

4.5 PSP Cover Sheet (Attach to the front of each proposal)

Treatment of Ballast Water: Towards the Elimination of Alien
 Proposal Title: Aquatic Introductions into the San Francisco Bay-Delta
 Applicant Name: California State University, Hayward Foundation
 Mailing Address: 25976 Carlos Bee Blvd., Hayward, CA 94542
 Telephone: (510) 885-3001 (principal investigator)
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 Email: ckitting@csuhayward.edu

Amount of funding requested: \$ 596,783 for 1 years

Indicate the Topic for which you are applying (check only one box).

- | | |
|--|--|
| <input type="checkbox"/> Fish Passage/Fish Screens | <input checked="" type="checkbox"/> Introduced Species |
| <input type="checkbox"/> Habitat Restoration | <input type="checkbox"/> Fish Management/Hatchery |
| <input type="checkbox"/> Local Watershed Stewardship | <input type="checkbox"/> Environmental Education |
| <input type="checkbox"/> Water Quality | |

Does the proposal address a specified Focused Action? yes no

What county or counties is the project located in? Alameda

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

- | | |
|---|--|
| <input type="checkbox"/> Sacramento River Mainstem | <input type="checkbox"/> East Side Trib: _____ |
| <input type="checkbox"/> Sacramento Trib: _____ | <input type="checkbox"/> Suisun Marsh and Bay |
| <input type="checkbox"/> San Joaquin River Mainstem | <input type="checkbox"/> North Bay/South Bay: _____ |
| <input type="checkbox"/> San Joaquin Trib: _____ | <input checked="" type="checkbox"/> Landscape (entire Bay-Delta watershed) |
| <input type="checkbox"/> Delta: _____ | <input type="checkbox"/> Other: _____ |

Indicate the primary species which the proposal addresses (check all that apply):

- | | |
|--|--|
| <input type="checkbox"/> San Joaquin and East-side Delta tributaries fall-run chinook salmon | <input type="checkbox"/> Spring-run chinook salmon |
| <input type="checkbox"/> Winter-run chinook salmon | <input type="checkbox"/> Fall-run chinook salmon |
| <input type="checkbox"/> Late-fall run chinook salmon | <input checked="" type="checkbox"/> Longfin smelt |
| <input checked="" type="checkbox"/> Delta smelt | <input checked="" type="checkbox"/> Steelhead trout |
| <input checked="" type="checkbox"/> Splittail | <input checked="" type="checkbox"/> Striped bass |
| <input type="checkbox"/> Green sturgeon | <input checked="" type="checkbox"/> All chinook species |
| <input type="checkbox"/> Migratory birds | <input checked="" type="checkbox"/> All anadromous salmonids |
| <input type="checkbox"/> Other: _____ | |

Specify the ERP strategic objective and target (s) that the project addresses. Include page numbers from January 1999 version of ERP Volume I and II:

ERP Objective: To eliminate further introductions of new species in ballast water

Targets: 1. eliminate the dumping of all organism-containing ballast water/sediment;
2. reduce the amount of ship ballast water contaminated with estuarine organisms

(ERP Volume 1: Page 464)

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

- | | |
|--|---|
| <input type="checkbox"/> State agency | <input 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 checked="" type="checkbox"/> University (State) | <input type="checkbox"/> Other: _____ |

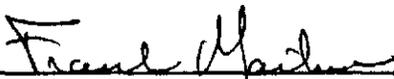
Indicate the type of project (check only one box):

- | | |
|--|---|
| <input type="checkbox"/> Planning | <input type="checkbox"/> Implementation |
| <input type="checkbox"/> Monitoring | <input type="checkbox"/> Education |
| <input checked="" 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 the applicant is an entity or organization); and
- 3.) The person submitting the application has read and understood the conflict of interest and confidentiality discussion in the PSP (Section 2.4) and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent as provided in the Section.

Frank Martino, Provost and Vice President, Academic Affairs
Printed name of applicant


Signature of applicant

Title Page

Title of Project:

Treatment of Ballast Water: Towards the Elimination of Alien Aquatic Introductions into the San Francisco Bay-Delta

Primary Contact

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Participants and Collaborators

- (1) John Rees, Adjunct Professor, Department of Biological Sciences, California State University, Hayward, CA 94542 *and*
Senior Research Scientist, Environmental Research Center, California State University, Hayward, 751 West Midway, Bldg 7, Alameda Point, CA 94501
- (2) Leland Cole, President, Electrox, Inc.
- (3) Watson Aldridge, Executive Vice-President, Electrox, Inc.
- (4) Joseph Bishop, Vice-President, Administration, Electrox, Inc
Electrox, Inc: 2701 Monarch Street, Suite 150, Alameda, CA 94501

Type of Organization and Tax Status

State agency/university (tax status: state agency)

Tax Identification Number

94-1524922

Executive Summary

Brief Description of Project. The proposed project will investigate a range of bench scale physical and chemical methodologies to treat ship ballast sediment and water such that living organisms can be separated, treated and/or destroyed, and the treated water can be safely redischarged to receiving waters (San Francisco Bay-Delta) or other facilities (storage tanks, POTW facilities). A pilot demonstration test on a large volume of ballast water (~3,000 gallons) will be run at the end of the project once bench scale testing is complete. An initial survey will be performed to determine the range of constituents, both living and inanimate, which are typically found in ballast tanks. Surveys of ballast tank contents, and analyses of actual ballast tank water, will be conducted and the results tabulated. Ballast tanks can contain any or all of the following, in any or all combinations, ranging from very low to high concentrations: living organisms, ranging from viruses to fish, and including bacteria, single-celled animal and plant flagellates, invertebrate larvae, and adult invertebrates, total dissolved and suspended solids (TDS and TSS) in concentrations ranging from 0 ppm to muds or sludges, depending on the presence or absence of ballast sediment, oils and greases, dissolved metals, and a range of salinity (from 0 to 34 ppt). Bench testing will be performed on the known spectrum of ballast water types, determined by constructing an operational matrix. After each bench test has been run successfully, the range of constituents in the sample, test methods needed for successful treatment, and test results will be tabulated. The result will provide a list of recipes for successful treatment of any given ballast water and sediment sample, type of treatment(s) required, and projected cost of treatment (cost/gallon). A demonstration pilot test using ballast water will be run at project conclusion.

Size and location. Since the proposed project is a bench laboratory and pilot demonstration project, the geographic size of the project is not applicable. All phases of the work, including bench and pilot scale testing, will be carried out at Alameda Point, Alameda, CA.

Primary Biological/Ecological Objectives. The primary biological/ecological objective is to develop effective methodologies for the treatment of any given sample of ballast water and sediment such that the resulting water/sediment liquid is free from non-native organisms. Viruses and bacteria can be removed through our testing procedure, but are not addressed in this proposal. The San Francisco Bay-Delta is considered the most invaded and has the highest number of non-native species of any US estuary. The principal means by which most aquatic non-native species are thought to have entered the Bay-Delta since 1970 has been ship ballast water. The need for ballast water (and associated sediment) treatment prior to discharge into the San Francisco estuary and other estuaries country (and world)-wide is widely recognized. The prevention of the introduction of additional potentially dangerous non-native aquatic species into the Bay-Delta system would have lasting positive effects on all priority fish species (all races of salmon, steelhead, splittail, delta smelt, longfin smelt and species of sturgeon) and on all CALFED ecological management zones throughout the entire Bay-Delta watershed. The prevention of introduction of additional non-native aquatic species, coupled with CALFED restoration efforts, should provide the priority fish species and other native aquatic species with an "ecological breather", enabling population increases without the added stress of the presence additional aquatic non-natives. Results of this project, if implemented at full-scale throughout the Bay-Delta at port facilities, would benefit the aquatic ecology the entire Bay-Delta watershed, including central Valley rivers and tributaries.

Cost. The cost of the proposed project is \$596,783.00.

Adverse Third Party Impacts. We anticipate no adverse third party impacts as a result of our project.

Applicant Qualifications. We have assembled an integrated team for the proposed project, including two experienced field and laboratory biologists, two chemists/chemical engineers, and a lab and field operations manager. These two basic groups will interact with each other at all times during throughout the project.

The biological group will consist of Drs. Kitting, and Rees (CSU Hayward) and the chemistry and chemical engineering group (Electrox, Inc) will consist of Dr. Leland Cole, Mr. Watson Aldridge, and Mr. Joseph Bishop. Professor Kitting earned his Biological Sciences Ph.D. in 1979 at Stanford University and is currently a Professor of Biology at CSUH. Dr. Kitting has managed projects related to marsh processes and restoration for agencies and private clients for the past 15 years, and he and his students have had extensive experience on the role native and introduced wetlands species in the Bay-Delta. Dr. Rees has had 20 years experience in general environmental project management in both the public and private sectors and has conducted studies and published on introduced SF Bay-Delta invertebrates. Dr. Cole received his Ph.D. in chemical engineering at Oregon State University and is currently the President and technical director of Electrox, Inc. He has 45 years experience in chemistry and chemical engineering project related work, much of that related to water treatment and analysis. Dr. Cole has managed and directed projects on the design of instrumentation for a variety of analytical applications, including the treatment and analysis of wastewater. Mr. Aldridge is a manufacturing engineer with 30 years experience in industry and business. He has a wide range of expertise in both custom job manufacturing environment and coordinating the efforts of multiple field operations. Mr. Bishop received his B.A. from Oregon State University in chemistry. He has managed environmental field projects requiring extraction and analysis of water and wastewater samples.

Monitoring and Data Evaluation. "Monitoring" in our proposed project will not be the type of monitoring performed in an ecological restoration project. Only the test results of our laboratory and pilot demonstration test can be considered "monitoring". An initial survey will be performed to determine the range of constituents, both living and inanimate, which are to be found in any selected ballast tank or tanks requiring treatment. Once a range of constituents has been collected, a matrix will be constructed with ballast water type along one axis and the technology or technologies needed to treat that ballast water, such that it would be "clean" enough to put back into receiving waters or into tankage prior to disposal into a local POTW, on the second axis. Bench testing will be performed on a range of ballast water types determined in our constructed matrix. After each test has been run successfully, the range of constituents in the sample, test methods needed for successful treatment, and test results will be tabulated ("monitoring" our test results). A pilot demonstration test, based on the results of our bench scale tests, will be run at the conclusion of bench scale testing (a second level of "monitoring").

Local Support/Coordination with Other Programs. The local RWQCB, Port of Oakland, and Coast Guard are interested in the results of our proposed project. Regional Water Quality Control Board staff have indicated where local ballast water samples can be found for laboratory and pilot testing. They are also advocating pursuing treatment of ballast water in conjunction with possible final discharge into local POTW's. The Coast Guard (Coast Guard Island, Alameda) has verbally pledged its support.

Compatibility with CALFED objectives. This proposed project will aid the objectives of the CALFED program through the improvement of ecosystem quality and ecological function by means of elimination of introduction of new non-native aquatic species. The project is conflict-neutral with regard to CALFED other objectives including water supply and levee system integrity, water use efficiency, and water transfers. The proposed project benefits CALFED objectives of water quality through removal of not only non-native aquatic species, but also any solids, oil and greases, and dissolved heavy metals which would otherwise be discharged into the waters of the Bay-Delta in ballast water. The project would also benefit watershed management as elimination further introductions of non-native aquatics would compete eliminate competition with native species, including priority fish species (all races of chinook salmon, steelhead, splittail, Delta smelt, longfin smelt).

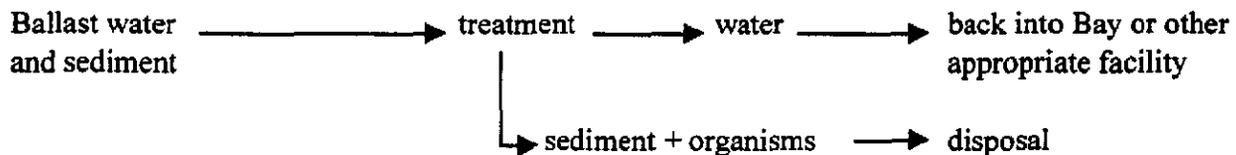
Project Description

Note: all references to “ballast water” in this and following sections of the proposal include both “ballast water” AND associated “ballast sediment”. Discharged ballast sediment is probably a significant source of introduced aquatic species in the Bay-Delta Estuary. Many benthic organisms can live for months or even years in the sediment which collects in ballast tanks.

1. Proposed Scope of Work.

Project Description. The project will investigate a range of bench scale physical and chemical methodologies to treat ship ballast sediment and water such that all living organisms are removed, and the resulting liquid can be returned to receiving waters (in this case, San Francisco Bay) or other appropriate facilities (storage tanks, POTW facilities for final treatment) minus any organisms, non-indigenous or otherwise. In effect, organisms in the ballast water will be treated like suspended particles, and all will be removed and/or destroyed upon completion of treatment. A general overall diagram of the generalized envisioned treatment process is given in Figure 1 below.

Figure 1. Generalized Process Diagram for Ballast Water Treatment

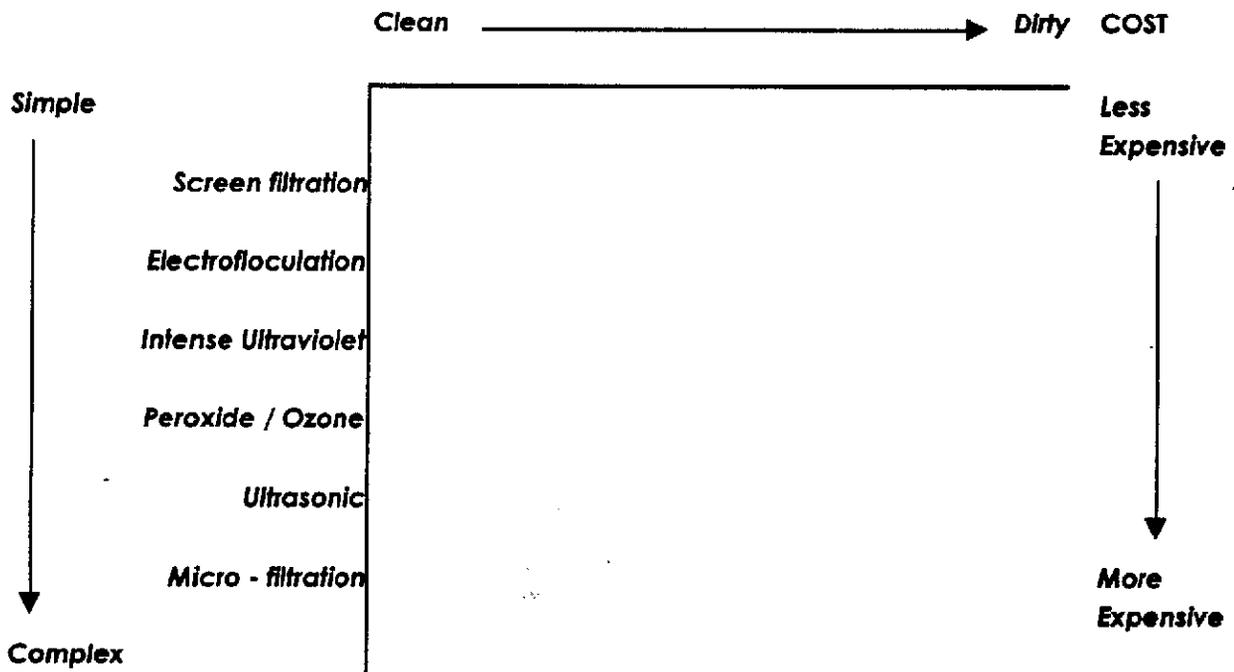


Little or no data is available on ballast water physical and chemical characteristics, as well as concentrations and type of organisms, and obtaining ballast water and sediment samples is challenging due to the sensitivity of ballast water treatment and its impact on the economic bottom line of the shipping industry. We do know that a wide variety of living organisms can be found in any given sample of ballast water and sediment, including single-celled algae, pelagic invertebrate life stages (annelids, crustaceans), hydroids, bryozoans, and even fish. We plan to obtain samples of ballast water through a variety of methods, including: (1) actual ballast water samples, obtained from any or all of the following sources (a) commercial vessels at local ports such as the Port of Oakland (upon approval), (b) from vessels of the Maritime Academy in Vallejo, with whom CSU Hayward has institutional relations, (c) from vessels of local entities with which Electrox, Inc., has relations (d) from Navy reserve ships at Alameda Point, (e) from smaller vessels (other than commercial vessels) such as private yachts or other smaller, private vessels (fishing boats) (f) actual ballast water samples obtained outside of San Francisco Bay, including Canadian Ports (Port of Vancouver, and/or east coast USA ports AND/OR (2) synthetic ballast water samples, made up in the laboratory, containing a range of few to many, and low to high concentrations of all of the following ballast water “ingredients” (1) “sediment” (made up from local sources); (2) “aquatic organisms”, obtained either through laboratory culture (algae, copepods, invertebrate pelagic stages (sea urchins), benthic animals and plant (hydroids, anemones, benthic algae) and small fish, or from actual or “concocted” local plankton samples. Some ballast water samples can contain varying concentrations of oil and grease and dissolved heavy metals, and these can be added to some samples to simulate these conditions. Thus we can “obtain” representative ballast water samples irrespective of whether every specific type of ballast water is obtainable in the field.

Project Approach. In order to address as many of the ballast water types found in the wide variety of boats and ships which enter the Estuary, as well as to anticipate as many means of potential end-treatment and disposal options as possible, we will approach our laboratory and pilot-scale work in the following way;

- (a) A survey will be performed to determine, as best as possible, the range of constituents, both living and inanimate, which can be anticipated will be found in any selected ballast tank or tanks requiring treatment. Ballast tanks quite probably contain any or all of the following constituents, in any or all combinations, ranging from very low to high concentrations: living organisms, ranging from viruses to fish, and including bacteria, single celled animal and plant flagellates, invertebrate larvae, and adult invertebrates, total dissolved and suspended solids (TDS and TSS) in concentrations ranging from 0 ppm to muds or sludges, depending on the presence or absence of ballast sediment, oils and greases, dissolved metals, and a range of salinity (from 0 to 34 ppt). We plan to collect our data from experts and other workers in the field, including biologists who have investigated ballast tanks from ships coming into port, environmental companies engaged in cleaning out ballast tanks, port directors in the USA and Canada with knowledge of the constituents of ballast water (the Port of Vancouver has a pilot ballast water program under way), and military personnel.
- (b) Once a range of constituents has been collected a matrix will be constructed with ballast water type along one axis and the technology or technologies needed to treat that ballast water such that it would be "clean" enough to put back into receiving waters or into tankage prior to disposal into a local POTW, on the second axis (Figure 2). The definition of "clean" water needs to be determined, but will probably meet all POTW discharge standards for organics and inorganics, and will be detectably free of living organisms according to standards to be determined.

Figure 2. Type of Ballast Water vs. Treatment Technologies and Cost



(c) Bench testing will be performed on a range of ballast water types determined in our constructed matrix. The ballast water types will be made up in small batches (5-20 liters) and test treated in the laboratory. All possible constituents of ballast water will be test treated by virtue of our matrix: living organisms (with the possible exceptions of bacteria and viruses), TSS and TDS (in a range of concentrations), oils and greases, dissolved metals, and salinity. The more constituents in ballast water, and the higher their concentration, the more treatment types will be needed (generally, but not always) performed in sequence, the longer the

treatment will take, the higher will be its cost (at the bench scale level, pilot level, and full-scale treatment). Thus our bench treatments will enable us to determine ultimate cost at full scale treatment, vital when surveying all possible options for ballast water treatment. Each of our test runs will then be analyzed for effective results: concentration of organisms (performed through microscopy), TSS and TDS concentrations, metal concentrations and salinity concentrations (performed at a certified analytical lab). (d) After each test has been run successfully, the range of constituents in the sample, test methods needed for successful treatment, and test results will be tabulated. With our range of test results, we will be able to predict, with a given sample of ballast water, which treatment types are needed, length of time of treatment, and cost (per gallon) of ballast water; see figure 2). (e) A demonstration pilot test, based on the results of our bench scale tests, will be run at the conclusion of bench scale testing. Actual ballast water will be used in the pilot test.

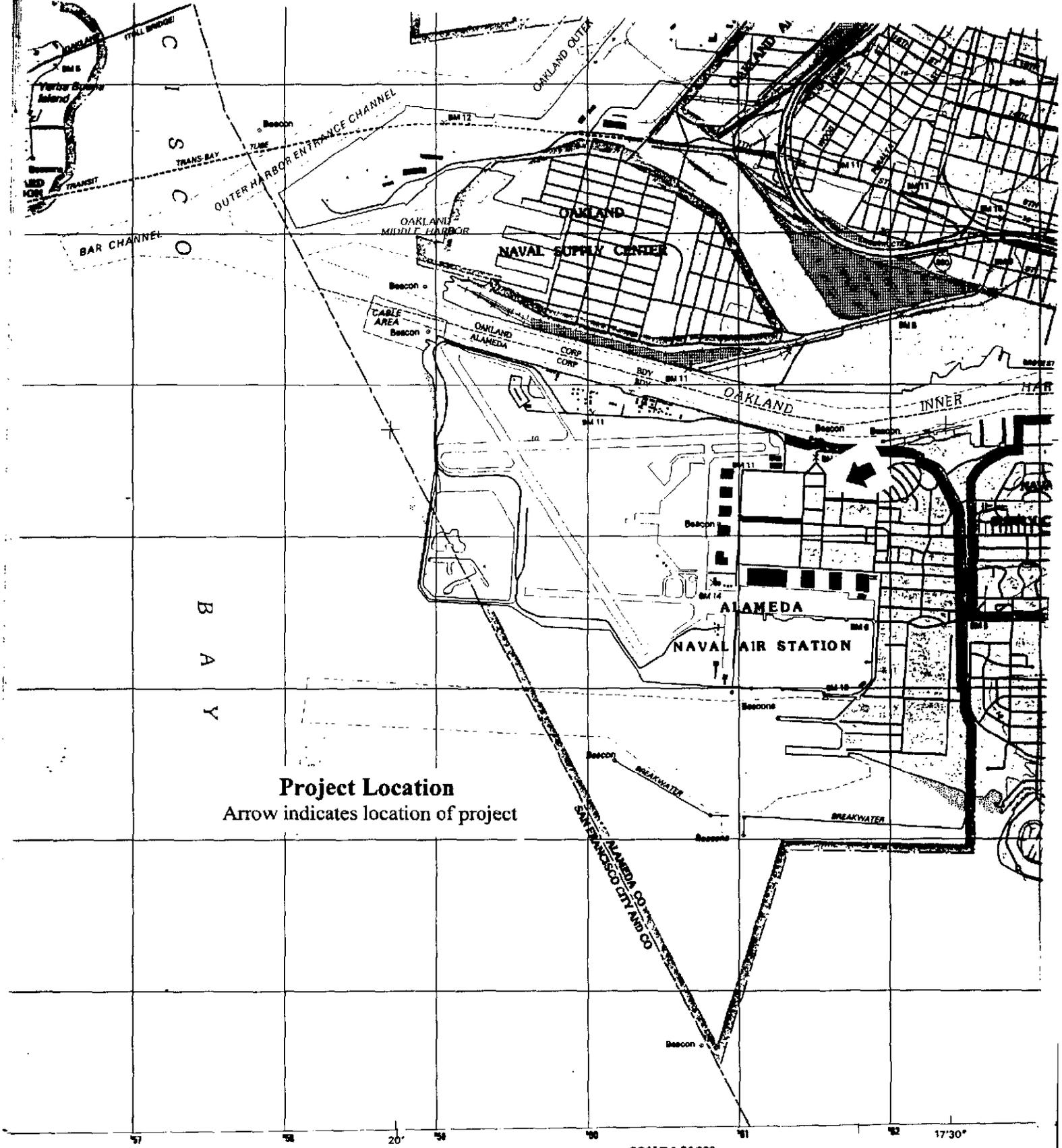
Tasks and Deliverables. We have established one task in our proposed project. The task will entail test treating all types of ballast water (and sediment) we have established will be present in any given ballast tank at bench scale level, until we have successfully treated all samples in our prepared matrix, to our satisfaction (in the case of biological organisms) and to present POTW discharge standards (in the case of physical and chemical constituents). The task will be divided into two major subtasks: (1) bench scale testing, and (2) a demonstration pilot test. The **deliverables** in the bench scale testing will include: (a) a matrix of data of ballast water constituents which have been obtained from field obtained samples and from actual ballast tanks. This data will be obtained from workers in the field and samples will be taken directly from ballast tanks. We feel certain that we can obtain ranges of data which would effectively embrace virtually the contents of any given ballast tank (b) a matrix of results of samples of bench-scale treated ballast water, and for each sample tested in our matrix will include estimates of time it will take to treat a given ballast water sample (in gal/hr), types of technology or technologies that will be needed to treat the given sample, and a cost to treat the given sample (per gallon). In the pilot scale testing, an actual ballast tank sample will be test treated at about 5 gal/minute. Test results from the pilot demonstration test will be a deliverable.

Tasks and Budget Schedule. We have only one task in our budget. The quarterly budget schedule is presented under the "Cost" section of this proposal. The proposed project will take one year to complete.

Separable Tasks. We have not separated the project or the budget into separable tasks, and have only one task for the entire project. We did not believe it feasible to break up the project into more than one task, as the success of the project will be determined upon completion of a successful pilot test.

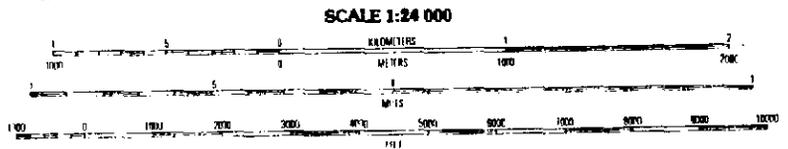
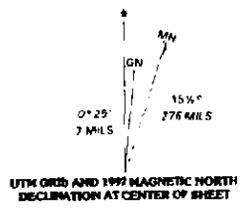
2. Location and/or Geographic Boundaries of the Project.

Project Location. The project will be carried out entirely at Alameda Point, City of Alameda, Alameda County. Since the project will be carried entirely in a laboratory and/or dockside environmental at Alameda Point, project watersheds and boundary footprints are not applicable. USGS map and digital geographic coordinates :Lat: 37^o 30' - 38^o 00' ; Long: 122^o 00' - 30'. See attached USGS Map for location of Project .

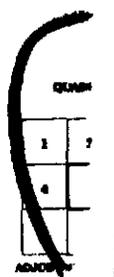


Project Location
 Arrow indicates location of project

Geological Survey
 Map from imagery
 used as of 1999
 SE. Map issued 1996
 F. Projection and
 datum, zone 10
 UTM (zone 10)
 W. Above by dashed
 line MAD 27 and MAD 83
 to from National Geodetic
 Survey of 1983
 by boundaries of
 1 on this map



CONTOUR INTERVAL 20 FEET
 SUPPLEMENTARY CONTOUR INTERVAL 5 FEET
 NATIONAL GEODETIC VERTICAL DATUM OF 1929



THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
 FOR SALE BY U.S. GEOLOGICAL SURVEY, P.O. BOX 25286, DENVER, COLORADO 80225
 A 57% TYPED DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
 I - 0 1 9 7 9 1

Subj: **Re: FW: Ballast Water**
Date: 4/8/99 4:04:56 PM Pacific Daylight Time
From: Smm@rb2.swrcb.ca.gov (Steve Moore)
To: johntrees@aol.com, kwebb@delta.dfg.ca.gov

Hi Kim and John

Just wanted to pass along the response that the RWQCB is supportive of using existing wastewater treatment facilities as tools to deactivate exotic organisms in ballast water. Pretreatment may or may not be necessary. The Southeast Plant in SF currently accepts untreated ballast water from the Hunters Point drydock ship dismantling and repair facility. They work on 3-4 large ships per year and discharge 100% of the ballast water to sanitary sewer, due to NPDES discharge prohibitions for ballast water.

-Steve

Steve Moore, P.E.
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California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay St., #1400
Oakland, CA 94612
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smm@rb2.swrcb.ca.gov

Ecological/Biological Benefits

1. Ecological/biological Objectives

Primary ecological/biological objectives for the project. The primary ecological/biological objective of the project is the prevention of new aquatic introductions into the Estuary via treatment of ballast water and sediment. Ballast water and associated sediment is in many cases is now being discharged untreated directly into the waters of the Bay-Delta. The San Francisco Bay-Delta is considered the most invaded of all United States estuaries in terms of aquatic species. The means by which most aquatic non-native species are thought to have entered the Bay-Delta recently (since 1945) has been ship ballast water, and a recent accelerating rate of introductions is thought primarily attributable to increased ballast water discharge due to an increased volume of trade and shipping in to the Bay-Delta. Ballast water research has shown that 90% of vessels coming into some US ports carry a load of living organisms, most originating from ports outside of the USA. The result of ballast water discharge from foreign vessels into the Bay-Delta has been an accelerated increase in the introduction of aquatic non-native species. It has been estimated that since 1970 there has been one new aquatic non-native species invading the Estuary every 24 weeks. There is at present, no approach, integrated or otherwise, to prevent new introductions into the Estuary through the discharge of ballast water. Ships entering the Estuary from overseas ports now operate on an "honor system" with regard to their exchanging ballast water on the high seas.

Need for project and comparison with similar approaches. The need for ballast water (and associated sediment) treatment prior to discharge into receiving waters is widely recognized. The National Research Council has promulgated the need for controlling the introduction of non-native species through ballast water, and recently (February, 1999), President Clinton issued an executive order convening a panel of experts to look into the general problem of non-indigenous species, of which introductions by ballast water are a subset. Methodologies to treat ballast water prior to discharge have not been systematically investigated, and there are no "similar approaches" will which to compare our project protocol. There are other approaches to deal with the discharge of ballast water other than treatment in port, including exchanging ballast water on the high seas, or the possibility of collecting ballast water in-port in large storage tanks and sending the water to be treated ultimately in local POTW's. There are serious reservations with both of these scenarios, however, as even assuming that ballast water exchange is performed on the high seas (and there are no regulations in place now for insuring that all ships entering the Bay have exchanged their ballast water) ballast exchange is often incomplete. Many organisms, especially estuarine forms, can withstand a wide range of salinities, and those in the ballast sediment are probably affected minimally by ballast exchange. Treatment in local POTW's, even if the capacity exists for treatment of such large volumes, faces regulatory and technical hurdles, as permits for treatment need to be obtained, and the salt content may be too high for direct POTW input without pretreatment.

Summarization of expected benefits. The following direct benefits can be expected from the project if and when project results are implemented full-scale: (1) the number of aquatic species that are being introduced into the Bay-Delta via ballast water and sediment discharge will be reduced or eliminated, (2) fewer introductions into the Bay-Delta will benefit ecological function in all CALFED ecological management zones, including newly restored areas within each of the management zones, (3) benefits would accrue to the planktonic and benthic ecosystems in all management zones, and to priority fish species (all anadromous salmon, Delta smelt, longfin smelt, sturgeon species).

Primary stressors, species, and habitats on which project focuses. The effects of introduced species on priority fish species in the Bay-Delta Estuary, as well as on all other native aquatic species, are unclear, but the effects are undoubtedly major. Some non-natives are so abundant that they are having a measurable negative effect on the Estuary ecosystem. The Asian clam *Potamocorbula* can apparently filter the entire water column in areas of the Estuary where it is abundant, reducing phytoplankton density, and ultimately

reducing the zooplankton on which most priority fish species feed, particularly in their younger stages. The Chinese mitten crab (*Eriochir sinensis*) has attained abundances during the fall of the year such that they have interfered with water diversion activities at Delta pumping stations as they are migrating to spawn. Other potentially dangerous non-native invertebrates, such as the zebra mussel (*Dreissena* spp) and estuarine ctenophore *Mnemiopsis* are "waiting in the wings", as it were, for an auspicious moment for introduction. The proposed project would focus on the prevention of further aquatic introductions via ballast water, although a full-scale ballast water treatment system in place would still not prevent all introductions. Other preventative activities, such as halting bait organism dumping and release of aquarium and nursery plants and animals in the Bay-Delta ecosystem are also needed. The prevention of additional potentially dangerous non-native aquatic species into the Bay-Delta system would have positive effects on all priority fish species (all races of salmon, steelhead, splittail, delta smelt, and species of sturgeon) and on all habitats throughout the entire Bay-Delta watershed, including the upper fresh water reaches of Sierra streams and rivers. With the prevention of introduction of additional non-native aquatic species, coupled with CALFED restoration efforts, the effects of those non-natives already present will be decreased, and the addition of new habitats and decreased competition from new introductions will provide the priority fish species and other native aquatic species with an "ecological breather" enabling population increases without the competitive stresses of additional aquatic non-natives.

Identification and quantification of expected benefits. The project will produce the following benefits: (1) data on effectiveness of selected methodologies for treatment of a wide spectrum of ballast water and sediment types; (2) cost estimates for full-scale treatment scenarios dependent upon the composition of the ballast water; (3) pretreatment scenarios for ballast water prior to potential discharge into POTW's; (4) performance of a demonstration pilot test based on data generated during bench-scale testing; (5) ability to scale up to a full-scale treatment or pretreatment system which can be utilized in a variety of situations, including on-board treatment, dockside treatment, pretreatment prior to discharge into large tanks or POTW's. The quantification of the success of prevention of further aquatic introductions has been difficult to assess quantitatively; however, if the prevention of further introductions of potentially very destructive species such as *Mnemiopsis* (not yet present in the Bay-Delta) is accomplished by full-scale treatment of ballast water to the levels envisioned by CALFED (<1% of 1998 ballast water volumes by 2008), the economic benefits would easily reach millions of dollars during the first decade of the century. Over a protracted period of time (100 years or more) the results could be incalculable.

Hypothesis to be evaluated. Can the treatment of ballast water and ballast sediment eliminate living organisms in any given ballast tank water? This hypothesis can be tested and accepted or rejected through laboratory bench and pilot scale testing.

Durability of benefits as a result of project implementation. The durability of the benefits of the project will be long-lasting once a full-scale ballast water treatment program, a natural follow-up to this proposed project, is instituted estuary-wide, and assuming that the program is maintained over time.

Project relation to an ecosystem based approach and adaptive management. The implementation of the project would benefit all aquatic ecosystems throughout the Bay-Delta Estuary. With regard to an adaptive management-based approach, the proposed project has a focused research agenda needed to evaluate program alternatives and options, and can be phased-in in accordance with the ERP over time.

2. Linkages

Relationship to past and future projects In one sense, this project has no direct past linkages to CALFED or other California state-wide projects. There is little to no information regarding contents of ballast water entering the estuary, treatment options or scenarios, or other similar projects. In a future linkage sense, this project relates to many other CALFED (and other funded ecosystem-based restoration projects), as non-native aquatic species have effected almost every ecosystem element

regarded as valued by the CALFED ERP, including Bay-Delta benthos, plankton, and priority fish species. Results of a Bay-Delta wide program to limit the entry of non-native aquatic species, including, but not limited to ballast water treatment, may aid in the eventual success of restoration efforts over the entire CALFED landscape. It is widely accepted that non-native aquatic introductions have had widespread and profound, although non-quantified effects on all Bay-Delta aquatic Bay ecosystems. A natural follow-up stage to this proposed project is the implementation of a Bay-Delta wide full-scale ballast water and sediment treatment program. No previous phases of this project have been performed to our knowledge.

Linkage to other future ERP actions and goals. CALFED promulgates goals of 95% elimination of dumping of ballast water and sediment by 2005 and 99% elimination by 2008, compared with a 1998 standards (ERP, Vol. p. 464) Examples of linkages of this project with future ERP actions and goals includes: restoration of the plankton food supply of native fishes in the Estuary, protection and restoration of native aquatic species, and increasing Estuary and central valley anadromous fish populations. Reducing introduced aquatic species in the Bay-Delta should reduce competition with native plankton species and with anadromous fish populations. The project is also linked with other proposed projects to restrict non-native introductions, including elimination of non-native bait species and halting the release and spread of aquarium organisms and aquatic pets into the Bay-Delta watershed (ERP, Vol I pp. 460-469). Ballast water treatment implementation will, when conjoined with other methods of controlling introduction of non-native species (more rigorous levels of agency enforcement and a program aimed at greater public awareness), go a great way towards stemming the flow of new aquatic non-native species into the estuary. The implementation of our project, when enacted with other objectives to limit non-native aquatics, will ultimately effect all CALFED ERP ecological management zones, (ERP Vol. II, pp. 54-455) although some zones will undoubtedly benefit more than others (the Delta, Suisun Marsh/North San Francisco Bay; ERP Vol II, pp. 54-155).

This project and overall CALFED objectives. This proposed project will aid the objectives of the CALFED program through the improvement of ecosystem quality and ecological function by means of elimination of introduction of new non-native aquatic species. The proposed project has no direct relationship to any existing legal obligations or agency mandates.

3. System-wide Ecosystem Benefits. Synergistic, system-wide ecosystem benefits of the project include enhancement of benthic and zooplankton communities in restored (and non-restored) areas of the Bay-Delta and enhancement of native fish species and priority fish species (races of salmon, splittail, Delta smelt, and sturgeon) through elimination of introduction of new non-native aquatic species. With a Bay-Delta-wide ballast water treatment system in place, including in the North, Central and South Bays, Suisun Bay, the lower and upper Delta and Central Valley ports (Stockton and Sacramento), benefits of the project will be ecosystem-wide.

4. Compatibility with Non-ecosystem Objectives. The project is conflict-neutral with regard to CALFED objectives including water supply and levee system integrity, water use efficiency, and water transfers. The project benefits CALFED objectives of water quality through removal of not only non-native aquatic species, but also any solids, oil and greases, and dissolved heavy metals which would otherwise be discharged into the waters of the Bay-Delta. The project would also benefit watershed management through elimination further introductions of non-native aquatics which would compete with native species, including priority fish species (all races of salmon, splittail, Delta smelt, steelhead). Examples of potential project benefits for third parties: fisherman would benefit from enhanced fish populations and agencies will be relieved of spending as much money as they would have otherwise on control of aquatic non-natives.

Technical Feasibility and Timing

Alternatives evaluated. Since little to no data is available on properties of ballast water and sediment, methods for treatment and disposal, or alternative ballast water treatment scenarios, there are few alternatives of ballast water treatment to evaluate. Open ocean ballast exchange is a possibility, but ballast exchange is never complete, and many estuarine organisms can withstand a wide range of salinities and would likely survive ballast exchange, especially in sediments. No local agencies are empowered at the present time to sample ballast tanks of ships in the Bay-Delta, although the Coast Guard expects to be able to test for salinity of ballast tanks in the near future. There are no regulations in place at the present time for enforcement of ballast water exchange on the high seas, or for the prevention of ballast discharge in any part of the Bay-Delta. One promising concept is direct discharge of ballast water into local sanitary disposal treatment facilities (POTW's), but until a spectrum of ballast tanks have been evaluated for contents and the contents of a particular ballast tank have been analyzed, it is unlikely that POTW's would consider direct disposal. POTW disposal of ballast water does also not address ballast sediment. Pretreatment prior to direct disposal into POTW's is also an option, and one which this proposed project addresses. Ballast tank contents can be analyzed on a ship-by-ship basis, and then pretreated by the appropriate technology or technologies prior to disposal into a POTW. The permitting issue for POTW's must also be addressed, as POTW facilities will have to be permitted to accept ballast water (and sediment). Local POTW's are not now permitted to accept ballast water.

Environmental Compliance Documents and Project Implementation. Since this project involves only bench and pilot scale testing involving relatively small amounts of water, we do not anticipate that any environmental compliance documents will need to be prepared. Full-scale treatment of ballast water and sediment would require compliance documentation, but full-scale treatment is not part of the proposed project.

Nature and Approach to Resolving Outstanding Implementation Issues. Implementation is not part of the proposed project, and we do not foresee any outstanding implementation issues. Full-scale treatment of ballast water and sediment would involve outstanding implementation issues, but full-scale treatment is not part of the proposed project.

Monitoring and Data Collection Methodology

Biological/Ecological Objectives. The primary biological/ecological objective is the prevention of new introductions of non-native aquatic species via ship ballast water and sediment discharge into the San Francisco Bay-Delta estuary and central valley rivers. The major biological/ecological question to be answered is to find successful bench and pilot scale techniques and technologies to eliminate/destroy biological organisms in any ballast water sample encountered in the field or concocted in the laboratory. The rationale for this approach is that our project plan is all-inclusive and explores options for preparing treated ballast water for a wide variety of potential disposal options, including direct discharge back into Bay-Delta receiving waters, directly into POTW's after pretreatment, and as pretreatment for discharge/disposal options perhaps not yet envisioned, such as discharge directly into storm drains (see Table 1, below). It is not possible to elaborate on limitations of the approach, or to compare our proposed project with alternative approaches, as none are available at present. Laboratory monitoring will be performed in this phase of the project (see Table 1, below). Ballast water samples with number and type of organisms will be treated and subsequently examined microscopically. We can therefore continually assess and revise treatment in the laboratory until elimination of all organisms is achieved. Monitoring estuary-wide for introductions will only be applicable after a full-scale ballast treatment program is in place. This proposed project does not include a proposal for full-scale treatment.

Monitoring Parameters and Data Collection Approach. *Duration of monitoring* - one year; *Types of equipment* - microscopes, filtration systems, photo-oxidation system, electrolytic system, UV-light system, pH meters, salinity meters, culture systems for organisms (algae, crustaceans, others to be selected); *Personnel*-staff, lab biologist, chemist; *Constituents*-count and type of organisms, TSS and TDS, oil and greases, dissolved organics, dissolved metals, salinity. Data will be collected on a standard data sheet. Samples will be assayed before and after for all "constituents" listed above. Biological monitoring will be done in-house. All other constituents will be analyzed by a local certified analytical laboratory. A number of protocol texts will be used for data gathering and analysis, including Standard Methods for Water and Wastewater, and the latest versions of ASME and AIChE laboratory and field manuals. *Coordination with other programs*- Port of Vancouver (Canada) is collecting ballast water constituent data, but status of treatment data not known at present; Port of Oakland has expressed interest in data that our proposed project generates. We will coordinate and integrate our data as much as possible with their data, and other data from other ports as it comes to our attention.

Data Evaluation Approach. Samples will be of two types: those requiring preservation for biological samples and those requiring preservation, handling, and storage for chemical samples. Biological samples will be preserved in 10% formalin or 20% alcohol, and stored until counted/analyzed. Chemical sampling, handling, preservation, storage, analytical techniques, and analysis will be either guided by or performed by a local certified analytical laboratory. Bench tests will be performed in the laboratory until each test is successful and will be repeated until success is achieved. See laboratory evaluation sheet (Table 2, below) for selected parameters to be measured in bench and pilot scale testing: More will be added as testing proceeds. The bench scale data will be used to scale up equipment to pilot scale. Pilot scale data will be used to scale up to full-scale treatment, although full-scale up is not included in this present proposal. Any data existing for ballast water constituents (as well as utilizing actual ballast water samples) will be used to set up bench scale testing.

Peer Review. We plan to publish our results in a peer-reviewed journal upon project completion.

Table 1. Biological/Ecological Objectives

Hypothesis/Question to be Evaluated	Monitoring Parameter(s) and Data Collection Approach	Data Evaluation Approach	Comments/ Data Priority
What level of treatment is needed to treat down to acceptable standards any given sample of ballast water?	See Table 2	If testing is not successful for any given test, test is re-run until success is achieved	In any given sample of ballast water, treatment is run until test is successful
Have all organisms been removed from the ballast water sample?	See Table 2	If testing is not successful for any given test, test is re-run until success is achieved	In any given sample of ballast water, treatment is run until test is successful
Has ballast water been successfully treated/pretreated down to applicable standards?	See Table 2; compare results with pretreatment or treatment standards	If testing is not successful for any given test, test is re-run until success is achieved	In any given sample of ballast water, treatment is run until test is successful

**Table 2. Sample Data Sheet
Bench / Pilot Scale Ballast Water Treatment**

Constituent	Concentration Parameters	Type of Treatment Used	Concentration Before Run	Concentration After Run	Notes/ Comments
Organism Type	#/liter				
TSS	ppm				
TDS	ppm				
Dissolved Metal Concentration	ppm				
Dissolved organics	ppm				
Oils and greases	ppm				
Other					

Section VIII. Local Involvement

Alameda County governmental agencies notified. We have notified the Alameda County Board of Supervisors and the Alameda County planning department of our proposed project. See copies of letters attached.

Local environmental groups and other interested parties notified. We have discussed our proposed project with a number of local interested entities and other parties, including the Regional Water Quality Control Board (San Francisco Bay Region), the Port of Oakland, and the Coast Guard. (see copy of letter attached). The RWQCB, Port of Oakland, and Coast Guard are interested in the results of our proposed project. The RWQCB has referred us local sources of ballast water: San Francisco Drydock, Hunter's Point, Mare Island, and Bay Ship and Yatch. These facilities now discharge their ballast water in the local POTW, and samples can be made available for analysis and test treatment. Peak discharges can be up to 1.6 mil gal/day. The Coast Guard is not mandated to take ballast water samples from ships within San Francisco Bay, despite being the lead federal agency for ballast water issues. They plan to take random samples of ballast water this summer to test for salinity only. The Port of Oakland expressed interest in our results, and "may" be in a position to take ballast water samples "sometime this summer" (summer of 1999). Some environmental firms we spoke to, whose major business is with the shipping industry, stated that their clients would not allow ballast water samples to be taken on their ships at present. We had a similar response from a engineer (who shall remain unnamed) at a Bay-Delta port facility, who asked us to write him with our concerns and requests. Due to time constraints, we did not follow up on his request at this time, but will do so upon project approval. The Coast Guard has referred us to a point of contact in Washington, D.C. The Port of Oakland has referred us to the Pacific Merchant Shippers Association. Both of these parties will be utilized for information and/or sources of ballast water.

Landowners, facility owners, other affected parties. There are no landowners, facility owners, or other parties who will be affected by this stage of the project.

Describe a plan for public outreach. We see no need for public outreach at this specific project. Since methodologies are being investigated for the treatment of ballast sediment and water, and since no methodology(ies)/treatment options have been selected as yet, public outreach seems inappropriate at this phase of the work.

Permission for property use or access. Property use or access is not applicable to the project.

Third Party Impacts. We do not anticipate any third party impacts from our proposed project.

Electrox™, Inc.

Water, Soil and Energy Solutions

2701 Monarch Street, Suite 150 - Alameda, CA 94501

Phone 510-864-3020 - Fax 510-864-3023 - www.electroxinc.com

April 7, 1999

John T. Rees

Senior Research Scientist

Environmental Research Center

California State University, Hayward 751 West Midway, Bldg. 7

Alameda Point, CA 94501

Wilma Chan, Supervisor

Alameda County Board of Supervisors 1221 Oak Street

Suite 536

Oakland, CA 94612

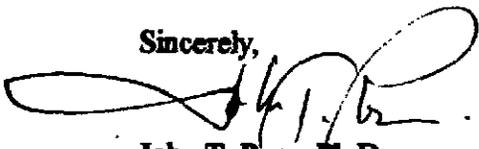
Dear Ms. Chan:

This letter addresses a request of CALFED, a Federal/California State entity dedicated to Bay/Delta biological restoration, to inform the Alameda County Board of Supervisors that a CALFED-sponsored research project may be taking place in Alameda County. Cal State Hayward, in association with Electrox, a company based in Alameda Point, is planning to investigate experimentally methodologies for removal of exotic organisms from ballast water of ships entering San Francisco Bay using a variety of physical and chemical techniques. This first stage of the work will be performed entirely in the laboratory, and no persons or entities will be impacted by this work at this time.

Thank you for your attention. If you would like more information about CSU Hayward, CALFED, ACET Corporation, or our project, please do not hesitate to call me at (510)525-7550.

Thank you for your attention and interest in the manner.

Sincerely,



John T. Rees, Ph.D.

Senior Research Scientist

Electrox™, Inc.

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Alameda Point, CA 94501

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399 Elmhurst St.

Room 136

Hayward, CA 94544

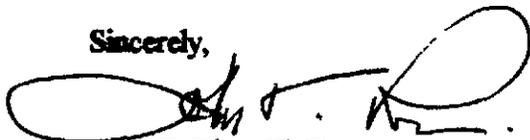
Dear Sir or Madam:

This letter addresses a request of CALFED, a Federal/California State entity dedicated to Bay/Delta biological restoration, to inform the Alameda County Board of Supervisors that a CALFED-sponsored research project may be taking place in Alameda County. Cal State Hayward, in association with Electrox, a company based in Alameda Point, is planning to investigate experimentally methodologies for removal of exotic organisms from ballast water of ships entering San Francisco Bay using a variety of physical and chemical techniques. This first stage of the work will be performed entirely in the laboratory, and no persons or entities will be impacted by this work at this time.

Thank you for your attention. If you would like more information about CSU Hayward, CALFED, ACET Corporation, or our project, please do not hesitate to call me at (510)525-7550.

Thank you for your attention and interest in the manner.

Sincerely,



John T. Rees, Ph.D.

Senior Research Scientist

Cost

1. Budget. See detailed budgeted costs in Tables attached.

Project Management Task Description. Since our proposed project will involve only laboratory work and one pilot demonstration, project management will be performed by each member of the team responsible for his specific phase of laboratory or pilot work.. We have factored in project management costs into our budget (See Budget). Project managers will insure completion of task elements and subtasks, and preparation of quarterly reports. Prof. Kitting will provide general project oversight.

Overhead costs exceeding 25% of direct salary and benefits . Our budget includes indirect costs calculated at California State University, Hayward's federally-negotiated rate, 47% of salaries, wages and benefits. CSUH does not have a negotiated state rate. Only allowable direct cost items are included in our indirect cost pool, in accordance with DHHS audit guidelines.

2. Schedule.

Start/Completion dates. We plan to begin the project on January 1, 2000. Project completion date will be December 31, 2000.

Milestones. We anticipate 9 months of bench scale testing. The final three months will entail reviewing and analyzing our bench scale results and setting up for the pilot demonstration test. A final report will be submitted upon the completion of the pilot test. We plan to publish at least one paper on the results of our bench and pilot scale tests, which will serve as a peer review of our results.

Payments and Milestones. Not applicable.

Potential to incrementally fund proposed scope of work. We have not indicated any potential to incrementally fund the proposed scope of work.

Table 3. Total Budget (CALFED funds only)

Task	Direct Labor Hours	Direct Salary and Benefits	Service Contracts	Material/ Acquisition Costs	Misc. and Other Direct	Overhead/ Indirect Costs	TOTAL COST
Task 1	6,584	\$158,450	\$0	\$0	\$281,059	\$74,472	\$513,981
Project Mgmt.	1,216	\$38,293	\$0	\$0	\$26,511	\$17,998	\$82,802

Table 4. Budget Broken Down Quarterly

Task	Quarterly Budget Jan-March 00	Quarterly Budget April-June 00	Quarterly Budget July-Sept 00	Quarterly Budget Oct-Dec 00	Total Budget
Task 1	159,346	152,371	140,796	144,271	596,783

CALFED BAY-DELTA PROGRAM
Ecosystem Restoration Programs
Demonstration Program for the Removal of Living
Organisms from Ships' Ballast Waters

Direct Cost, Task 1, Bench Scale / Pilot Scale Demonstration
Twelve (12) Months Duration, Y1

Salaries		REQUEST
Chris Kitting	.0692 FTE (\$93,020/yr)	\$6,440
John Rees	.1538 FTE (\$92,000/yr)	\$14,154
Chemist	1 x \$25/hr x 20hr/wk x 52 weeks	\$26,000
Biologist	1 x \$20/hr x 20hr/wk x 52 weeks	\$20,800
Graduate Students	2 x \$10/hr x 16hr/wk x 52 weeks	\$16,640
Equipment Operators	3 x \$25/hr x 40hr/wk x 13 weeks	\$39,000
Fringe Benefits		
Chris Kitting	Academic year release rate = 30%	\$1,932
John Rees	Adjunct faculty rate = 14%	\$1,982
Chemist	Rate = 34%	\$8,840
Biologist	Rate = 34%	\$7,072
Graduate Students	Student benefits rate = 14%	\$2,330
Equipment Operators	Rate = 34%	\$13,260
Subtotal, Salaries, Wages and Benefits:		\$158,450
Other Direct Cost Task 1		
Office / Laboratory Space		\$12,540
Equipment and Supplies		\$11,600
Analytical Laboratory Expense		\$12,600
Repairs to Equipment		\$2,500
Field Investigation & Data Gathering Trip / Expense		\$5,190
Field Sampling Trips / Expenses		\$5,210
Local Demonstration / Mobilization Cost		\$166,950
Office Expense (phone, fax, copies, etc.)		\$6,000
Conference / Presentation Cost		\$1,450
Publication Cost		\$3,000
Joint Venture Partner, Electrox:		
Leland Cole (\$127,680/yr salary plus benefits)		\$19,643
Joseph Bishop (\$111,720/yr salary plus benefits)		\$17,188
Watson Aldridge (\$111,720/yr salary plus benefits)		\$17,188
Subtotal, Other Direct Cost		\$281,059
Total Direct Cost		\$439,509
Indirect Cost (47% of salaries, wages and benefits)		\$74,472
Total for Task 1, Direct Cost & Indirect Cost		REQUEST \$513,981

**CALFED BAY-DELTA PROGRAM
Ecosystem Restoration Programs
Demonstration Program for the Removal of Living
Organisms from Ships' Ballast Waters**

**Project Management Cost, Task 1, Bench Scale / Pilot Scale Demonstration
Twelve (12) Months Duration, Y1**

		<u>REQUEST</u>
Salaries		
Chris Kitting (\$93,020 annualized salary)	.0462 FTE	\$4,293
John Rees (\$92,000/yr)	.0462 FTE	\$4,246
Adm. Asst. / Contrast	1 x \$25.00 x 16hr/wk x 52 weeks	\$20,800
Fringe Benefits		
Chris Kitting	Academic yr release rate = 30%	\$1,288
John Rees	Adjunct faculty rate = 14%	\$594
Adm. Asst. / Contrast	Rate = 34%	\$7,072
Subtotal, Salaries, Wages and Benefits:		\$38,293
Other Project Management Cost		
Office Space		\$2,640
Office Expenses (phone, fax, copies, etc.)		\$3,000
Project Management Software		\$450
Computer, printer, monitor, etc.		\$4,200
Joint Venture Partner, Electrox:		
Leland Cole (\$127,680/yr salary plus benefits)		\$5,899
Joseph Bishop (\$111,720/yr salary plus benefits)		\$5,161
Watson Aldridge (\$111,720/yr salary plus benefits)		\$5,161
Subtotal, Other Project Management Cost		\$26,511
Total Project Management Cost		\$64,804
Indirect Cost (47% of salaries, wages and benefits)		\$17,998
		<u>REQUEST</u>
Total for Task 1, Proj. Mgt. Direct & Indirect Cost		\$82,802
		<u>REQUEST</u>
Total Task 1, Direct and Proj. Mgt. Cost		\$596,783

CALFED BAY-DELTA PROGRAM
Ecosystem Restoration Programs
Demonstration Program for the Removal of Living
Organisms from Ships' Ballast Waters

People Commitments to Project Direct Cost	Man Days Available	Man Days Devoted	Man Hours Devoted	Percent Devoted
Chris Kitting	260	18	144	6.92%
John Rees	260	40	320	15.38%
Leland Cole	260	40	320	15.38%
Joseph Bishop	260	40	320	15.38%
Watson Aldridge	260	40	320	15.38%
Chemist	260	130	1,040	50.00%
Biologist	260	130	1,040	50.00%
Graduate Students	520	208	1,664	40.00%
Equipment Operators	780	195	1,560	25.00%
		823	6,584	

People Commitment to Project Management Effort	Man Days Available	Man Days Devoted	Man Hours Devoted	Percent Devoted
Chris Kitting	260	12	96	4.62%
John Rees	260	12	96	4.62%
Leland Cole	260	12	96	4.62%
Joseph Bishop	260	12	96	4.62%
Watson Aldridge	260	12	96	4.62%
Admin Asst.	260	104	832	40.00%
		152	1,216	

CALFED BAY-DELTA PROGRAM
Ecosystem Restoration Programs
Demonstration Program for the
Removal of Living Organisms from Ships' Ballast Waters

Quarterly Budget
Twelve (12) Months Duration, Y1

	Total	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
TASK 1, DIRECT COST					
Salaries and Benefits	\$158,450	\$39,612.50	\$39,612.50	\$39,612.50	\$39,612.50
Other Direct Cost					
Office / Laboratory Space	\$12,540	\$3,135.00	\$3,135.00	\$3,135.00	\$3,135.00
Equipment and Supplies	\$11,600	\$8,700.00	\$2,900.00	\$0.00	\$0.00
Analytical Laboratory	\$12,600	\$3,150.00	\$3,150.00	\$3,150.00	\$3,150.00
Repairs to Equipment	\$2,500	\$0.00	\$1,250.00	\$0.00	\$1,250.00
Field Investigation	\$5,190	\$2,595.00	\$2,595.00	\$0.00	\$0.00
Field Sampling	\$5,210	\$2,605.00	\$2,605.00	\$0.00	\$0.00
Demonstration	\$166,950	\$41,737.50	\$41,737.50	\$41,737.50	\$41,737.50
Office Expense	\$6,000	\$1,500.00	\$1,500.00	\$1,500.00	\$1,500.00
Conference / Presentation	\$1,450	\$0.00	\$725.00	\$0.00	\$725.00
Publication	\$3,000	\$0.00	\$1,500.00	\$0.00	\$1,500.00
Joint Venture Partner costs	\$54,019	\$13,504.75	\$13,504.75	\$13,504.75	\$13,504.75
Indirect Cost	\$74,472	\$18,618.00	\$18,618.00	\$18,618.00	\$18,618.00
TASK 1, PROJECT MANAGEMENT					
Salaries and Benefits	\$38,293	\$9,573.25	\$9,573.25	\$9,573.25	\$9,573.25
Other Cost					
Office Space	\$2,640	\$660.00	\$660.00	\$660.00	\$660.00
Office Expenses	\$3,000	\$750.00	\$750.00	\$750.00	\$750.00
Project Management Software	\$450	\$450.00	\$0.00	\$0.00	\$0.00
Computers, equipment	\$4,200	\$4,200.00	\$0.00	\$0.00	\$0.00
Joint Venture Partner costs	\$16,221	\$4,055.25	\$4,055.25	\$4,055.25	\$4,055.25
Indirect Cost	\$17,998	\$4,499.50	\$4,499.50	\$4,499.50	\$4,499.50
Totals	\$596,783	\$159,346	\$152,371	\$140,796	\$144,271
Accumulation		\$159,345.75	\$311,716.50	\$452,512.25	\$596,783.00

Cost-Sharing

Other funds committed. CALTIP (California Technology Investment Partnership), an initiative of the California State Office of Strategic Technology, has expressed an interest in funding an extended pilot ballast water treatment demonstration project based on our bench scale test results. The management team presented in this proposal would also manage the extended demonstration project. The extended pilot work would be principally utilized for the optimization of equipment utilized during pilot treatment. CALTIP funds, if forthcoming, would be in addition to, and not a replacement of, CALFED funds requested in this proposal. A proposal is being submitted to CALTIP for these additional funds. Our project would be eligible for funding levels of 25% of our proposed CALFED project, or \$149,196.

Status of committed funds. Funds from CALTIP would be forthcoming upon submittal of an approved proposal (to CALTIP). CALTIP has not committed any funds at this time.

Cost-sharing requirements. For CALTIP funds to be applicable for an extended pilot scale ballast water demonstration project, CALFED funds requested for our proposed project would need to originate from federal, not state sources. The extended pilot ballast water treatment demonstration project would be in addition to, and not part of, our proposed project.

Applicant Qualifications

Organization of staff and other resources. The staff will be organized into two basic groups interacting at all times with each other. There will be a biological group consisting of Drs. Kitting, Rees, and a biological lab technician, and a chemistry and chemical engineering group (Electrox, Inc) consisting of Dr. Leland Cole, Mr. Watson Aldridge, and Mr. Joseph Bishop along with a chemistry laboratory technician. The physical resources used will be Electrox, Inc's laboratory and office facilities, located in Bldgs 7 and 20, Alameda Point, the former Alameda Naval Air Station. We will also use the CSU Hayward Environmental Research Center's office and communications resources in Bldg 7 (ACET Corporation). There will be occasional collaborators in project implementation, including personnel at the Port of Oakland and Electrox operators needed during the pilot scale phase of the project. CSU Hayward will contribute the talent and energy of two graduate students from the Department of Biological Sciences.

Specific responsibilities. All major project participants have roles in project management. C. Kitting and J. Rees will be managing laboratory cultures, laboratory staff and graduate students. They will also be enumerating and identifying organisms encountered in ballast water, making up laboratory ballast water samples, and tabulating and evaluating the results of testing on biological organisms. L. Cole will be managing laboratory procedures for treating ballast water, and reviewing results. W. Aldridge and J. Bishop will be managing laboratory staff, performing testing in the laboratory, trouble-shooting, and reviewing results. These two gentlemen will also be responsible for design, planning, and execution of the pilot demonstration test. Administration (billing, time sheets, quarterly reports, final reports, financial reporting to CALFED) will be coordinated by a budgeted office assistant with input from all project managers. J. Rees will be responsible for managing preparation of the final report and the preparation of a publication for peer review.

Conflicts of Interest. We do not foresee any conflicts of interest with respect to the proposed project.

Biosketches. See Table 3 below for biosketches of principle staff.

Table 5. Biosketches of Principal Staff

Principal Staff Member	Qualifications	Experience/ Performance on Similar Projects
<p>Dr. John Rees Biology, CSU Hayward</p>	<p>Dr. Rees earned his Ph.D. in Zoology at the University of California at Berkeley in 1975 with a research emphasis in laboratory invertebrate culture. He is at present holds an adjunct appointment at the University of California at Hayward in the Department of Biological Sciences and is a Senior Research Scientist at the CSUH Environmental Research Center.</p>	<p>Dr. Rees has had 20 years experience in general environmental project management, and his career experience has included both the public and private sectors. He has had nine years post-doctoral and senior scientist experience in publicly-funded laboratory and field ecological research. Dr. Rees has had applied and basic research</p>

	<p>In his private sector experience, he has managed projects in water quality assessment, site assessment and contaminated site remediation technologies, application of NEPA/CEQA regulations, and natural resource and endangered species management. He has published 25 refereed publications on general aquatic ecology, environmental compliance, and pollution control.</p>	<p>experience in general freshwater, estuarine, and marine ecology, ecological field sampling techniques and data analysis, and general water quality issues. He has had responsibility for the establishment and monitoring of laboratory and experimental field work to ascertain the effects of artificially induced perturbations (such as a decrease in pH) in freshwater laboratory microcosms.</p>
<p>Dr. Chris Kitting Biology, CSU Hayward</p>	<p>Professor Kitting earned his Biological Sciences Ph.D. in 1979 at Stanford University and is currently a Professor in the Biological Sciences Department at CSU Hayward. Dr. Kitting is an active member of 10 major ecological organizations, and currently serves on several scientific panels for reviewing environmental effects on aquatic organisms. He has published 25 major papers, most of which emphasize effects of vegetation on animal populations. Dr. Kitting serves on the Board of Directors at the San Francisco National Wildlife Refuge and the Program Committee of the Delta Science Center.</p>	<p>Dr. Kitting has managed projects, mostly related to marsh processes and restoration, for agencies and private clients for 15 years. His graduate students have worked on a wide variety of research projects involving marsh ecosystem functions, including restoration of salmon spawning sites in East Bay creeks and phytoplankton and zooplankton population dynamics in fresh water habitats. He has directed student research and published results throughout his CSUH career.</p>
<p>Dr. Leland Cole Chemical Engineering, Electrox, Inc</p>	<p>Dr. Cole received his Ph.D. in chemical engineering at Oregon State University in 1946. He is currently the President and technical director of Electrox, Inc. He has approximately 45 years business development experience in chemistry, chemical engineering, and physical chemistry. His range of experience includes laboratory and engine test pit studies on rocket engines and the development of new chemical engineering products for the private</p>	<p>Dr. Cole has directed projects on the design of instrumentation for a variety of analytical applications, including the treatment and analysis of wastewater. Among his many achievements, he invented designed, manufactured, and field installed the first electroflocculation and photolytic oxidation systems for water and waste water</p>

	<p>sector. He has been on the board of directors of a company which designed instrumentation in waste water treatment systems and medical instrumentation. He has developed, designed, and patented electroflocculation and photolytic oxidation systems for the treatment of water and wastewater. Dr. Cole is the author of numerous publications and has published in the Journal of Chemical Physics and the Analytical Chemical Journal. He is the author or co-author of U.S. Patents, or Patents Pending, Washington, DC</p>	<p>treatment. At present he manages a variety of projects which employ his patented water and wastewater treatment systems.</p>
<p>Mr. Watson Aldridge Construction Engineer, Electrox, Inc.</p>	<p>Mr. Aldridge is a manufacturing engineer with 30 years experience in industry and business. He presently holds a position of executive vice-president of Electrox, Inc. His background includes work in the concrete industry, and he has been a production and planning manager for manufacturing plants in the Southeastern United States. In those capacities, he was responsible for all-over operations, including field installation.</p>	<p>Mr. Aldridge has a wide range of experience in both a custom job manufacturing environment and coordinating the efforts of multiple field operations. He has applied experience in directing the manufacture of new mobile water treatment equipment and system, and is responsible for coordination of field crews and operations personnel. He is responsible for the selection of vendor and contracting services in the laboratory and field.</p>
<p>Mr. Joseph Bishop Laboratory Chemist, Electrox, Inc</p>	<p>Mr. Bishop received his B.A. from Oregon State University in chemistry. His present position is VP of Administration of Electrox, Inc. He has held several positions in the private sector in chemistry and chemical engineering, and has worked with companies in the mining and metals extraction industry. He has had field and laboratory experience in the environmental industry.</p>	<p>Mr. Bishop has managed environmental field projects requiring extraction and analysis of water and wastewater samples. He is familiar with water and wastewater chemistry, and has managed laboratory personnel in analytical techniques, instrumentation, and procedures.</p>

COMPLIANCE WITH TERMS AND CONDITIONS

Attachment D.

As a state entity, we have no standard clauses and related proposal submittal requirements.

Attachment E.

Applicable federal forms are attached.

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; use this form for certification and sign; or use Department of the Interior Form 1954 (DI-1954). (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.

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 from covered transactions 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-2014
March 1995
(This form consolidates DI-1953, DI-1954,
DI-1955, DI-1956 and DI-1963)

PART C: Certification Regarding Drug-Free Workplace Requirements

CHECK ___ IF THIS CERTIFICATION IS FOR AN APPLICANT WHO IS NOT AN INDIVIDUAL.

Alternate I. (Grantees Other Than Individuals)

A. The grantee certifies that it will or continue to provide a drug-free workplace by:

- (a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;
- (b) Establishing an ongoing drug-free awareness program to inform employees about--
 - (1) The dangers of drug abuse in the workplace;
 - (2) The grantee's policy of maintaining a drug-free workplace;
 - (3) Any available drug counseling, rehabilitation, and employee assistance programs; and
 - (4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;
- (c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);
- (d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will --
 - (1) Abide by the terms of the statement; and
 - (2) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;
- (e) Notifying the agency in writing, within ten calendar days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification numbers(s) of each affected grant;
- (f) Taking one of the following actions, within 30 calendar days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted --
 - (1) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or
 - (2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;
- (g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a) (b), (c), (d), (e) and (f).

B. The grantee may insert in the space provided below the site(s) for the performance of work done in connection with the specific grant.

Place of Performance (Street address, city, county, state, zip code)

Check ___ if there are workplaces on file that are not identified here.

PART D: Certification Regarding Drug-Free Workplace Requirements

CHECK ___ IF THIS CERTIFICATION IS FOR AN APPLICANT WHO IS AN INDIVIDUAL.

Alternate II. (Grantees Who Are Individuals)

- (a) The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in conducting any activity with the grant,
- (b) If convicted of a criminal drug offense resulting from a violation occurring during the conduct of any grant activity, he or she will report the conviction, in writing, within 10 calendar days of the conviction, to the grant officer or other designee, unless the Federal agency designates a central point for the receipt of such notices. When notice is made to such a central point, it shall include the identification number(s) of each affected grant

**PART E: Certification Regarding Lobbying
Certification for Contracts, Grants, Loans, and Cooperative Agreements**

CHECK IF CERTIFICATION IS FOR THE AWARD OF ANY OF THE FOLLOWING AND
THE AMOUNT EXCEEDS \$100,000: A FEDERAL GRANT OR COOPERATIVE AGREEMENT;
SUBCONTRACT, OR SUBGRANT UNDER THE GRANT OR COOPERATIVE AGREEMENT.

CHECK IF CERTIFICATION IS FOR THE AWARD OF A FEDERAL
LOAN EXCEEDING THE AMOUNT OF \$150,000, OR A SUBGRANT OR
SUBCONTRACT EXCEEDING \$100,000, UNDER THE LOAN.

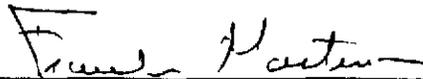
The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U S Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each-such failure.

As the authorized certifying official, I hereby certify that the above specified certifications are true.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL



TYPED NAME AND TITLE Frank Martino, Provost and Vice President, Academic Affairs

DATE

4-14-99

ASSURANCES - NON-CONSTRUCTION PROGRAMS

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0040), Washington, DC 20503.

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

NOTE: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.
2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.
3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.
4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.
5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).
6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. §§290 dd-3 and 290 ee 3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.
7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.
8. Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

9. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.
10. Will comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is \$10,000 or more.
11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523), and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).
12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.
13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).
14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.
15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.
16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.
17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."
18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL



TITLE Frank Martino, Provost and Vice President, Academic Affairs

APPLICANT ORGANIZATION

California State University, Hayward

DATE SUBMITTED

4-14-99