He has worked on projects addressing groundwater pollution and remediation at a number of sites, including superfund sites. Dr. MacDonald received his Ph.D. and M.S. in Civil Engineering from Stanford University and his B.S. in Geology-Physics/Mathematics from Brown University.

Dr. Joseph E. Nation 415-453-5086 415-453-5865 fax nation@ecoinfo.com
Dr. Nation is a principal and Managing Director for California Data and Analysis, a public policy economic consulting firm. Projects include economic development, regional economic analysis, industry impacts, labor economics, online information services. He holds an elected position as a Director for the Marin Municipal Water District and served as Board President in 1995. He presently serves as Senate Rules Committee appointee to California Board of education commission to develop K-12 public school curriculum. Previously Assistant Professor of Economics at The University of San Francisco. His education includes Doctor of Philosophy (Public Analysis), Rand Graduate School; M.S. in Foreign Service, Georgetown University; B.A., Economics, University of Colorado.

Kathleen Ward Jennings 415-422-2187 415-422-6363 fax JenningsK@usfca.edu
Ms. Jennings is presently an instructor with the Master of Science in Environmental Management program, University of San Francisco. She was previously Environmental Scientist, TETRA Tech, Inc. and Staff Scientist, Aqua Terra Technologies. She also served as Staff Scientist for the Institute of Chemical Biology, University of San Francisco. Past projects include all aspects of water quality monitoring programs in northern California including field and laboratory water quality analysis, benthic macroinvertebrate studies, stream sediment analysis, and field bioaccumulation and biomagnification studies. Ms. Jennings' education includes a B.S. in Biology and a M.S. in Environmental Management at University of San Francisco. She is currently engaged in Ph.D. studies in Wildland Resource Science at U.C. Berkeley.

Michael Carlin, Biologist 415-554-3192 415-422-6263 fax MCARLIN@puc.sf.ca.us
Mr. Carlin was formerly the Chief of Planning for the San Francisco Bay Regional Water Quality Control Board responsible for the 1995 update of the San Francisco Bay Basin Water Quality Control Plan and overseeing the toxic control, dredging, wetlands and regional monitoring programs. He was involved in Bay-Delta issues for a number of years as the Regional Board liaison to the State Water Resources Control Board. He is an Adjunct Professor at University of San Francisco where he teaches the Water Quality Management graduate course. He currently holds the position of Water Resources and Planning Manager for the San Francisco Public Utilities Commission. His education includes a B.A. in Marine Biology and a Masters of Public Administration in Environmental Management.

Robert Odland 510-524-0648 510-524-0567 fax rodland@jgc.org
Mr. Odland is a member of the Federal Bar and California Bar. He specializes in the implementation of plans and policies, providing legal and consulting services to local governments and other entities within the following fields, Development Regulation, Environmental and Resource Management Systems, Growth Management Systems, Sustainable Development Policies and Regulations, Land Planning and Management Systems. He has been providing these services for over 25 years to cities, counties, special districts, regional associations, private companies, Indian reservations, states, the U.S. government and governments of other countries. He has managed general plan projects that dealt with watershed conservation, agricultural lands, wetlands, habitats, aquifers, air quality, water quality, open space, flood hazards, unstable soils, and protection of scenic views. He obtained his law and urban planning degrees at the University of California at Berkeley and his engineering degree at the U.S. Military Academy at West Point.

Betsy Reifsnieder 916-442-3155 916-442-3396 fax breiff@friendsoftheriver.org
Ms. Reifsnieder is the Executive Director of the Friends of the River. She is the past Associate Director of the Mono Lake Committee. She has held the position of Program Manager for Water Conservation for the U.S. Bureau of Reclamation's Mid-Pacific Region. Ms. Reifsnieder was previously the Water Conservation Coordinator for the Sierra Club and served on its Legislative Committee. In 1995, she was selected in the drought response delegation to China and will be serving on the U.S. water resources planning delegation to South Africa in September, 1997. Ms. Reifsnieder received her B.A. degree in Diplomacy and World Affairs.

Erich Seamon 415-924-4600 415-927-4953 fax eseamon@ix.netcom.com
Mr. Seamon is the GIS applications programmer for the Marin Municipal Water District. He has over 5 years experience with workstation ARC/INFO, and extensive UNIX administration and programming experience on HP and Sun workstations. He is also experienced with PC, Macintosh, and VAX platforms, as well as Windows 95, NT, and MS-DOS. Past projects include a variety of geospatial projects, including watershed modeling, land use suitability analyses, parcel query and relational database. He has performed remote sensed soil and vegetation interpretation and analysis, using primarily LANDSAT and SPOT imagery. Other projects included flooding/watershed analysis, soil analysis and description, erosion and runoff predictability, seismic reflection, refraction, and resistivity. Mr. Seamon has a B.A. and a M.S. degree in Geology.

California Agricultural Representative (to be announced)

This is an important person for the project. Someone who has a thorough understanding of the California farmer perspective and issues, and an open mind to innovative solutions will be sought. The ability to provide a communication link to communities in the identified opportunity areas is also important. Input from CALFED in filling this position will be solicited.

James Fryer, Project Manager and Principal Investigator

Professional Experience

1990-Present: Marin Municipal Water District

Responsibilities included coordination of \$3.5 million budget for 22,000 acre watershed, landscape, and demand management programs. Participate in development of Integrated Water Resources Management Program. Analysis of water supply and demand. Develop and implement demand management programs. Economic analysis of program proposals. Develop packets and present items to publicly elected Board. Research and reports, project management, contract negotiation and management. Representative on local and statewide water resources committees. Public relations activities. Supervision of Demand Management Department staff. Evaluation of program effectiveness. Presentations at national, state, and local level conferences; public educational seminars; and local public speaking engagements. Developed model process for Conservation Master Planning incorporating the use of baseline studies and economic analysis that has been utilized by numerous water agencies in the U.S. and internationally.

Past Chair of California Dept. Of Water Resources - Water & Land Use Planning Subcommittee. Past Steering Committee member of California Urban Water Conservation Council and past Co-Chair of Strategic Planning Subcommittee. Member of 1994 Mono Lake/USBR Selection Committee to review water conservation project proposals from 26 agencies and disburse \$2.3 million in grants. Consulted with British Columbia Water and Wastewater Association for development of regional planning effort in 1996. Selected in U.S. delegation to water resources planning workshop in Hermanus, South Africa, September 1997.

1984-90:

Navigation systems design and sales, yacht racing campaign project management, yacht broker, delivery captain, rigger on racing and cruising sailing yachts.

Education: M.S. Candidate, Environmental Management, University of San Francisco
B.A. Music, San Francisco State University
Oceanography, Humboldt State University
Natural Resources, Central Piedmont Community College in North Carolina.

Related Qualifications:

Served on numerous project advisory committees, published numerous technical and policy papers, and human interest articles.

Computer literate including extensive navigational experience with electronic charting and logging with GPS interface and full navigation functions on raster scanned NOAA charts, shortwave radio Weather Fax, MARPLOT, Paradox, Microsoft Project, Excel, Lotus, Wordperfect, Netscape, Windows, Powerpoint, allCLEAR, etc.

Extensive natural waters experience including approximately 50,000 nm of canoeing, rafting, and sailing on river, lake, bay, coastal, and offshore waters. Locations include North Pacific, San Francisco Bay/Delta, Klamath River, Sacramento River, Mono Lake, California; North Atlantic; Caribbean; Bermuda; New River, Catawba River, North Carolina; Kissimmee River, Florida, San Juan Islands, Washington; Andaman Sea, Thailand; South China Sea, Pearl River, China; Mediterranean Sea; Dalyan Dere, Turkey; Danube River, Austria; Frazer River, Butte Inlet, Desolation Sound, Gulf Islands, British Columbia; Trisuli River and Pewa Tal, Nepal; Ganges River, India.

Other Interests: Environmental sustainability issues, advanced scuba diving certification, ethnomusicology.

NONDISCRIMINATION COMPLIANCE STATEMENT

COMPANY NAME

University of San Francisco

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

CERTIFICATION

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

OFFICIAL'S NAME

ELSIE S. TAMAYO



DATE EXECUTED

JULY 16, 1997

EXECUTED IN THE COUNTY OF

SAN FRANCISCO

PROSPECTIVE CONTRACTOR'S SIGNATURE

PROSPECTIVE CONTRACTOR'S TITLE

PROSPECTIVE CONTRACTOR'S LEGAL BUSINESS NAME

UNIVERSITY OF SAN FRANCISCO