



RESOLUTION

RELATING TO AN AGREEMENT BETWEEN THE CITY AND COUNTY OF HONOLULU AND THE UNIVERSITY OF HAWAII WATER RESOURCES RESEARCH CENTER TO CONDUCT AN ASSESSMENT OF THE IMPACT OF OCEAN SEWER OUTFALLS ON THE MARINE ENVIRONMENT OFF OAHU, HAWAII.

WHEREAS, the City Council of the City and County of Honolulu approved a draft intergovernmental agreement with the University of Hawaii to conduct an assessment of the impact of ocean sewer outfalls on the marine environment off Oahu, Hawaii by Resolution 12-86, CD1 on May 9, 2012; and

WHEREAS, the approved draft intergovernmental agreement, Exhibit A of Resolution 12-86 CD1, included a provision for liquidated damages in Paragraph 4 of the Special Provisions; and

WHEREAS, the University of Hawaii will not accept the liquidated damages provision without further review and approval by its General Counsel, which may take several months; and

WHEREAS, removing the liquidated damages provision will avoid the undue burden of a prolonged discussion on the matter; and

WHEREAS, it is in the best interests of the City to remove the liquidated damages provision; and

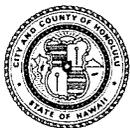
WHEREAS, due to these difficult economic times, the University of Hawaii can no longer bill an indirect cost rate of 3.5% in agreements with the City; and

WHEREAS, the University of Hawaii has requested an indirect cost rate of 36.7%; and

WHEREAS, in the genuine interest of performing the work to meet the City's federal and state permit obligations, the University of Hawaii is willing to charge the City an indirect cost rate of 10% for FY 2012 and FY 2013; and

WHEREAS, the City has the funding to cover the rate increase for FY 2012 and FY 2013; and

WHEREAS, the City and the University of Hawaii will negotiate annually the indirect cost rate for the remaining term of the agreement from FY 2014 through FY 2017; and



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WHEREAS, the indirect cost rate will not exceed 36.7% for FY 2014 through FY 2017 as reflected in the draft budget presented as Appendix E of the attached Exhibit A; and

WHEREAS, Chapter 1, Article 8, Revised Ordinances of Honolulu 1990, as amended, requires that any intergovernmental agreement or any amendments thereto which places an obligation upon the City or any department or agency thereof shall require the prior consent and approval of the City Council of the City and County of Honolulu; and

WHEREAS, Chapter 1, Article 8, Revised Ordinances of Honolulu 1990, as amended, requires that any material change to a draft intergovernmental agreement approved by the City Council of the City and County of Honolulu shall require additional review and approval by the City Council; and

WHEREAS, pursuant to Section 103D-102(b)(3), Hawaii Revised Statutes, the Hawaii procurement code does not apply to contracts by governmental bodies to "procure goods, services, or construction from a governmental body other than the University of Hawaii bookstores, from the federal government, or from another state or its political subdivision"; and

WHEREAS, pursuant to Section 103D-102(d), Hawaii Revised Statutes, the City and County of Honolulu and the University of Hawaii Water Resource Research Center are nevertheless encouraged to adopt and use provisions of this chapter and its implementing rules as appropriate; provided that the use of one or more provisions shall not constitute a waiver of the exemption conferred and subject the procurement or the governmental body to any other provision of this chapter; and

WHEREAS, the City and County of Honolulu is required to comply with State and Federal requirements pursuant to the Clean Water Act and the 301(h)-modified NPDES permits issued by the United States Environmental Protection Agency and the State of Hawaii, Department of Health authorizing discharges at the Sand Island and Barber's Point ocean outfalls by conducting biological monitoring to determine the impact of these outfall discharges on the marine environment; and

WHEREAS, the City and County of Honolulu desires to continue studies of fish liver histopathology at the Waianae ocean outfall and is required to comply with State and Federal requirements pursuant to the Clean Water Act and its conservation district use permit issued by the State of Hawaii, Department of Land and Natural Resources



RESOLUTION

for the Waianae Ocean Outfall by conducting biological monitoring to determine the impact of the outfall discharge on the marine environment; and

WHEREAS, the City and County of Honolulu is required to comply with State and Federal requirements pursuant to the Clean Water Act and State requirements for a zone of mixing at the Mokapu ocean outfall by conducting biological monitoring to determine the impact of the outfall discharge on the marine environment; and

WHEREAS, the terms and conditions of the agreement between the University of Hawaii Water Resources Research Center and the City and County of Honolulu are attached hereto as Exhibit A and by reference made a part hereof; now, therefore,

BE IT RESOLVED by the Council of the City and County of Honolulu that it authorizes the City and County of Honolulu to enter into an intergovernmental agreement with the University of Hawaii for the purpose of studying the impacts of treated wastewater on the marine communities in the vicinity of the City's ocean outfalls; and



RESOLUTION

BE IT FINALLY RESOLVED that the Clerk be and is hereby directed to transmit a copy of this Resolution to the Mayor or Managing Director and the Director of the Department of Environmental Services, and the University of Hawaii Water Resources Research Center:

University of Hawaii
Water Resources Research Center
University of Hawaii at Manoa
2540 Dole Street, Holmes Hall 283
Honolulu, Hawaii 96822

INTRODUCED BY:

Ernest Martin (BR)

DATE OF INTRODUCTION:

June 15, 2012
Honolulu, Hawaii

Councilmembers

EXHIBIT A

CONTRACT NO. FOR PROFESSIONAL SERVICES

THIS AGREEMENT FOR PROFESSIONAL SERVICES, made this _____ day of _____, 2012, by and between the CITY AND COUNTY OF HONOLULU, a municipal corporation of the State of Hawaii, whose principal place of business and mailing address is Honolulu Hale, 530 South King Street, Honolulu, Hawaii 96813, hereinafter referred to as the "CITY", and UNIVERSITY OF HAWAII, an institution of higher education, authorized to do business in Hawaii, whose principal place of business and mailing address is the Office of Research Services, 2530 Dole Street, Sakamaki D-200, Honolulu, Hawaii 96822, hereinafter called the "CONTRACTOR".

WITNESSED THAT:

WHEREAS, the CITY wishes to obtain the services of the CONTRACTOR's Water Resources Research Center to conduct a FIVE (5) YEAR BIOLOGICAL AND SEDIMENT STUDY ON THE MARINE COMMUNITIES NEAR THE CITY'S OCEAN SEWER OUTFALLS, hereinafter called the "PROJECT"; and

WHEREAS, the services entered hereunder are technical and professional in nature and City personnel are not able to provide these services; and

WHEREAS, the services to be rendered hereunder are exempt from the Hawaii Procurement Code pursuant to Section 103D-102(b)(3) Hawaii Revised Statutes ("HRS"); and

WHEREAS, the Governmental bodies making procurements which are exempt from the Hawaii Procurement Code are nevertheless encouraged to adopt and use provisions of the chapter and its implementing rules as appropriate; provided that the use of one or more provisions shall not constitute a waiver of the exemption conferred and subject the procurement or the governmental body to any other provision of the chapter pursuant to Section 103D-102(b) HRS; and

NOW, THEREFORE, the CITY and CONTRACTOR, in consideration of the foregoing and of the mutual promises hereinafter set forth, and intending to be legally bound, hereby mutually agree as follows:

1. That the CONTRACTOR shall perform and complete in a professional manner all of the services required for the PROJECT in accordance with and as set forth in the Contract Documents as hereinafter described, shall furnish all services, labor, goods, materials, supplies, equipment and other incidentals reasonably necessary for the successful completion of the PROJECT and the work contemplated under the Contract Documents (the "Work"), and the CONTRACTOR shall receive and accept as full compensation for all of the Work the price for the various items of the Work as hereinafter set forth.
2. The CONTRACTOR shall complete the technical and professional services and perform the Work in accordance with:
 - a. This Agreement;
 - b. The Special Provisions and any attachments and exhibits thereto ("Special Provisions"); and
 - c. The General Terms and Conditions for Contractors for Professional Services for the City and County of Honolulu, dated 8/2000 (the "General Terms and Conditions");all of which are collectively referred to as the "Contract Documents", are attached hereto and incorporated herein, and are listed in order of

controlling preference should there be any conflict in the terms of the Contract Documents, and any modifications, changes or amendments in connection therewith being specifically referred to and incorporated herein by reference and made a part hereof as though fully set forth herein.

3. The CONTRACTOR shall complete the Work required under the Contract Documents as provided for in the Special Provisions attached hereto.
4. The CITY agrees to pay the CONTRACTOR, for the satisfactory performance and completion of the Work, the payments in accordance with the following schedule of payments, but subject to availability of funds after June 30, 2012:

FY 2012 portion of the contract (January 1, 2012 through June 30, 2012) the CITY will pay the CONTRACTOR in two (2) equal installments totaling up to (\$281,747);

FY 2013 portion of the contract (July 1, 2012 through June 30, 2013) the city will pay the CONTRACTOR in four (4) equal installments totaling up to (\$589,491);

FY 2014 portion of the contract (July 1, 2013 through June 30, 2014) the city will pay the CONTRACTOR in four (4) equal installments totaling up to (\$735,654);

FY 2015 portion of the contract (July 1, 2014 through June 30, 2015) the city will pay the CONTRACTOR in four (4) equal installments totaling up to (\$750,640);

FY 2016 portion of the contract (July 1, 2015 through June 30, 2016) the city will pay the CONTRACTOR in four (4) equal installments totaling up to (\$765,093);

FY 2017 portion of the contract (July 1, 2016 through December 31, 2016) the city will pay the CONTRACTOR in two (2) equal installments totaling up to (\$392,270).

This amount will cover biological and sediment studies for Sand Island, Mokapu, Barber's Point and Waianae outfalls, subject to the Special Provisions and General Terms and Conditions. Work Schedules are presented in Appendix A, attached to this contract.

5. COMPENSATION AND PAYMENT SCHEDULE. Subject to the General Terms and Conditions, the CONTRACTOR shall be compensated up to \$281,747 for the FY 2012, \$589,491 for the FY 2013, \$735,654 for the FY 2014, \$750,640 for the FY 2015, \$765,093 for the FY 2016, and \$392,270 for the FY 2017 portion of the contract. Payment shall be made, according to paragraph 4 above, for costs projected in the Budget Table in Appendix E. The CONTRACTOR may propose subsequent compensation, which is subject to appropriation and approval by the CITY. Acceptance of subsequent compensation will be authorized by an amendment to the contract.
6. Prior to beginning of FY2014 through FY 2017 fiscal year, the CONTRACTOR shall generate a budget for review and written approval

by the City Department of Environmental Services. The budget shall be submitted to the City by September 30th of the previous FY.

7. The CONTRACTOR will bill the City at an indirect rate cost of 10% for all outfall work performed in FY2012 and FY2013 and at a indirect cost rate to be negotiated annually between the parties not to exceed 36.7% by September 30 prior to the remaining FY2014 through 2017.
8. For the budget, the CONTRACTOR shall identify anticipated, unusual, high cost expenditures such as, but not limited to, computers, microscopes and cameras. These may be approximate figures.
9. In the event expenditures for a given fiscal year are less than the budget amount, the unspent amount may be rolled over to the next fiscal year budget. This may continue for subsequent fiscal years.
10. Within a given fiscal year, funds may be transferred between categories without approval from the CITY as long as the current contract price is not exceeded. However, fund transfer approval by CITY's officer-in-charge will be required for unanticipated, unusual, high cost expenditures such as, but not limited to, computers, microscopes and cameras.
11. At the end of the contract, the CONTRACTOR shall return to the CITY any unused funds advanced during the term of the contract.

12. The CONTRACTOR agrees to perform the work as specified herein and through amendments until completion, or until there is no funding for the contract, whichever first occurs.
13. By signing below, the CONTRACTOR hereby certifies that to the best of its knowledge and belief, cost or pricing data, as defined in Section 3-122-122, Hawaii Administrative Rules ("HAR") and submitted pursuant to Section 3-122-125, HAR, either actually or by specific identification in writing to the Officer-in-Charge in support of this Agreement, is accurate, complete, and current as of the date of this Agreement. This certification includes the cost or pricing data supporting any advance agreement(s) between the CONTRACTOR and the CITY that are part of the proposal.
14. As provided in the General Terms and Conditions, when notice is to be given to the CITY, it shall be mailed or delivered to:

City and County of Honolulu
Department of Environmental Services
1000 Uluohia Street, Suite 308
Kapolei, Hawaii 96707
Attention: Director

When notice is to be given to the CONTRACTOR, it shall be mailed or delivered to:

University of Hawaii
Water Resources Research Center
University of Hawaii at Manoa
2540 Dole Street, Holmes Hall 283

Honolulu, Hawaii 96822

Attention: Director

and:

University of Hawaii

Office of Research Services

2530 Dole Street, Sakamaki D-200

Honolulu, Hawaii 96822

Attention: Director

IN WITNESS WHEREOF, the parties hereto have executed this AGREEMENT
as of the day and year first above written.

APPROVAL RECOMMENDED:

CITY AND COUNTY OF HONOLULU

Timothy E. Steinberger, P.E., Director
Department of Environmental Services

Michael R. Hansen, Director
Department of Budget and Fiscal Services

APPROVED AS TO FORM AND LEGALITY:

UNIVERSITY OF HAWAII

Deputy Corporation Counsel

Yaa-Yin Fong
Director, Office of Research Services
Federal I.D. No. 99-6000354

SPECIAL PROVISIONS

1. SCOPE OF SERVICE. As detailed in the attached "Scope of Work," the services to be performed by the CONTRACTOR shall include the following at the Sand Island, Barber's Point, Waianae, and Mokapu Ocean Outfalls to comply with the biological and sediment monitoring requirements of the National Pollutant Discharge Elimination System Permits (NPDES) and the State of Hawaii Department of Land and Natural Resources Conservation District Use (CDU) Permit and to continue other studies requested by the CITY.

- a. Annual and other biological and sediment studies (benthic organisms, coral reefs and fishes) to determine the impact of ocean outfall discharges, if any, on the marine environment. Determine the effects of treated wastewater discharge on fish caught near the outfall diffusers by conducting annual fish liver histopathology studies. These studies shall be conducted in the vicinity of the Mokapu Ocean Outfall in FY2013.
- b. Deadlines to complete final reports of all the studies shall be in accordance with the Report Submittal Schedule in Appendix C.
- c. Sampling for biological monitoring at the Sand Island, Barber's Point, Waianae, and Mokapu Ocean Outfalls will follow the schedule outlined in Appendix C.

- d. The CITY and CONTRACTOR will generally follow the sampling schedule as provided in Appendix C, but delays may occur due to possible inclement weather conditions, equipment breakdowns and conflicts with other permit compliance schedules.
- e. Prepare and submit five (5) copies of preliminary reports for review by the CITY.
- f. Prepare and submit five (5) hard copies of final reports, four (4) bound copies and one (1) unbound copy to the CITY. The reports shall also be provided in electronic form, saved in Microsoft Word or other mutually agreeable format such as PDF.
- g. If requested by the CITY, the CONTRACTOR will present the study's current results and findings at public hearings, seminars, informational meetings, and neighborhood board/community meetings.
- h. Any database (e.g., species tabulation of micromollusks, crustaceans, polychaetes) created for this project from which the CITY can benefit, such as for inclusion in antidegradation reports, shall be prepared in a format that can be readily used by the CITY. A copy of the database will be given to the CITY upon termination of the agreement.

2. TIME. Performance of the services under this Agreement shall be satisfactorily completed by June 30, 2017, unless otherwise extended by an amendment.

3. COMPENSATION AND PAYMENT SCHEDULE. Subject to the General Terms and Conditions, the CONTRACTOR will be paid on a quarterly basis for expenses incurred on the project.

Compensation for subsequent fiscal years shall be authorized annually, subject to availability of funds, to complete the work through June 30, 2017.

Requests for increases in staff salary proportionate to a percentage increase in accordance with a labor contract agreement may be included in an amendment provided however that any increase to the Contract amount shall be subject to the availability of funds.

Payment shall be made for allowable costs in accordance with the Hawaii Administrative Rules, Title 3, Department of Accounting and General Services, Chapter 3-122, Subchapter 15, Cost or Pricing data, and Chapter 3-123, Cost Principles.

4. OTHER INSTRUCTIONS OR SPECIFICATIONS NOT COVERED IN GENERAL TERMS AND CONDITIONS OR ELSEWHERE.

- a. The study shall be conducted in accordance with the attached scope of work for the biological and sediment studies near the CITY's ocean outfalls.
- b. Delete Sections 4.2.1, 4.3, 6.6, and 8.3 of the GENERAL TERMS AND CONDITIONS.
- c. Replace Section 4.1.1 with the following language, "The University of Hawaii shall be responsible for damages or injury caused by the University of Hawaii's agents, officers, and employees in the course of their employment to the extent that the University of Hawaii's liability for such damage or injury has been determined by a court or otherwise agreed to by the University of Hawaii, and the University of Hawaii shall pay for such damages and injury, to the extent permitted by law and approved by the Legislature."
- d. CHANGE ORDER. The CITY, with the approval of the Director of Budget and Fiscal Services, may at any time, and without notice to any surety, unilaterally, order the CONTRACTOR to change the scope of work of the contract to reflect the change of the permit requirements under the contract at any time by written notice to the CONTRACTOR. If any change increases or decreases the CONTRACTOR's cost of, or the time required for, performance of any part of the work under the contract, an adjustment shall be made and the contract modified in writing accordingly.

- e. Replace Section 8.3 with the following language: “The officer-in-charge shall approve and accept completion of the contract upon satisfactory fulfillment of the terms of the contract.”

- f. Delete paragraphs 5 and 6 of Section 6.4 of the General Terms and Conditions and replace with the following language: “The officer-in-charge shall have access, at all reasonable times, to all notes, designs, drawings, tracing or other technical data pertaining to the services being performed under the contract for the purpose of inspection and making copies of them. Upon completion of the services under the contract, any or all of such notes, studies, designs, drawings, tracings or other technical data produced in the performance of the contract shall be delivered and surrendered to the officer-in-charge on demand, provided that copies of notes, studies, designs, drawings, tracings or other technical data may be delivered and surrendered instead of the originals. CONTRACTOR may utilize any materials produced or resulting from activities supported by this contract for education, research, or scientific purposes.”

- g. The CONTRACTOR agrees that any duly authorized representative of the CITY shall have access to and the right to examine and audit any directly pertinent books, document, papers and records of the

CONTRACTOR involving transactions related to the Agreement for a period of three (3) years following completion of this contract.

- h. The attached Scope of Work and Special Provision 1 above shall be performed without exception, unless modifications are submitted to and approved by the CITY.
- i. The contractual obligation of both parties in each fiscal period succeeding the first is subject to the appropriation and availability of funds. In the event that funds are not available for any succeeding fiscal period, the remainder of the contract shall be canceled and the CONTRACTOR shall be reimbursed for the reasonable costs incurred for satisfactory goods delivered or services performed under the contract up to the date of cancellation of the contract, including all reasonable costs resulting from the cancellation of the contract.
- j. Section 9.2 shall be amended as follows:
 - i) Revising the last sentence of the first paragraph to read:
“The CONTRACTOR shall continue performance of the contract to the extent it is not terminated and shall be liable for reasonable excess costs incurred in procuring similar goods and services.”

ii) Revising the second paragraph to read: “Notwithstanding the above, in the event the contract is terminated, in whole or in part, by the CITY as the result of a default by the CONTRACTOR, the CITY may secure, on any terms and in any manner that the CITY deems appropriate, supplies, materials, equipment and/or services similar to those required under the work terminated. The CONTRACTOR shall be liable to the CITY for any reasonable excess costs for such similar supplies, materials, equipment and/or services, and the CITY may withhold and apply any monies due or to become due to the CONTRACTOR under the contract for the completion of the work and/or for the payment of an additional CONTRACTOR or CONTRACTORS. This provision shall survive the termination of the contract.”

k. Section 9.3.2, paragraph (1) shall be deleted and replaced with the following language: “The CONTRACTOR may be required to deliver to the CITY, any completed goods, tools, dies, jigs, fixtures, plans, drawings, information, and contract rights, hereinafter called “manufacturing material” as the CONTRACTOR has specifically produced or specially acquired for the performance of the terminated part of the contract.”

- I. Section 10 of the GENERAL TERMS AND CONDITIONS is hereby amended to read, "Neither CITY nor the CONTRACTOR will institute litigation in any court concerning a dispute arising under this contract, unless that party has used good faith efforts to resolve the dispute on a timely basis through negotiation with the other party. A dispute may be submitted to mediation or arbitration upon mutual agreement of the parties. In the event that the parties cannot negotiate a timely settlement of a dispute, then either party may institute appropriate court action."

- m. The first sentence of Section 9.1 of the GENERAL TERMS AND CONDITIONS is hereby amended to read, "The CITY shall have the right to suspend performance of the services under the contract or terminate the contract in whole or in part at any time by written notice to the CONTRACTOR, and the CONTRACTOR shall be paid for that portion of the work completed to date of termination."

- n. Section 12.1.1, item 9, of the GENERAL TERMS AND CONDITIONS shall be deleted entirely.

- o. REFUNDS. Any unexpended sum remaining from the total amount advanced by the CITY to the CONTRACTOR, after completion of the Contract or termination of the Contract in whole or in part at any time by the CITY, shall be reimbursed to the CITY.

In the event a report is not completed (e.g., survey/sampling canceled), it is the responsibility of the CONTRACTOR to provide a report on its expenses relating to the report (e.g., initial startup) to receive compensation. The CONTRACTOR shall provide a written description on the extent of the work on the uncompleted report and reasons why the report was not finished.

SCOPE OF WORK

BIOLOGICAL AND SEDIMENT MONITORING PROGRAM

2012-2017

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SCOPE OF WORK

Biological and Sediment Monitoring Program 2012-2017

INTRODUCTION

The University of Hawaii Water Resources Research Center (WRRC) will conduct scientific monitoring of benthic fauna surrounding ocean disposal outlets of effluent from City and County of Honolulu (City) wastewater treatment plants. These studies, as detailed below, will contribute to the City's program to evaluate compliance with federal or state permits and will cover the Sand Island, Barber's Point, Waianae and Mokapu outfalls. With some exceptions noted below, collection of samples is the responsibility of the City; laboratory and statistical analysis of samples and synthesis of results will be carried out by WRRC. Specific objects of study vary between outfalls, but include, as detailed below, micromollusks, nonmollusks, polychaetes, crustaceans, and epifaunal micromollusks; fish liver histopathology; shallow-water observation of coral cover and reef fish populations; and assessment of videotapes of fish and epibenthic megainvertebrate populations.

BIOMONITORING PROGRAM FOR SAND ISLAND OCEAN OUTFALL

BENTHOS

Monitoring shall be conducted annually to assess the accumulation of pollutants in sediments and organisms, to monitor the status of the benthic community, to evaluate the physical and chemical quality of the sediments, and to evaluate compliance with applicable water quality standards and 301(h) permit criteria.

WRRC shall perform the biological monitoring portion of the project comprising the identification and enumeration of infaunal organisms including micromollusks, nonmollusks, polychaetes, crustaceans, and epifaunal micromollusks.

The WRRC biomonitoring team shall comply with the requirements specified in the applicable permits as they pertain to their work under this contract.

MATERIALS AND METHODS

Three grab samples shall be taken by the City's oceanographic team at each of 15 stations in the vicinity of the Sand Island Outfall (Figure S-1). Subsamples of these grab samples shall be delivered to the WRRC research team for analysis.

SAMPLING STATIONS

The specific locations of the core sampling stations are shown in Figure S-1. At this time, members of the WRRC biomonitoring team do not participate in the station selection process

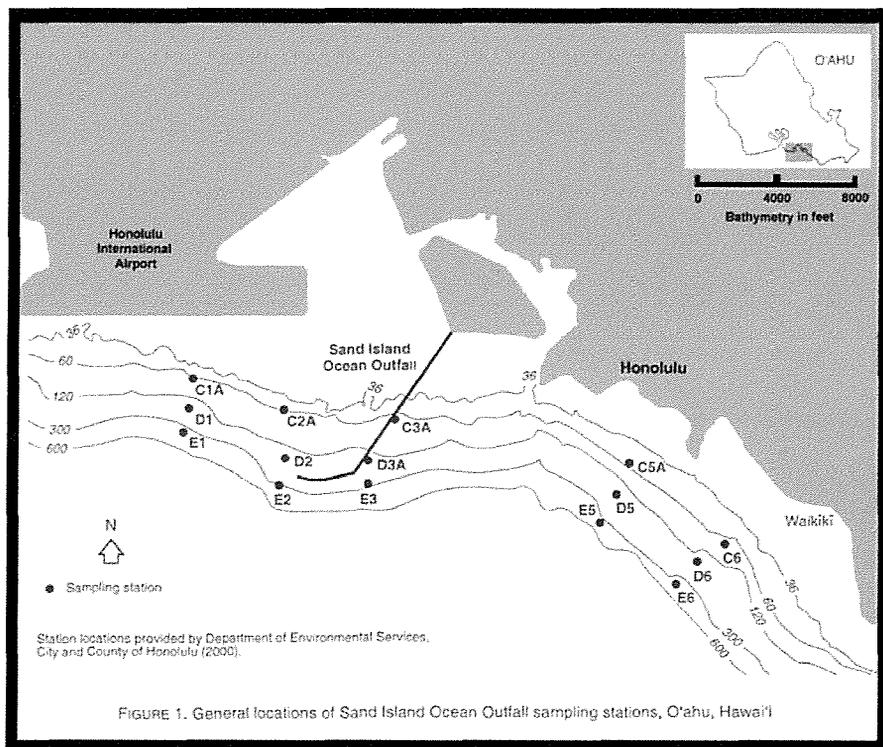


Figure S-1. Sand Island Ocean Outfall sampling stations, Oahu, Hawaii

SAMPLING METHODS

The sampling methodology to be used for this work will generally follow the recommendations of Swartz (1978) and U.S. Environmental Protection Agency guidelines (U.S. EPA 1981, 1987a, 1987b), hereafter referred to as EPA procedures. No changes to the sampling protocol, including the number of samples taken shall be made by the City's oceanographic team without prior consultation with the WRRC team.

SAMPLE PROCESSING

Handling, processing and preservation of the biological subsamples shall follow EPA procedures. Chain of custody forms shall be utilized with all subsamples. The protocols found in EPA's (1987a) guidance document on field and laboratory methods shall be used for quality assurance/quality control. The biological subsamples will be processed using two different procedures, one for nonmollusks and the other for micromollusks. Because of the difference in procedures, the two components of the fauna are not directly comparable and hence will be analyzed separately. Because the micromollusks will not be separated into living and dead fractions, they will represent time-averaged samples.

Nonmollusk samples:

Nonmollusk samples will be placed in 15% buffered formalin in the field and shall remain in this fixative for a minimum of 24 hours. The subsamples taken for analysis of nonmollusks shall be fixed in 15% buffered formalin for a minimum of 24 hours. In the laboratory the fixed subsamples shall be elutriated using the technique of Sanders et al. (1965). Subsamples shall be washed several times and then sieved for benthic organisms, using a 0.5-mm-mesh screen. Organisms retained on the screen shall be transferred to alcohol, stained with rose bengal solution, and stored in 70% ethanol within two to seven days of fixation. This method successfully removes from the sediment all organisms which are not heavily calcified (Nelson et al. 1987). Large carbonate rubble fragments, if present, shall be carefully washed and visually examined to ensure that any organisms in the external surfaces are removed. The fragments shall then be placed in a nitric acid bath for 24 hours (or longer as necessary) to dissolve the carbonate and recover organisms living in burrows. The acid dissolution techniques to be used are modified from the methods described in Brock and Brock (1977), as briefly described in Nelson (1986).

Micromollusk samples:

Subsamples of sediment for micromollusk identification and enumeration shall be placed in labeled jars in the field, then placed on ice and transported to the laboratory where they shall be refrigerated. In the laboratory, the subsamples shall be fixed in 98% ethanol for 48 hours and then air dried. A 15-cm³ portion shall be removed from each micromollusk subsample for sorting.

SAND ISLAND DATA ANALYSIS

All specimens shall be counted and identified to the lowest taxon possible. A selected bibliography for the identification of marine benthic species in Hawaii is provided in Nelson et al. (1987, appendix G). Voucher specimens shall be submitted to taxonomic specialists for verification when necessary. All specimens shall be archived and maintained for six years.

Analyses of community parameters shall include, but not be limited to, the following: number of

species per sample, number of individuals per sample, number of individuals per 0.1 m², total number of species per station, and total number of individuals per station. These parameters may be calculated for individual species, all nonmollusks, crustaceans, and mollusks.

Statistical analyses shall be presented, along with the data and graphical displays, to illustrate benthic community changes. Basic statistics, which include the mean, median, variance, 95% confidence limits of the mean, skewness, kurtosis, and the results of the Kolmogorov-Smirnov test for normality of distribution of the data, shall be calculated for nonmollusks, crustaceans, and mollusks for both number of individuals and number of species.

All data (number of individuals, number of taxa) shall be tested for the assumption of homogeneity of variances (F_{\max} test) prior to statistical analysis. Where variances are heterogeneous, square root or log 10 transformation shall be applied. Comparisons of mean values among stations shall be made with one-way analysis of variance (ANOVA). Following a significant result using ANOVA, a posteriori Student Newman Keuls tests shall be used to determine which differences in means among stations are significant. If the assumption of homogeneity of variances is not met after data transformation, nonparametric statistical methods shall be used for comparisons of number of individuals and number of taxa among stations.

Overall comparisons of taxa composition among stations shall be carried out using cluster analysis (Pielou 1984) for both the nonmollusk and mollusk components. The Bray Curtis similarity index (Bloom 1981) on double square root transformed data shall be performed using the group-average sorting strategy. To make analysis more manageable, only those taxa that contributed at least 0.05% of the total abundance shall be included in the analysis.

The Shannon-Wiener H diversity index (\log_{10}) and the evenness index (J) shall be computed for all stations (all replicates pooled), as recommended in the EPA procedures, for both the nonmollusk and mollusk components. Other multivariate (e.g. ordination) and regression analyses may also be conducted. Additional analyses shall be conducted, as appropriate, to elucidate spatial and temporal trends in the data.

Mean values for sediment parameters (grain size, ORP, TN, TOC) shall be statistically compared among stations. Data for these sediment parameters shall be provided to the WRRC team by the City.

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BIOMONITORING PROGRAM FOR BARBERS POINT OCEAN OUTFALL

BENTHOS

Monitoring shall be conducted annually to assess the accumulation of pollutants in sediments and organisms, to determine the status of the benthic community, to evaluate the physical and chemical quality of the sediments, and to evaluate compliance with applicable water quality standards and 301(h) permit criteria.

WRRC shall perform the biological monitoring portion of the project comprising the identification and enumeration of infaunal organisms including micromollusks, nonmollusks, polychaetes, crustaceans, and epifaunal micromollusks. WRRC will also conduct monitoring to assess changes in reef fish populations

The WRRC biomonitoring team shall comply with the requirements specified in the applicable permits as they pertain to their work under this contract.

MATERIALS AND METHODS

Five grab samples shall be taken by the City's oceanographic team at each of seven stations in the vicinity of the Barbers Point Outfall (Figure B-1). Subsamples of these grab samples shall be delivered to the WRRC research team for analysis.

SAMPLING STATIONS

The locations of sampling stations are shown in Figure B-1. Seven stations previously established along the diffuser isobath (61 m) shall be sampled

SAMPLING METHODS

The sampling methodology to be used for this study will generally follow the recommendations of Swartz (1978) and U.S. Environmental Protection Agency guidelines (U.S. EPA 1981, 1987a, 1987b), hereafter referred to as EPA procedures. No changes to the sampling protocol, including the number of samples taken shall be made by the City's oceanographic team without prior consultation with the WRRC team.

SAMPLE PROCESSING

Handling, processing, and preservation of the biological samples will follow EPA procedures. Chain of custody forms shall be utilized with all samples. The biological subsamples will be processed using two different procedures, one for micromollusks and the other for all other organisms. Because of the difference in procedures, the two components of the fauna are not directly comparable and hence will be analyzed separately. Because the micromollusks will not be separated into living and dead fractions, they will represent time-averaged samples.

Nonmollusk samples:

Nonmollusk samples will be placed in 15% buffered formalin in the field and shall remain in this fixative for a minimum of 24 hours. In the laboratory the fixed samples shall be elutriated using the technique of Sanders et al. (1965). This method successfully removes all organisms which are not heavily calcified from the sediment (Nelson et al. 1987). Samples shall be washed several

times and then sieved for benthic organisms, using a 0.5-mm-mesh screen. Organisms retained on the screen shall be transferred to alcohol, stained with rose bengal solution, and stored in 70%

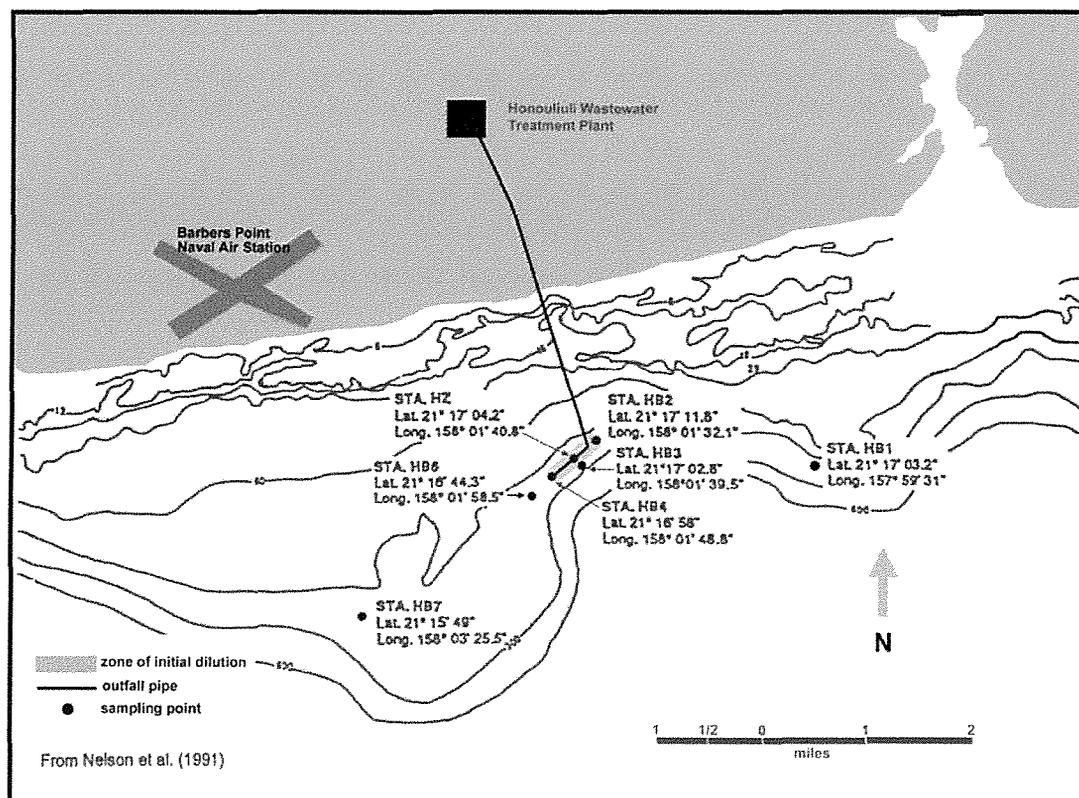


Figure B-1. Barbers Point Ocean Outfall benthic sampling stations

ethanol within two to seven days of fixation. Large carbonate rubble fragments, if present, shall be carefully washed and visually examined to ensure that any organisms on the external surfaces are removed. The fragments shall then be placed in a (or longer as necessary) for 24 hours to dissolve the carbonate and recover organisms living in burrows. The acid dissolution techniques to be used are modified from the methods described in Brock and Brock (1977), as briefly described in Nelson (1986).

Micromollusk samples:

Subsamples of sediment for micromollusk identification and enumeration shall be placed in labeled jars in the field, then placed on ice and transported to the laboratory where they shall be refrigerated. In the laboratory, the subsamples shall be fixed in 98% ethanol for 48 hours and then air dried. A 10-cm³ subsample shall be removed from each micromollusk sample for sorting.

BARBERS POINT DATA ANALYSIS

All specimens shall be counted and identified to the lowest taxon possible. A selected bibliography for the identification of marine benthic species in Hawaii is provided in Nelson et

al. (1987, appendix G). Voucher specimens shall be submitted to taxonomic specialists for verification when necessary. All specimens shall be archived and maintained for six years.

Analyses of community parameters shall include, but not be limited to, the following: number of species per sample, number of individuals per sample, number of individuals per 0.1 m², total number of species per station, and total number of individuals per station. These parameters may be calculated for individual species, all nonmollusks, crustaceans, and mollusks.

Statistical analyses shall be presented, along with the data and graphical displays, to illustrate benthic community changes. Basic statistics, which include the mean, median, variance, 95% confidence limits of the mean, skewness, kurtosis, and the results of the Kolmogorov-Smirnov test for normality of distribution of the data, shall be calculated for nonmollusks, crustaceans, and mollusks for both number of individuals and number of species.

All data (number of individuals, number of taxa) shall be tested for the assumption of homogeneity of variances (F_{\max} test) prior to statistical analysis. Where variances are heterogeneous, square root or log 10 transformation shall be applied. Comparisons of mean values among stations shall be made with one-way analysis of variance (ANOVA). Following a significant result using ANOVA, a posteriori Student Newman Keuls tests shall be used to determine which differences in means among stations are significant. If the assumption of homogeneity of variances is not met after data transformation, nonparametric statistical methods shall be used for comparisons of number of individuals and number of taxa among stations.

Overall comparisons of taxa composition among stations shall be carried out using cluster analysis (Pielou 1984) for both the nonmollusk and mollusk components. The Bray Curtis similarity index (Bloom 1981) on double square root transformed data shall be performed using the group-average sorting strategy. To make analysis more manageable, only those taxa that contributed at least 0.05% of the total abundance shall be included in the analysis.

The Shannon-Wiener H diversity index (\log_{10}) and the evenness index (J) shall be computed for all stations (all replicates pooled), as recommended in the EPA procedures, for both the nonmollusk and mollusk components. Other multivariate (e.g. ordination) and regression analyses may also be conducted. Additional analyses shall be conducted, as appropriate, to elucidate spatial and temporal trends in the data.

Mean values for sediment parameters (grain size, ORP, oil & grease, TOC) shall be statistically compared among stations. Data for these sediment parameters shall be provided to the WRRC team by the City.

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- Bloom, S.A. 1981. Similarity indices in community studies: Potential pitfalls. *Mar. Ecol. Prog. Ser.* 5:125-128.
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BARBERS POINT SHALLOW WATER

To assess the impact of the Barbers Point wastewater discharge on coral communities in the area, changes in living coral coverage and in the reef fish population shall be monitored annually.

MATERIALS AND METHODS

STUDY SITE LOCATIONS (all stations are approximately 10 m deep)

- BP-1 2.2 km east and inshore of outfall terminus (reference station)
- BP-2 1.6 km east and inshore of outfall terminus
- BP-3 2.9 km west and inshore of outfall terminus
- BP-4 on the outfall pipe 1.4 km shoreward of outfall terminus

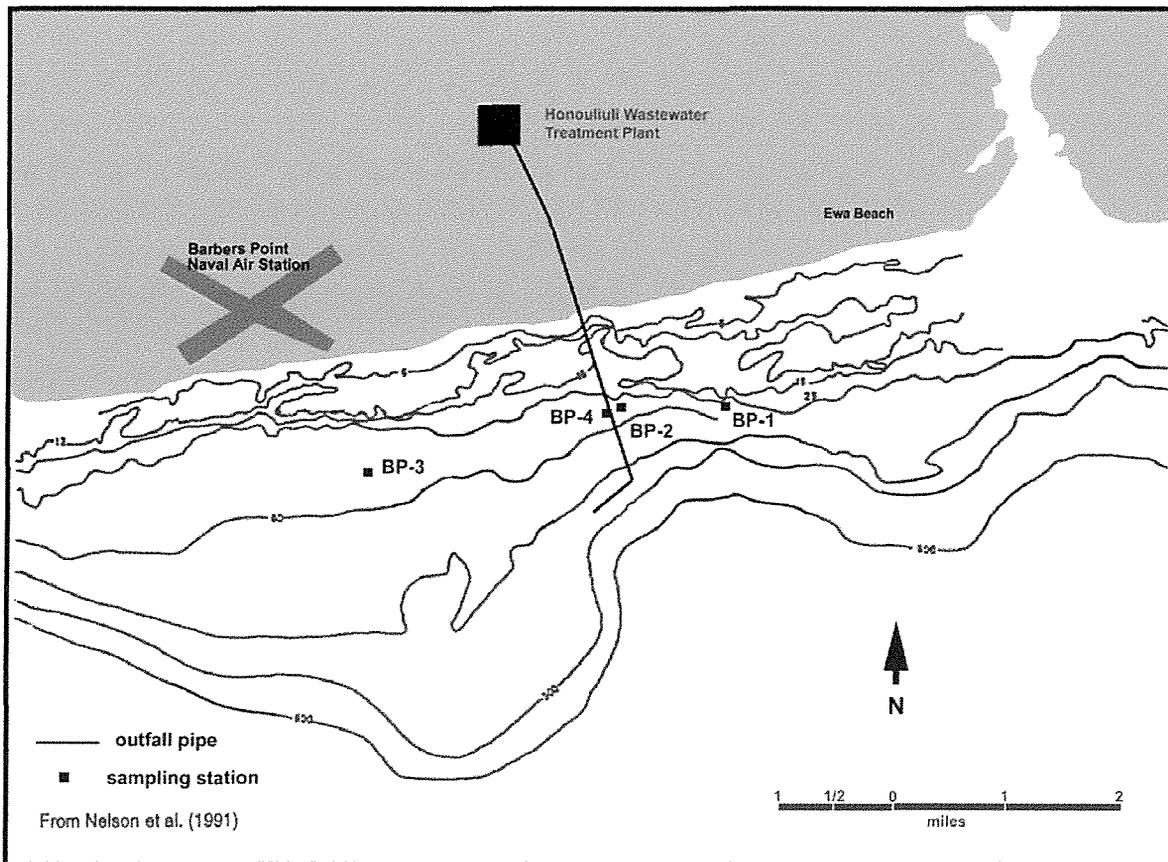


Figure B-2. Barbers Point Ocean Outfall shallow marine community monitoring stations

SAMPLING METHODS

At each station two permanent transect lines, each made with metal stakes and electrical wire 20-m long, and spaced 15 to 30 m apart, shall be sampled. Similar established lines, made of plastic-coated no. 14 copper wire, have been successfully used by Brock and Norris (1987) to mark transect locations on coral reefs. Twenty-meter lines were chosen to avoid reef edge effects (Brock 1982), which may occur because of the lack of extensive areas of coral growth. Corals in Hawaiian waters normally grow in less than 30m diameter patches interspersed with sand and rubble. Because of this patchiness, using 50-m transects for coral and fish surveys as recommended by U.S. EPA (1982) would be less efficient than using shorter transects. Transects laid in pairs 15 to 30 m apart will help alleviate the problem of lower fish counts usually recorded along one 20-m line as compared with one 50-m line.

Fish censuses shall be conducted over each 20-m long x 4 m wide corridor (80 m² area). A single diver equipped with scuba and an underwater slate and pencil shall count, identify, and record all fish species within the 20 m x 4 m area to the water's surface. The diver shall wait 5 to 10 minutes before starting the count to allow wary fishes in the area to adjust to his presence. This visual census technique at established transects provides a good and repeatable method of estimating diurnally active fish communities (V.E. Brock 1954; R.E. Brock 1982).

In order to monitor coral cover and growth the City's oceanographic team shall take photographs of the ocean floor at the transects using the procedures outlined in appendix D. The photographs will be delivered by the City's personnel to WRRC team member Dr. Richard E. Brock who will perform the analysis.

ADDITIONAL METHODS

Another method of quantitatively assessing benthic communities at each station is the use of 1m x 1m quadrats placed at marked locations to estimate coverage of corals and other sessile forms. Using this method, in-the-field appraisals shall be made of coverage and recorded as percent cover. If macrothalloid algae are encountered in the quadrats, they shall also be quantitatively recorded as percent cover.

Divers shall make simple physical measurements at the three stations while in the field. Measurements of percent oxygen concentration and temperature shall be made with a model 57 YSI oxygen meter (or equivalent), salinity with a hand-held refractometer, and water clarity with a 12-inch secchi disk.

Data shall be subjected to simple nonparametric statistical procedures provided in the SAS Institute statistical package (SAS Institute, Inc. 1985 or equivalent software). Nonparametric methods shall be used to avoid the necessity of meeting requirements of distribution normalcy and homogeneity of variance in the data. Data shall be analyzed using the Kruskal-Wallis one-way analysis of variance to discern statistically significant differences among ranked means for each transect site and sampling period; this procedure is outlined in Siegel (1956) and Sokal and Rohlf (1995). The a posteriori Student-Newman-Keuls multiple-range test (SAS Institute, Inc. 1985 or equivalent software) shall also be used to elucidate differences between locations.

Quality assurance/quality control (QA/QC) shall be maintained at each step of the sampling program. Field sampling shall be carried out at permanently marked stations; marking the actual sampling sites with steel pins ensures that the same areas are censused during each annual survey. If unidentified benthic species are encountered in the field surveys, samples shall be taken from areas outside of the sampling sites for positive identification in the laboratory. The integrity of the steel pins and all materials marking the field sampling sites shall be checked several times during the year. Thus when census work commences, there will be minimal disturbance of fish communities resulting in fewer errors associated with fleeing fishes. All field notes and data shall be retained, as shall all photographs, for future reference. In the preparation of the reports, all tabular data shall be checked by at least three different individuals.

The WRRC biomonitoring team shall comply with the requirements specified in the applicable permits as they pertain to their work under this contract.

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BARBERS POINT VIDEO ASSESSMENT OF MARINE COMMUNITIES

Fish and diurnally exposed megainvertebrate species resident to the Barbers Point deep-water outfall diffuser will be censused annually.

The City and County of Honolulu's Oceanographic Team will videotape the fish and epibenthic megainvertebrate populations at fixed points along two fixed-length transect lines at the outfall terminus using a remotely controlled video camera system.

Alternatively, with the City's permission, the Oceanographic Team shall use the video camera system to videotape deeper selected (known and identifiable) sections of each outfall pipe, including the diffuser. A remotely operated vehicle (ROV) owned by the City shall be used. The use of an ROV is stipulated in the National Pollutant Discharge Elimination System 301(h) waiver permit for secondary treatment of sewage at the Honouliuli Wastewater Treatment Plant. The City and County of Honolulu makes the videotape available for analysis of exposed fish and megainvertebrate populations resident to the diffuser.

The videotapes shall be viewed by WRRC researchers to identify and count the fish and megainvertebrates (e.g., sea urchins, holothurians). The results shall be used to semiquantitatively measure temporal changes in fish and megainvertebrate assemblages. Spatial changes will not be monitored since at the outfall the structure represents a unique high-relief, hard-substratum feature with no complement in the surrounding soft-bottom environment, and the uniqueness of the outfall habitat precludes selection of an appropriate control site. Temporal changes in fish and megainvertebrate assemblages shall be determined using appropriate biostatistical tests. Quality assurance/quality control is approached by viewing and conducting counts along each of the identified transects or census sites at least five times. This sampling replication reduces errors associated with counts, especially with only one individual (R.E.

Brock) conducting the counts. All videotapes and notes shall be retained. This methodology has been utilized by the WRRC project team in the study of these diffusers since 1991.

BIOMONITORING PROGRAM FOR MOKAPU OCEAN OUTFALL

MOKAPU BENTHOS

Monitoring of the marine communities and sediment in the vicinity of the Mokapu Ocean Outfall is conducted once every five years to assess the accumulation of pollutants in sediments and organisms, to monitor the status of the benthic community, to evaluate the physical and chemical quality of the sediments, and to evaluate compliance with applicable water quality standards. Thus this outfall will be surveyed only in 2013.

MATERIALS AND METHODS

SAMPLING STATIONS

Five grab samples shall be taken by the City's oceanographic team at each of six stations previously established along the diffuser isobath (34 m) near the Mokapu Outfall (Figure M-1). Subsamples of these grab samples shall be delivered to the WRRC research team for analysis.

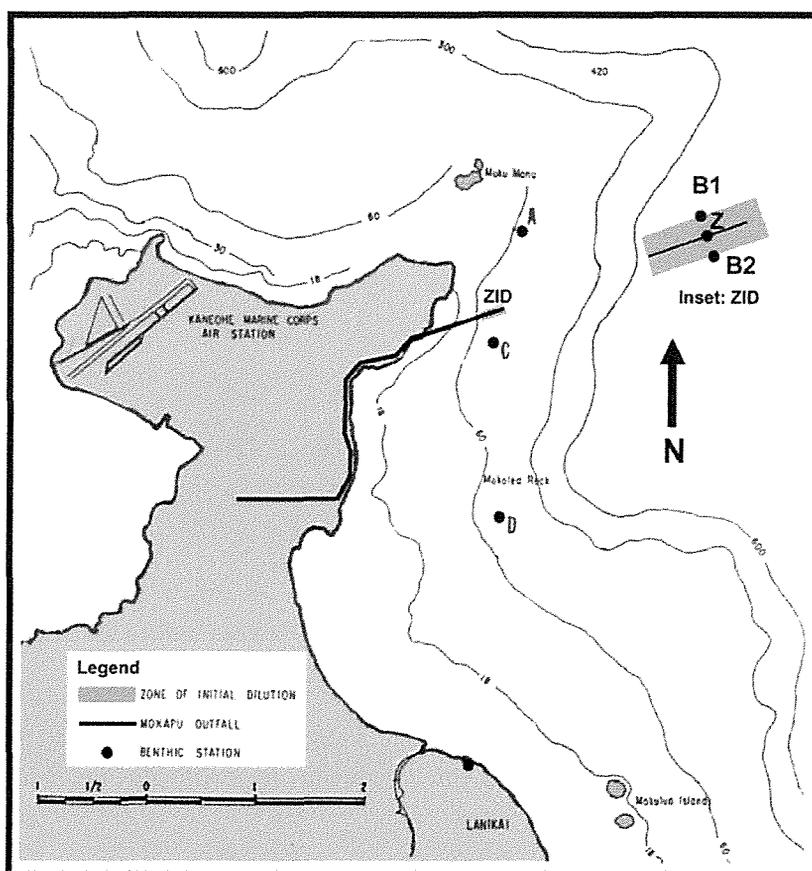


Figure M-1. Mokapu Ocean Outfall benthic sampling stations

SAMPLING METHODS

The sampling methodology used shall follow U.S. Environmental Protection Agency guidelines (U.S. EPA 1981, 1987a, 1987b), hereafter referred to as EPA procedures. No changes to the sampling protocol, including the number of samples taken shall be made by the City's oceanographic team without prior consultation with the WRRC team.

SAMPLE PROCESSING

Handling, processing, and preservation of the biological samples generally shall follow EPA procedures. Some procedures may differ from the recommended procedures because of the particular nature of the Mokapu sediments. Chain of custody forms shall be utilized with all samples.

Nonmollusk samples:

Nonmollusk samples will be placed in 15% buffered formalin in the field and shall remain in this fixative for a minimum of 24 hours. In the laboratory the fixed samples shall be elutriated using the technique of Sanders et al. (1965). This method successfully removes from the sediment all organisms which are not heavily calcified (Nelson et al. 1987). Samples shall be washed several times and then sieved for benthic organisms, using a 0.5-mm-mesh screen. Organisms retained on the screen shall be transferred to alcohol, stained with rose bengal solution, and stored in 70% ethanol within two to seven days of fixation. Large carbonate rubble fragments, if present, shall be carefully washed and visually examined to ensure that any organisms on the external surfaces are removed. The fragments shall then be placed in a nitric acid bath for 24 hours (or longer as necessary) to dissolve the carbonate and recover organisms living in burrows. The acid dissolution techniques to be used are modified from the methods described in Brock and Brock (1977), as briefly described in Nelson (1986).

Micromollusk samples:

Subsamples of sediment for micromollusk identification and enumeration shall be placed in labeled jars in the field, then placed on ice and transported to the laboratory where they shall be refrigerated. In the laboratory, the subsamples shall be fixed in 98% ethanol for 48 hours and then air dried. A 25-cm³ subsample shall be removed from each micromollusk sample for sorting.

The ORP, O&G, grain size, total nitrogen, TOC, sediment priority pollutant and pesticide analyses of the sediments shall be performed by the City's laboratory. The protocols found in EPA's (1987a) guidance document on field and laboratory methods shall be used for quality assurance/quality control.

MOKAPU DATA ANALYSIS

All specimens shall be counted and identified to the lowest taxonomic level possible. A selected bibliography for the identification of marine benthic species in Hawaii is provided in Nelson et al. (1987, appendix G). Voucher specimens shall be submitted to taxonomic specialists for verification when necessary. All specimens shall be archived and maintained for six years.

Basic statistics, which include the mean, median, variance, 95% confidence limits of the mean and median, skewness, kurtosis, and the results of the Kolmogorov-Smirnov test for normality of

distribution of the data shall be calculated for both nonmollusks and micromollusks for both number of individuals and number of species. All data shall be tested for normality.

All data analyzed shall be tested for assumptions of heterogeneity of variances (F_{\max} test) prior to statistical analysis (Sokal and Rohlf 1995). Heterogeneity of variances shall be corrected with either $\log_{10}(x+1)$ or square root transformation, and comparisons of stations will then be made for the transformed data with one-way analysis of variance (ANOVA). Following ANOVA, the a posteriori Tukey test shall be used to determine which differences among stations are significant. Where variances cannot be corrected by transformation, the Games and Howell test for significant differences in means with heterogeneous variances shall be used

The Shannon-Wiener H diversity index (\log_{10}) and the evenness index (J) shall be computed for all stations (all replicates pooled), as recommended in the EPA procedures. An overall comparison of species composition among stations shall be carried out using hierarchical cluster analysis (Pielou 1984) for both the nonmollusk and micromollusk components. The similarity matrix will be computed using the JMP Statistical Software Package developed by SAS Institute or equivalent. A dendrogram using Euclidean distances (McArtle and Anderson 2001; Dietz 1983) on untransformed abundance data shall be generated for nonmollusk and mollusks. To compress the data set to a more manageable size, only those species which contribute at least 5.0% of total abundance shall be included in the analysis.

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MOKAPU SHALLOW WATER

Inshore assessment of the coral and fish communities, as well as sampling of the benthic communities located near and far field from the outfall terminus, shall be conducted for the Mokapu Ocean Outfall in 2013 only. The monitoring program developed for the shallow water environment at the Barbers Point or Waianae Ocean Outfall shall serve as a model for the program at Mokapu.

Previous studies showed that extensive coral communities exist at depths between 8 and 15 m in the nearshore environment in the vicinity of the Mokapu Ocean Outfall (Russo et al. 1977, 1979). Coral communities in Hawaii are usually coralline algae dominated with, on the average, less than 10% live coral cover and represented by four to six dominant genera (Russo et al. 1979). Large patches of coral exist, usually interspersed with sand, boulders, or rubble on limestone basement rock.

MATERIALS AND METHODS

SAMPLING STATIONS

All biomonitoring sites shall be located at depths of approximately 9 to 12 m. Three stations (Figure M-2) will be monitored at or near locations surveyed in previous studies:

Station A40 Approximately 0.5 km north of the outfall diffuser at a depth of about 12 m.

Station B30 Approximately 0.5 km south of the outfall pipe at a depth of 9 m.

Station C40 Approximately 2 km south of the outfall diffuser at a depth of 12 m.

Stations at or near the outfall diffuser may also be established for monitoring of impacts to the marine environment.

SAMPLING METHODS

Guidelines for field monitoring, data reduction, and interpretation of benthic and fish communities have been established by U.S. EPA (1982). Not all of these guidelines can be completely met in the proposed monitoring program for coral and fish communities inshore of the Mokapu Ocean Outfall. The reasons for these shortcomings are noted below, along with proposed changes in methodology and the rationale for these changes.

At each station two permanent transect lines, each made with metal stakes and electrical wire 20 m long and spaced 15 to 30 m apart, shall be sampled. Similar established lines, made of plastic-coated no. 14 copper wire, have been successfully used by Brock and Norris (1987) to mark

transect locations on coral reefs. Twenty-meter lines were chosen to avoid reef edge effects (Brock 1982), which may occur because of the lack of extensive areas of coral growth. Corals in

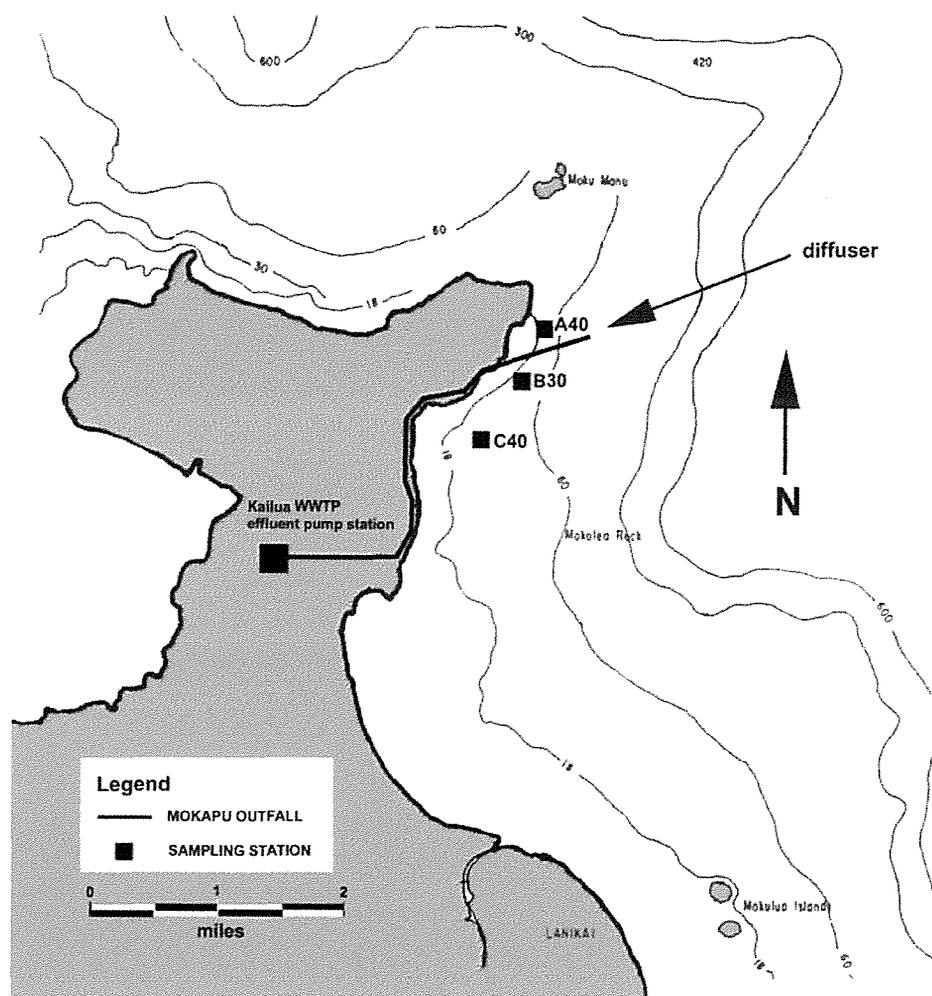


Figure M-2- Mokapu Ocean Outfall shallow marine community monitoring stations

Hawaiian waters normally grow in less than 30-m-diameter patches interspersed with sand and rubble. Because of this patchiness, using 50-m transects for coral and fish surveys as recommended by U.S. EPA (1982) would be less efficient than using shorter transects. Transects laid in pairs 15 to 30 m apart will help alleviate the problem of lower fish counts usually recorded along one 20-m line as compared with one 50-m line.

Fish censuses shall be conducted over each 20 m long x 4 m wide corridor (80 m² area). A single diver equipped with scuba and an underwater slate and pencil shall count, identify, and record all fish species within the 20 x 4 m area to the water's surface. The diver shall wait 5 to 10 minutes before starting the count to allow wary fishes in the area to adjust to his presence. This visual

census technique at established transects provides a good and repeatable method of estimating diurnally active fish communities (V.E. Brock 1954; R.E. Brock 1982).

In order to monitor coral cover and growth the City's oceanographic team shall take photographs of the ocean floor at the transects annually using the procedures outlined in appendix D. Four by six inch prints of the photographs will be delivered to WRRC team member Dr. Richard E. Brock who will perform the analysis.

DATA ANALYSIS

Coral cover (percent) shall be estimated by tracing areas of live coral on the photographs using an electronic digital planimeter and comparing these areas with the total photographed bottom area.

ADDITIONAL METHODS

Another method of quantitatively assess benthic communities at each station is the use of 1 x 1 m quadrats placed at marked locations to estimate coverage of corals and other sessile forms. Using this method in-the-field appraisals shall be made of coverage and recorded as percent cover. If macrothalloid algae are encountered in the quadrats, they shall also be quantitatively recorded as percent cover.

Data shall be subjected to simple nonparametric statistical procedures provided in the SAS Institute statistical package (SAS Institute, Inc. 1985 or equivalent). Nonparametric methods shall be used to avoid meeting requirements of distribution normalcy and homogeneity of variance in the data. Data shall be analyzed using the Kruskal-Wallis one-way analysis of variance to discern statistically significant differences among ranked means for each transect site and sampling period; this procedure is outlined in Siegel (1956) and Sokal and Rohlf (1995). The a posteriori Student-Newman-Keuls multiple-range test (SAS Institute, Inc. 1985 or equivalent) shall also be used to elucidate differences between locations.

Quality assurance/quality control (QA/QC) shall be maintained at each step of the sampling program. Field sampling will be carried out at permanently marked stations; marking the actual sampling site with steel pins ensures that the same areas are censused during each survey. If unidentified benthic species are encountered in the field surveys, samples shall be taken from areas outside of the sampling sites for positive identification in the laboratory. All field notes and data shall be retained, as shall all photographs, for future reference. In the preparation of the reports, all tabular data shall be checked by at least three different individuals.

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BIOMONITORING PROGRAM FOR WAIANAEOCEAN OUTFALL

WAIANAEO BENTHOS

Monitoring is conducted annually to assess the accumulation of pollutants in sediments and organisms, to monitor the status of the benthic community, to evaluate the physical and chemical quality of the sediments, and to evaluate compliance with applicable water quality standards. The biological monitoring portion of the project includes the identification of the infaunal communities, which include the micromollusk, nonmollusks, polychaetes, and crustaceans--and epifaunal micromollusks. The sediment analyses portion covers total organic carbon, oxidation-reduction potential, oil and grease, grain size, total nitrogen, and priority pollutants.

The WRRC biomonitoring team shall comply with the requirements specified in the applicable permits as they pertain to their work under this contract.

The Waianae Conservation District Use (CDU) Permit also requires the annual monitoring of the benthic infaunal communities, which include micromollusks, limu, sponges, and corals. The CDU Permit has no specific provisions such as exact location of the monitoring stations and laboratory analyses. Generally, the monitoring program specified for the Sand Island and Honouliuli outfalls serves as a model for the Waianae monitoring program. It should be noted that the location of the Waianae benthic stations was modified by the City and approved by the state Department of Land and Natural Resources.

MATERIALS AND METHODS

SAMPLING STATIONS

The approximate locations of the sampling stations are shown in Figure W-1. Six stations along the diffuser isobath (33 m) shall be sampled.

SAMPLING METHODS

Generally following EPA guidelines the City oceanographic team shall collect six replicate grab samples of approximately 227cm³ at each of the 6 sampling stations. Subsamples of these grab samples shall be delivered to the WRRC research team for analysis. No changes to the sampling protocol, including the number of samples taken shall be made by the City's oceanographic team without prior consultation with the WRRC team.

SAMPLE PROCESSING

Handling, processing, and preservation of the biological samples shall follow EPA procedures. Chain of custody forms shall be utilized with all samples.

Nonmollusk samples:

Nonmollusk samples will be placed in 15% buffered formalin in the field and shall remain in this fixative for a minimum of 24 hours. In the laboratory the fixed samples shall be elutriated using the technique of Sanders et al. (1965). This method successfully removes from the sediment all organisms which are not heavily calcified (Nelson et al. 1987). Samples shall be washed several

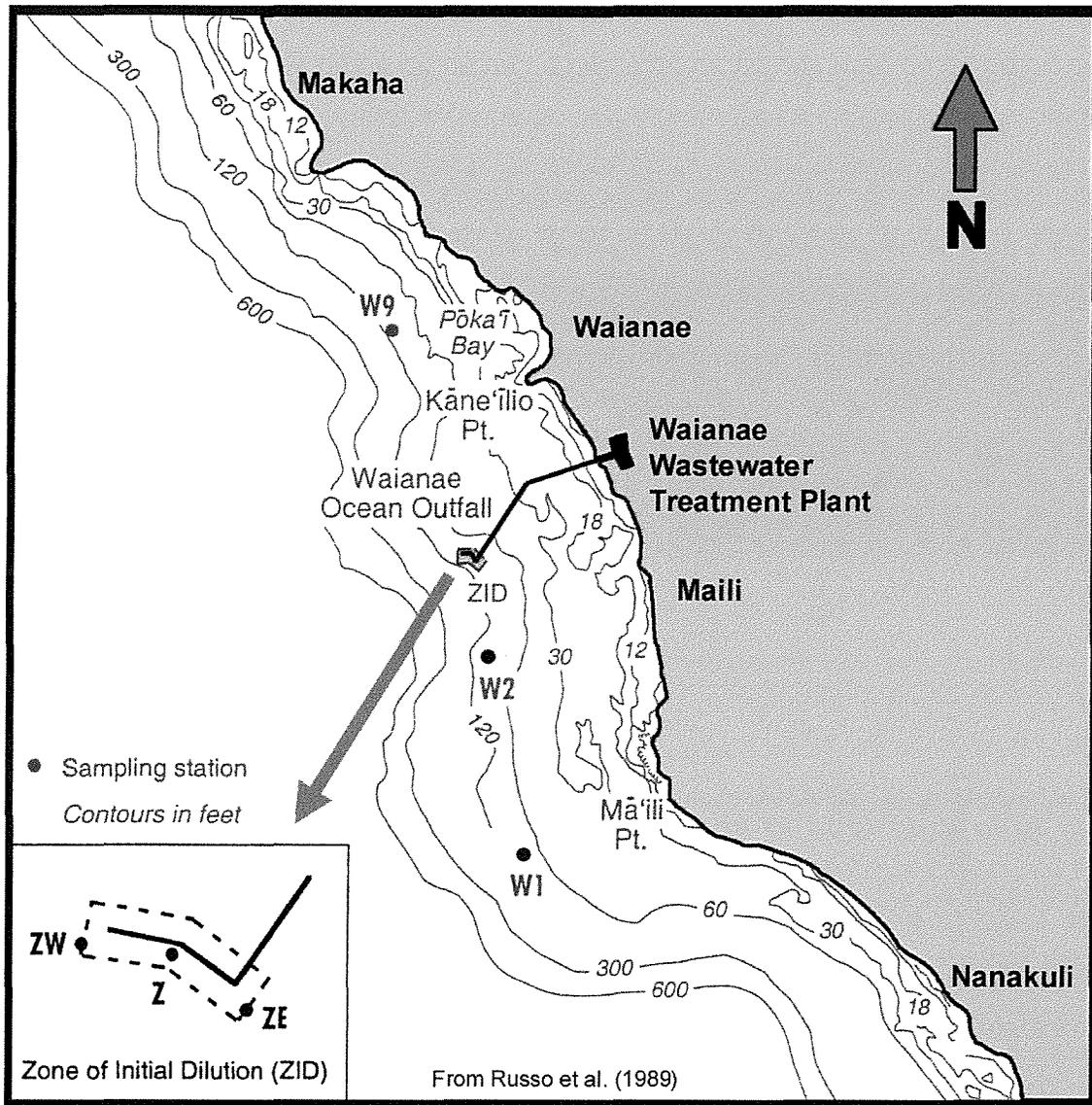


Figure W-1. Waianae Ocean Outfall Stations

times and then sieved for benthic organisms, using a 0.5-mm-mesh screen. Organisms retained on the screen shall be transferred to alcohol, stained with rose bengal solution, and stored in 70% ethanol within two to seven days of fixation. Large carbonate rubble fragments, if present, shall be carefully washed and visually examined to ensure that any organisms on the external surfaces are removed. The fragments shall then be placed in a nitric acid bath for 24 hours (or longer as necessary) to dissolve the carbonate and recover organisms living in burrows. The acid dissolution techniques to be used are modified from the methods described in Brock and Brock (1977), as briefly described in Nelson (1986).

Micromollusk samples:

Subsamples of sediment for micromollusk identification and enumeration shall be placed in labeled jars in the field, then placed on ice and transported to the laboratory where they shall be

refrigerated. In the laboratory, the subsamples shall be fixed in 98% ethanol for 48 hours and then air dried. A 25-cm³ subsample shall be removed from each micromollusk sample for sorting.

The ORP, O&G, grain size, total nitrogen, TOC, sediment priority pollutant and pesticide analyses of the sediments shall be performed by the City's laboratory. The protocols found in EPA's (1987a) guidance document on field and laboratory methods shall be used for quality assurance/quality control.

WAIANAE DATA ANALYSIS

All specimens shall be counted and identified to the lowest taxonomic level possible. A selected bibliography for the identification of marine benthic species in Hawaii is provided in Nelson et al. (1987, appendix G). Voucher specimens shall be submitted to taxonomic specialists for verification when necessary. All specimens shall be archived and maintained for six years.

Community structure analysis for each replicate, each station, and the group of offshore stations shall be made. The values determined shall be used to further determine mean, range, standard deviation, sample number, and 95% confidence limits, if appropriate. Additional statistical analyses may be conducted to determine temporal and spatial trends in the marine environment. Statistical analyses shall be conducted and graphic displays shall be presented in the report to demonstrate the current status of, and any changes to, the benthic infaunal communities found at the ZID boundary, gradient, and reference stations. Specific methods to be used for data analyses are mentioned below.

Basic statistics that include the mean, variance, standard error, and 95% confidence intervals shall be calculated for each station for both number of individuals and number of species.

All data (number of individuals and number of species) for both nonmollusks and micromollusks shall be tested for assumptions of normality (Kolmogorov-Smirnov test; Sokal and Rohlf 1995) and heterogeneity of variances (F_{\max} test) prior to statistical analysis. Comparisons of mean values among stations shall be made using one-way analysis of variance (ANOVA) where data meet assumptions of the analysis. Log transformation shall be performed if data still show heterogeneous variances. If variances cannot be homogenized after log transformation, the Games and Howell test for differences in means among treatments will be used (Sokal and Rohlf 1995). Following ANOVA, the a posteriori Tukey test shall be used to determine which differences in means among stations are significant.

An overall comparison of species composition among stations shall be carried out using cluster analysis (Pielou 1984) for both the nonmollusk and micromollusk components. The similarity index based on Euclidean distances (McArtle and Anderson 2001; Dietz, 1983) on untransformed data shall be performed. To make analysis more manageable, only those species that contributed at least 5.0% of the total abundance shall be included in the analysis. The hierarchical cluster program developed SAS Institute JMP Statistical Software shall be used to compute the similarity matrix. The Shannon-Wiener diversity index and evenness index shall be calculated for all stations (all replicates pooled), as recommended in the EPA procedures, for both the nonmollusk and micromollusk components.

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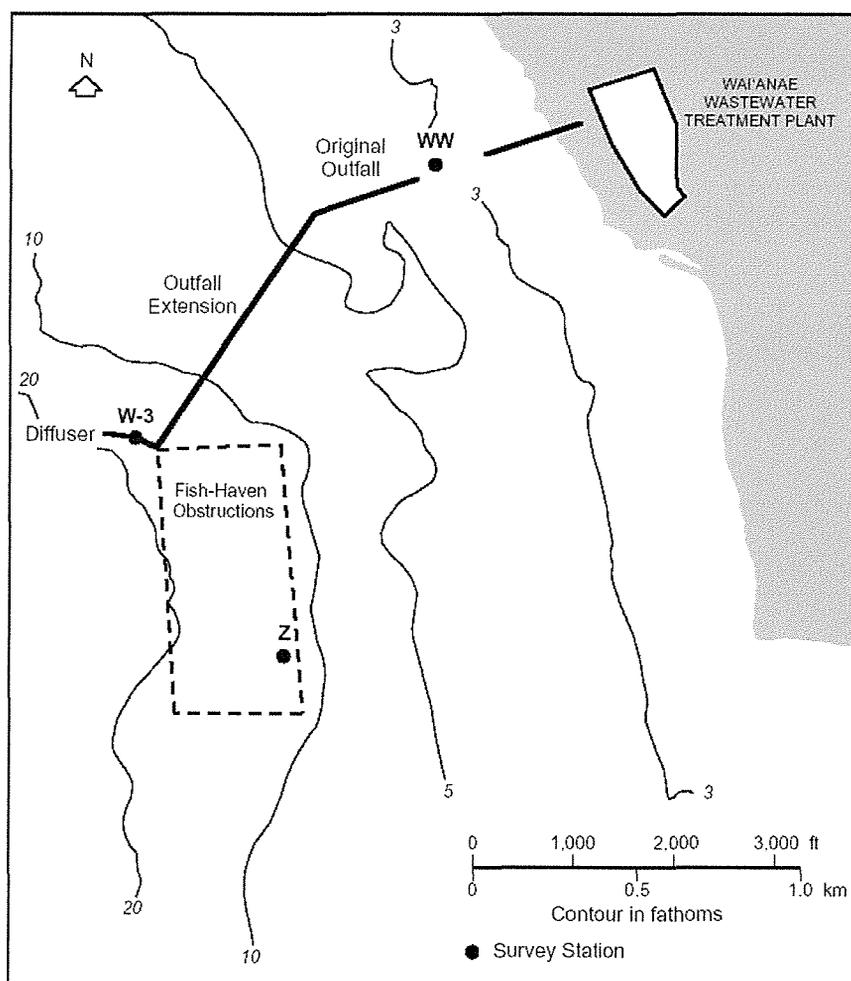
WAIANAЕ SHALLOW WATER

As required by the Waianae Conservation District Use Permit, fishery stocks are censused visually by a diver shoreward of the Waianae Ocean Outfall. Generally, the monitoring program specified for the Sand Island and Honouliuli Permits serves as a model for this outfall's program.

MATERIALS AND METHODS

SAMPLING STATIONS

Specific locations of the three sampling stations are shown in Figure W-3. Stations were originally chosen by the Hawaii Department of Land and Natural Resources (DLNR) for annual monitoring.



Adapted from Russo and Lau (1986)

Figure W-3. Waianae Ocean Outfall shallow marine community monitoring stations

SAMPLING METHODS

Divers equipped with scuba shall perform fish counts along permanent transects at all stations. (Brock 1982). Fishes shall be counted along each of the transects. At Station Z divers shall count fishes along a permanent transect 25 m long and 4 m wide. At Station W-3 fish counts shall be made along a transect located at the terminal 15 m of the diffuser censusing a 6 m wide area. At Station WW fishes shall be counted along two transects 20 m long x 9 m wide.

Fish species composition at all stations shall be compared among years and with past surveys using Cochran's nonparametric Q-test for species presence or absence (Green 1979). The Q value shall be tested against the chi-square critical value for years minus one degree of freedom and $p = 0.05$. Green recommends this test because it precludes meeting the assumptions of homogeneous variances of abundances and distribution normalcy of the data. The test addresses the null hypothesis "no differences in species composition among survey years." A Bray-Curtis similarity index shall also be used to compare similarity among years.

Estimates of coral cover shall be made on selected permanent quadrats using bottom photography and the subsequent projection of photos on a grid. Coral cover among years at

Station Z is located in the fish-haven habitat established by the Hawai'i State Department of Land and Natural Resources (DLNR) 1.0 km southeast of the outfall diffuser at a depth of approximately 16 m. The substratum is flat limestone and rubble with coral growth. Two transect lines (each 25 m long) are spaced 27 m apart and positioned perpendicular to shore. These were permanently placed near artificial reefs, which make up part of the fish-haven habitat, and near a ledge that drops off to 23 m depth.

This station was set up in 2003 roughly 300 m east of the old station W-2, which was on the sunken ship *Mahi*. Because of dangerous shifting and corrosion of the ship it was deemed unsafe to continue diving on the wreck for future coral transect and fish counts. Hawai'i State DLNR gave the CCH permission to set up station Z to replace the former station W-2.

Station Z shall be compared between consecutive years using a paired t-test to determine whether significant differences in total coral cover exist. A two-way ANOVA without replication (quadrat vs. year) shall be used to test for significant differences in coral cover over all the survey years (Sokal and Rohlf 1995).

A census of megainvertebrates shall be conducted at all stations to determine presence/absence of individuals.

There are no spatial controls in this study; the stations selected are all located at different depths and differ in surrounding bottom type. At the chosen stations, relief is provided by artificial structures (i.e., the diffuser and armor rock). Because of the uniqueness of each station, comparisons cannot be made among stations for coral and fish abundance or species richness. Only year-to-year comparisons of survey data can be made.

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FISH HISTOPATHOLOGY STUDIES

SCOPE OF WORK

Fish liver histopathology will be performed on fish caught near the diffusers of the ocean outfalls at Sand Island, Barbers Point, and Wai'anae. The guidelines in the U.S. Environmental Protection Agency's (1987) "Guidance for Conducting Fish Liver Histopathology Studies During 301(h) Monitoring" will be followed to assess potential impacts of permitted discharges on marine biota.

For each monitoring site, fish liver histopathology shall be conducted on ten specimens each of three different fish species provided live to the WRRC researcher by the City and County of Honolulu. Specimens shall be collected near three ocean outfalls and a mutually agreed upon reference site. Ideally, the same species will be collected at all monitoring sites. If one of the same species cannot be obtained from a particular site and another species is collected, the additional species shall also be collected from the reference site. Sampling shall be conducted annually at times mutually agreed upon by the City and WRRC.

City personnel will deliver the live fish to WRRC researcher Dr. Thierry Work for necropsy and histopathology examination. Delivery will be made by early afternoon on the day the fish are captured. Liver tissue for the histopathology examination shall be collected from the fish immediately after they are killed.

The following shall be noted and reported for each fish:

1. Species, date, and location of collection
2. Fork length, total length and total wet-weight of the fish
3. Gross external abnormalities
4. Wet-weight, color and any gross abnormalities of the liver
5. Gross abnormalities of other visceral organs

In addition the investigator shall collect appropriate tissue specimens so that an estimation of the age of the fish can be made and histologically examine representative sections of liver tissue for structural anomalies at the cellular level.

MATERIALS AND METHODS

Davidson's Fixative shall be used as a tissue preservative. Liver tissue shall be blocked and embedded in paraffin and 5 to 6 micron thick sections shall be cut on a microtome. Liver sections shall be routinely stained with hematoxylin and eosin. Alternative methods include gross photography and photomicroscopy; thus photographic documentation of normal tissue and lesions may also be performed.

Liver tissue, blocks, and slides shall be archived.

Statistical tests will be performed using the procedures in the EPA guidance manual. Reports describing the methods, means, and observations and summarizing gross necropsy and histopathology findings shall be submitted to the City at regular intervals.

REFERENCE CITED

U.S. Environmental Protection Agency. 1987. Guidance for conducting fish liver histopathology studies during 301(h) monitoring. EPA 430/09-87-004, Marine Operations Division, Office of Marine and Estuarine Protection, U.S. Environmental Protection Agency, Washington, D.C. 146 pp. + appendix.

STORET DATA SUBMISSIONS

Upon completion of the performance of the taxonomy counts WRRC shall submit fauna data for the Sand Island and Barbers Point Ocean Outfalls in an Excel spreadsheet [translated into text form] which will be downloaded into the CDX website. The data included in the spreadsheet to be sent to CDX will include: 1) Activity Date; 2) Monitoring location ID; 3) Project ID; 4) Activity ID; 5) Taxon name; 6) Number of specimens for each taxa in each replicate; and 7) Result comment. If a new taxon is found for the outfall, this taxon will be documented in the “result comment” field.

APPENDIX A, WORK SCHEDULE

Fiscal Year	Outfall Monitoring Studies
FY2012	Barbers Point 2012, Waianae 2012
FY2013	Sand Island 2012, Barbers Point 2013, Mokapu 2013, and Waianae 2013
FY2014	Sand Island 2013, Barbers Point 2014, and Waianae 2014
FY2015	Sand Island 2014, Barbers Point 2015, and Waianae 2015
FY2016	Sand Island 2015, Barbers Point 2016, and Waianae 2016
FY2017	Sand Island 2016

APPENDIX B, REPORT SUBMISSION SCHEDULE

SAND ISLAND OCEAN OUTFALL

Sand Island Benthic Monitoring

WRRC shall submit the Sand Island benthic reports to the Department of Environmental Services, City and County of Honolulu, within 178 days of receiving from the City all of the samples and results of the laboratory analyses needed to produce the reports.

WRRC shall submit the Sand Island benthic reports to the Department of Environmental Services, City and County of Honolulu, within 178 days of receiving the last sample and laboratory analyses result from the City.

The City shall be allotted 70 calendar days from the date of the last sample collection to provide WRRC with physical and chemical analyses results.

An approximate schedule of tasks follows:

- a. 13 weeks - Sampling, sorting, counting, and identification. Sediment physical and chemical analyses by the City's Water Quality Laboratory to WRRC by 70 calendar days from the last sampling date specified in the Sampling and Report Submission Schedule in Appendix C.
- b. 6 weeks - Statistical analysis and report writing; first draft to WRRC editor
- c. 4 weeks
 - City's review of draft (2 weeks) concurrent with editing and production of report
 - Editing and production of report (4 weeks)
- d. 2 weeks
 - Author review, correction
 - Last minute changes; final report submission

Total: Approximately 25 weeks

Sand Island STORET data submission

WRRC shall upload the results of the Sand Island taxonomy counts in an Excel spreadsheet to the CDX website within 16 weeks of the completed delivery of all samples to WRRC's biomonitoring labs by the City and County of Honolulu. The data included in the spreadsheet to be uploaded to CDX will include: 1) Activity Date; 2) Monitoring location ID; 3) Project ID; 4) Activity ID; 5) Taxon name; 6) number of specimens for each taxa in each replicate; and 7) Result comment. If a new taxon is found for the outfall, this taxon will be documented in the "result comment" field.

BARBERS POINT OCEAN OUTFALL

Barbers Point Benthic Monitoring

WRRC shall submit the Barbers Point benthic reports to the Department of Environmental Services, City and County of Honolulu, within 133 days of receiving the last sample and laboratory analyses result from the City.

The City shall be allotted 70 calendar days from the date of the last sample collection to provide WRRC with physical and chemical analyses results.

An approximate schedule of tasks follows:

- a) 10 weeks - Sampling, sorting, counting, and identification. Sediment physical and chemical analyses by City's Environmental Quality Laboratory to WRRC by 70 calendar days.
- b) 4 weeks - Statistical analysis and report writing; first draft to WRRC editor
- c) 3 weeks
 - City's review of draft (2 weeks) concurrent with editing and production of report
 - Editing and production of reports (3 weeks)
- d) 2 weeks
 - Author review, correction
 - Last minute changes; final report submission

Total: Approximately 19 weeks

Barbers Point STORET

WRRC shall submit the Barbers Point STORET data on an Excel spreadsheet to the City within 14 weeks of the completed delivery of all Barbers Point sediment samples to WRRC by the City and County of Honolulu.

Barbers Point STORET data submission

WRRC shall upload the results of the Barbers Point taxonomy counts in an Excel spreadsheet to the CDX website within 14 weeks of the completed delivery of all Barbers Point samples to WRRC's biomonitoring labs by the City and County of Honolulu. The data included in the spreadsheet to be uploaded to CDX will include: 1) Activity Date; 2) Monitoring location ID; 3) Project ID; 4) Activity ID; 5) Taxon name; 6) Number of specimens for each taxa in each replicate; and 7) Result comment. If a new taxon is found for the outfall, this taxon will be documented in the "result comment" field.

Barbers Point Shallow-Water Environment Monitoring

WRRC shall submit Barbers Point shallow-water reports to the Department of Environmental Services, City and County of Honolulu, within 121 days of the receipt of photographs from the City.

Barbers Point ROV

WRRC shall submit the Barbers Point fish survey using Remotely Operated Vehicle (ROV)

reports to the Department of Environmental Services, City and County of Honolulu, approximately 120 days after receipt of tapes from the City.

MOKAPU OCEAN OUTFALL

Mokapu Benthic Monitoring

WRRC shall submit the Mokapu benthic reports to the Department of Environmental Services, City and County of Honolulu, within 150 days of receiving the last sample and laboratory analyses result from the City.

Mokapu Shallow-Water Environment Monitoring

WRRC shall submit the Mokapu coral reef survey reports to the City within 150 days of receipt of tapes/photographs from the City Oceanographic Team.

In general the City shall be allotted one week to review the draft report. For each day the City exceeds this allotment WRRC shall have an additional day added to the report submission deadlines.

WAIANAЕ OCEAN OUTFALL

Waianae Benthic Monitoring

WRRC shall submit Waianae benthic survey reports to the City within 150 days of receiving the last sample and laboratory analyses result from the City.

Waianae Shallow-Water Environment Monitoring

WRRC shall submit Waianae coral reef survey reports to the City within 150 days of receipt of tapes/photographs.

In general the City shall be allotted one week to review the draft report. For each day the City exceeds this allotment WRRC shall have an additional day added to the report submission deadlines.

FISH HISTOPATHOLOGY

For Waianae a final report on the histopathology of fishes will be submitted within 150 days of delivery of fish specimens to WRRC. Extension of submission deadline may be requested on a case-to-case basis.

For Barbers Point, a final report on the histopathology of fishes will be submitted within 128 days of delivery of fish specimens to WRRC.

For Sand Island, a final report on the histopathology of fishes will be submitted within 166 days of delivery of fish specimens to WRRC.

In general the City shall be allotted one week to review the draft report. For each day the City exceeds this allotment WRRC shall have an additional day added to the report submission deadlines.

APPENDIX C
SUGGESTED SAMPLING AND REPORT SUBMISSION SCHEDULE

	Proposed Last Sampling Date	Final Report Due to City*	Report Due to EPA*	Proposed Last Sampling Date	Final Report Due to City	Report Due to EPA*	Proposed Last Sampling Date	Final Report Due to City	Report Due to EPA*	Proposed Last Sampling Date	Final Report Due to City	Report Due to EPA*	Proposed Last Sampling Date	Final Report Due to City	Report Due to EPA*
Barbers Point			Barbers Point			Barbers Point			Barbers Point			Barbers Point			
Benthos	1/15/12	5/23/12	5/29/12	01/15/13	05/22/13	05/28/13	01/15/14	05/23/14	05/29/14	01/15/15	05/23/15	05/29/15	01/15/16	05/23/16	05/29/16
Coral/fish	1/22/12	5/23/12	5/29/12	01/22/13	05/22/13	05/28/13	01/22/14	05/23/14	05/29/14	01/22/15	05/23/15	05/29/15	01/22/16	05/23/16	05/29/16
Fish video	1/23/12	5/23/12	5/29/12	01/23/13	05/22/13	05/28/13	01/23/14	05/23/14	05/29/14	01/23/15	05/23/15	05/29/15	01/23/16	05/23/16	05/29/16
Histopathology	1/15/12	5/23/12	5/29/12	01/15/13	05/22/13	05/28/13	01/15/14	05/23/14	05/29/14	01/15/15	05/23/15	05/29/15	01/15/16	05/23/16	05/29/16
Waianae			Waianae			Waianae			Waianae			Waianae			
Benthos	08/15/12	01/17/13		05/15/13	10/17/13		05/15/14	10/17/14		05/15/15	10/17/15		05/15/16	10/17/16	
Coral/fish	08/21/12	01/18/13		05/21/13	10/18/13		05/21/14	10/18/14		05/21/15	10/18/15		05/21/16	10/18/16	
Histopathology	08/29/12	01/26/13		05/29/13	10/26/13		05/29/14	10/26/14		05/29/15	10/26/15		05/29/16	10/26/16	
Mokapu			Mokapu			Mokapu			Mokapu			Mokapu			
Benthos				03/11/13	08/08/13										
Coral/fish				03/19/13	08/16/13										
Sand Island			Sand Island			Sand Island			Sand Island			Sand Island			
Benthos	09/18/12	03/14/13	03/30/13	09/18/13	03/15/14	03/31/14	09/18/14	03/15/15	03/31/15	09/18/15	03/15/16	03/31/16	09/18/16	03/15/17	03/31/17
Histopathology	09/30/12	03/14/13	03/30/13	09/30/13	03/15/14	03/31/14	09/30/14	03/15/15	03/31/15	09/30/15	03/15/16	03/31/16	09/30/16	03/15/17	03/31/17
Control Station			Control Station			Control Station			Control Station			Control Station			
Histopathology **	**			**			**			**			**		

Color coding:

FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
1/1/12 – 6/30/12	7/1/12 – 6/30/13	7/1/13 – 6/30/14	7/1/14 – 6/30/15	7/1/15 – 6/30/16	7/1/16 – 6/30/17

*If the date falls on a weekend or holiday, the report will be due on the last working day preceding the weekend or holiday.

**No date specified for control station histopathology sample collection. Report will be due 150 days after delivery of fish samples to histopathologist.

APPENDIX D.

CITY OCEANOGRAPHIC TEAM SAMPLING PROCEDURES AND SAMPLING SITE BACKGROUND INFORMATION.

Sand Island benthic study

Sampling procedures:

Three samples shall be taken at each of the 15 stations . City personnel will collect all samples and measure ORP.

Sediment shall be collected using a 0.16 m² modified van Veen grab sampler or hand-held sediment corers (at shallow-water stations). Penetration depth shall be determined for each sample. A 7.6-cm subsample, to a depth of 5 cm, shall be taken from each grab for analysis of nonmollusks (i.e., all organisms except micromollusks). A 4.8-cm subsample, to a depth of 5 cm, shall be taken from each grab for micromollusk (and occasional larger specimens) analysis. Subsampling is necessary because the epifauna and infauna in the area are known to be both small and abundant (Nelson 1986; Russo et al. 1988). Each replicate subsample for the core monitoring work shall be taken from a separate van Veen sample and shall not be composited for analysis.

Subsamples for geochemical analysis (TOC, ORP, acid volatile sulphate, total Kjeldahl nitrogen, and priority pollutants and other pesticides) and for grain-size distribution shall be obtained from grabs from which the biological subsamples are taken. Each van Veen grab sample will contain more than enough sediment for both purposes.

Barbers Point benthic study

Sampling procedures:

A 0.16-m² modified van Veen grab sampler deployed from a research vessel by the City's Oceanographic Team shall be used to obtain bottom samples at all stations. Penetration depth shall be determined for each sample.

Five replicate van Veen grab samples shall be taken at each station. From each sample, a 7.6 cm diameter by 5 cm deep subsample shall be taken for infaunal analysis and a 4.8 cm diameter by 5 cm deep subsample for micromollusk (and occasional larger mollusk specimens) analysis. Subsampling is necessary because the epifauna and infauna in the area are known to be both small and abundant (Nelson 1986; Russo et al. 1988). Each replicate sample shall be taken from a separate van Veen sample and shall not be composited for analysis. All five biological subsamples shall be processed on a 0.5-mm screen, and the organisms shall be retained and preserved as appropriate for subsequent identification.

Subsamples for geochemical analysis (total organic carbon, oxidation-reduction potential , sediment oil and grease, and priority pollutants and other pesticides) and for grain-size distribution shall be obtained from grabs from which the biological subsamples are taken. Each replicate van Veen grab sample will contain more than enough sediment for both purposes.

Mokapu benthic study

The sampling stations and their locations are as follows:

- Station A Approximately 1 km north of the zone of initial dilution (ZID) boundary
- Station B1 Approximately 33 m north of the diffuser on the ZID boundary
- Station Z In the ZID near the diffuser
- Station B2 Approximately 33 m south of the diffuser pipe on the ZID boundary
- Station C Approximately 1 km south of the ZID boundary as a site to determine near-field effects
- Station D Approximately 3.2 km south of the ZID boundary as a reference station beyond the influence of the outfall

Stations at or near the outfall diffuser may also be established for monitoring of impacts to the marine environment.

Station positions shall be determined using a global positioning system or other means that allow accurate reoccupation of stations. Station positions in relation to latitude, longitude, and bathymetric contours are shown in Figure M- 1.

Mokapu Benthic Monitoring Station Background Information:

The net current direction is to the north (Hans-Jurgen Krock, personal communication). Stations cannot be located farther north because of the depth gradient, nor farther west because of exposure to Mokapu Point.

The bottom at the 34-m diffuser isobath consists of a mosaic of limestone rock interspersed with pockets of sand and, in some areas, coral rubble. In the general area from Mokapu Point to Mokolea Rock (Figure M-1) the bottom is mostly limestone platform and the sediment, which is sparse and consists mainly of carbonate sands.

Specifically, the substratum north of the diffuser (Station A) is scoured by tidal currents that run generally northward or southward, depending on the tidal cycle between Moku Manu Island and Mokapu Point. Wave reflection and refraction in this area are quite pronounced. Farther south, wave deflection off the island of O'ahu contributes to rough seas and bottom scour near Stations B I and B2, especially at depths less than 40 m. At Stations C and D, current and wave energy are less than those near Mokapu Point and the bottom scour is relatively less than that at stations farther north. Corals can persist in depths less than 25 m near these stations. At the diffuser isobath at Stations C and D, the sediments, although sparse, are carbonate sands.

Sampling procedures:

High sea conditions are typical of this coastal area off O'ahu. Because movement of the research platform makes it difficult to deploy the van Veen grab sampler, scuba divers shall collect sediments by hand at each station. Five replicate samples of approximately 227 cm³ shall be collected at each station using a corer 7.6 cm in diameter by 5 cm deep. From each sample, a subsample shall be taken for infaunal analysis and a 4.8 cm diameter by 5 cm deep subsample for micromollusk (and occasional larger mollusk specimens) analysis. Subsampling is necessary because the epifauna and infauna in the nearshore region of Hawaii are known to be both small and abundant (Nelson 1986). Three additional cores at each station will be taken for sediment physical and chemical analyses. A predetermined swimming pattern will be used for sediment collection.

Oxidation-reduction potential will be measured using an Orion model 231 ORP meter (or equivalent). Readings will be taken on board the research vessel before the cores are processed and taken to the laboratory for further sediment analysis. Laboratory sediment analyses will follow U.S. EPA procedures.

Waianae Benthic Study

Sampling procedures:

The sampling methodology to be used for this study will generally follow U.S. Environmental Protection Agency guidelines (U.S. EPA 1981, 1987a, 1987b), hereafter referred to as EPA procedures. Some procedures will differ because of the particular nature of the Wai'anae substratum and sediments.

Using a bottom grab sampler may not be feasible since there is a fair amount of coral rubble in the area which might cause the grab sampler to be damaged or prevented from closing. Therefore, scuba divers shall descend to the diffuser depth and sample by hand using corers. Six replicate samples of approximately 227 cm³ shall be collected at each station using a corer 7.6 cm in diameter by 5 cm deep. From each sample, a subsample shall be taken for infaunal analysis and a 4.8 cm diameter by 5 cm deep subsample for micromollusk (and occasional larger mollusk specimens) analysis. Subsampling is necessary because the epifauna and infauna in the nearshore region of Hawaii are known to be both small and abundant (Nelson 1986). Three additional cores' will be taken at each station for sediment physical and chemical analyses. A predetermined swimming pattern will be used for sediment collection.

Oxidation-reduction potential will be measured using an Orion ORP meter (model 231). Readings will be taken on board the research vessel before the cores are processed and taken to the laboratory for further sediment analysis. Laboratory sediment analyses will follow U.S. EPA procedures.

Barbers Point shallow water study:

Procedures:

The same transects at each station shall be monitored yearly during the same month to determine any temporal changes in fish diversity, abundance, and species composition. Prior to sampling the exact locations of the stations shall be determined using a global positioning system or other means that allow accurate reoccupation of stations. To monitor coral growth and cover, photographs shall be taken of at least 0.67 m² of bottom area every 5 m along the permanent transects. Photographs shall be taken using an underwater camera mounted on a rigid framing device which maintains a constant focal distance above the bottom along the transect line. One corner of each frame shall be marked with a stake and labeled with the quadrat number. Instead of developing the photographs as slides and projecting them onto a screen grid to estimate percentage of coral cover, as recommended by U.S. EPA (1982), large prints (4 inches 6 inches) shall be made. Coral cover (percent) shall be estimated by tracing areas of live coral in the prints using an electronic digital planimeter and comparing these areas with the total photographed bottom area. The photographs shall be taken by a member of the City and County of Honolulu Oceanographic Team. The analysis will be performed by Dr. Richard E. Brock.

Monitoring Station Background Information:

Biomonitoring shall be conducted at sites with a depth of approximately 10 m (~5 fathoms). This depth was chosen because corals are well developed at this isobath and are representative of coral communities found off the south shore of Oahu (Russo 1981). Four previously established

sampling stations, chosen for the presence of patches of extensive extant coral growth, shall be monitored: Station BP-1, a reference station located 2.2 km east and inshore of the outfall terminus; Station BP-2, an experimental station located about 1.6 km slightly east and inshore of the terminus; Station BP-3, an experimental station located about 2.9 km west and inshore of the terminus; and Station BP-4, an experimental station located on the outfall pipeline about 1.4 km inshore of the outfall terminus (Figure B-2). Current movement in the area is dominated by fluctuating (east, west) tidal shifts and complicated by larger eddy processes (Hans-Jurgen Krock, personal communication). The reference station (BP-1) location was chosen east of the diffuser since prevalent annual average water movement appears to be to the west.

Mokapu shallow water study:

Monitoring Station Background Information:

Inshore assessment of the coral and fish communities, as well as sampling of the benthic communities located near and far field from the outfall terminus, shall be conducted for the Mokapu Ocean Outfall in 2003 only. The monitoring program developed for the shallow water environment at the Barbers Point or Waianae Ocean Outfall shall serve as a model for the program at Mo kapu.

Previous studies showed that extensive coral communities exist at depths between 8 and 15 m in the nearshore environment in the vicinity of the Mokapu Ocean Outfall (Russo et al. 1977, 1979). Coral communities in Hawaii are usually coralline algae dominated with, on the average, less than 10% live coral cover and represented by four to six dominant genera (Russo et al. 1979). Large patches of coral exist, usually interspersed with sand, boulders, or rubble on limestone basement rock.

All biomonitoring sites shall be located at depths of approximately 9 to 12 m. Three stations (Figure M-2) will be monitored at or near locations surveyed in previous studies. The stations and their locations, along with a brief description of the respective area, are as follows:

Station A40 Approximately 0.5 km north of the outfall diffuser at a depth of about 12 m. Basaltic pavement and boulders are predominant, and numerous large *Pocillopora meandrina* colonies, both live and dead, are present.

Station B30 Approximately 0.5 km south of the outfall pipe at a depth of 9 m. This area is covered with boulders and small colonies of *P. meandrina*. *Porites lobata* colonies are also present.

Station C40 Approximately 2 km south of the outfall diffuser at a depth of 12 m. This area has a limestone pavement and fairly well-developed reef structure. Extensive lobate coral colonies and hemispherical *P. meandrina* colonies are present.

Tidal currents predominate, and the average water movement is southward in the Mo kapu area.

Procedures:

In order to monitor coral cover and growth the City's oceanographic team shall take photographs of the ocean floor at the Mokapu transects annually using the procedures outlined in appendix D. Four by six inch prints of the photographs will be delivered to WRRC team member Dr. Richard E. Brock who will perform the analysis.

Waianae shallow water study:

Monitoring Station Background Information:

Station Z is located in the fish-haven habitat established by the Hawai'i State Department of Land and Natural Resources (DLNR) 1.0 km southeast of the outfall diffuser at a depth of approximately 16 m. The substratum is flat limestone and rubble with coral growth. Two transect lines (each 25 m long) are spaced 27 m apart and positioned perpendicular to shore. These were permanently placed near artificial reefs, which make up part of the fish-haven habitat, and near a ledge that drops off to 23 m depth

Station W-3 At the terminal 30 m of the diffuser at a depth of 30 m. The 1.5-m-diameter pipe is buried in the sediment and covered with tremie concrete. Discharge is through risers projecting vertically from the pipe. Surrounding sediments consist of coarse carbonate sands.

Station WW About 1 km offshore on the effluent pipeline at a depth of approximately 8 m. The outfall pipe is covered with tremie concrete and surrounded by large armor rock boulders. Two transects: one 20 m west of the pipeline (Transect Alpha) and the other on the pipeline (Transect Beta) have been set up at this station. Transect Alpha lies on flat limestone substratum and Transect Beta on the armor rock covering the pipeline. Both transects are approximately 20 m long and run perpendicular to shore. With authorization from DLNR, Station WW became a permanent station in 1994.

Fish histopathology studies – Sand Island, Barbers Point, and Waianae outfalls and control stations

The City and County of Honolulu oceanographic team will provide ten specimens each of three different fish species live to the WRRC researcher. Specimens shall be collected near four ocean outfalls and a mutually agreed upon reference site. Ideally, the same species will be collected at all monitoring sites. If one of the same species cannot be obtained from a particular site and another species is collected, the additional species shall also be collected from the reference site. Sampling shall be conducted annually at times mutually agreed upon by the City and WRRC.

City personnel will deliver the live fish to WRRC researcher Dr. Thierry Work for necropsy and histopathology examination. Delivery will be made by early afternoon on the day the fish are captured.

Appendix E: Budget 2012-2016 Outfall Biomonitoring Program

Appendix E: Budget 2012-2016 Outfall Biomonitoring Program												
	APT fringe rate= 40.25%		GA fringe rate= 11.09%									
	Faculty overload fringe rate= 2.17%		RCUH fringe rate= 9.37%									
	student fringe rate= 0.52%											
	Reg. Employ ann. increase= 2.00%											
	1/1/12-6/30/12		7/1/12-6/30/13		7/1/13-6/30/14		7/1/14-6/30/15		7/1/15-6/30/16		7/1/16-12/31/16	
REGULAR EMPLOYEES built in annual increase	FY 2012 salary (1/2 annual)	FY 2012 fringe	FY 2013 salary	FY 2013 fringe	FY 2014 salary	FY 2014 fringe	FY 2015 salary	FY 2015 fringe	FY 2016 salary	FY 2016 fringe	FY2017 salary	FY2017 fringe
APTs												
APT PBA03 full time	\$19,080	\$7,680	38,160	\$15,359	\$38,923	\$15,667	\$39,702	\$15,980	\$40,496	\$16,300	\$20,653	\$8,313
APT full time	\$19,080	\$7,680	38,160	\$15,359	\$38,923	\$15,667	\$39,702	\$15,980	\$40,496	\$16,300	\$20,653	\$8,313
APT full time	\$21,114	\$8,498	42,228	\$16,997	\$43,073	\$17,337	\$43,934	\$17,683	\$44,813	\$18,037	\$22,854	\$9,199
APT half time	\$12,522	\$5,040	25,044	\$10,080	\$25,545	\$10,282	\$26,056	\$10,487	\$26,577	\$10,697	\$13,554	\$5,456
GAs												
GA MS 20 hrs	\$9,748	\$970	18,198	\$2,018	\$19,924	\$2,099	\$19,680	\$2,183	\$20,466	\$2,270	\$10,233	\$1,135
GA PhD 20 hours	\$9,462	\$1,049	19,680	\$2,183	\$20,466	\$2,270	\$20,466	\$2,270	\$20,466	\$2,270	\$10,233	\$1,135
GA MS 20 hours	\$9,462	\$1,049	19,680	\$2,183	\$20,466	\$2,270	\$20,466	\$2,270	\$20,466	\$2,270	\$10,644	\$1,180
GA PhD 20 hours	\$10,233	\$1,135	21,288	\$2,361	\$21,288	\$2,361	\$21,288	\$2,361	\$21,288	\$2,361	\$10,644	\$1,180
Total Regular Employee salaries/fringes (rows 8-16)	\$109,701	\$33,102	\$222,438	\$66,540	\$227,608	\$67,951	\$231,293	\$69,213	\$234,273	\$70,184	\$119,063	\$35,748
reg. salaries plus fringes	\$142,803		\$288,978		\$295,558		\$300,507		\$304,457		\$154,811	
OVERLOAD - Increase 3% annually from 2013												
Faculty												
polychaete 3 months	\$18,859	\$409	\$38,849	\$843	\$40,014	\$868	\$41,214	\$894	\$42,451	\$921	\$21,862	\$474
mollusk 1 month	\$4,016	\$87	\$8,272	\$180	\$8,520	\$185	\$8,776	\$190	\$9,039	\$196	\$4,655	\$101
coordinator 1 month	\$2,809	\$61	\$5,787	\$126	\$5,960	\$129	\$6,139	\$133	\$6,323	\$137	\$3,256	\$71
PI 1 month	\$6,791	\$147	\$13,988	\$304	\$14,408	\$313	\$14,840	\$322	\$15,286	\$332	\$7,872	\$171
Total Faculty Overload/fringes (rows 21-24)	\$32,474	\$705	\$66,895	\$1,452	\$68,902	\$1,495	\$70,969	\$1,540	\$73,098	\$1,586	\$37,646	\$817
overloads plus fringes	\$33,178		\$68,347		\$70,397		\$72,509		\$74,685		\$38,463	
STUDENTS - annual 1 step increase												
(A33 - \$10.8) 52 wks 20hr/wk	\$5,616	\$29	\$11,648	\$61	\$11,908	\$61.92	\$12,324	\$64.08	\$12,792	\$66.52	\$6,396	\$33.26
(A33 - \$10.8) 52 wks 20hr/wk	\$5,616	\$29	\$11,648	\$61	\$11,908	\$61.92	\$12,324	\$64.08	\$12,792	\$66.52	\$6,396	\$33.26
(A33 - \$10.8) 52 wks 20hr/wk	\$5,616	\$29	\$11,648	\$61	\$11,908	\$61.92	\$12,324	\$64.08	\$12,792	\$66.52	\$6,396	\$33.26
Pub/Admin. asst. (A31 - \$10) 52 wks 20hr/wk	\$5,200	\$27	\$10,816	\$56	\$11,232	\$58.41	\$11,648	\$60.57	\$11,908	\$61.92	\$5,954	\$30.96
Total Undergrad Student Salaries/fringes (rows 29-32)	\$22,048	\$115	\$45,760	\$238	\$46,956	\$244	\$48,620	\$253	\$50,284	\$261	\$25,142	\$131
undergrad salaries plus fringes	\$22,163		\$45,998		\$47,200		\$48,873		\$50,545		\$25,273	
CONSULTANTS 2% annual increases												
crustacea annually	\$8,768		\$17,886		\$18,243		\$18,608		\$18,980		\$9,680	
SI/BP report writer annually	\$11,971		\$24,420		\$24,908		\$25,406		\$25,915		\$13,216	
coral/fish annually	\$13,317		\$27,167		\$27,710		\$28,264		\$28,829		\$14,703	
			\$8,878									
fish histo annually	\$6,711		\$13,690		\$20,400		\$20,808		\$21,224		\$10,824	
			\$4,200									
Wal shallow annually	\$9,725		\$19,838		\$20,235		\$20,639		\$21,052		\$10,737	
Total Consultants contracts (rows 36-40)	\$50,491		\$116,078		\$111,496		\$113,726		\$116,001		\$59,160	
UNIVERSITY NON-SALARY COSTS												
travel	\$2,000		\$4,000		\$4,000		\$4,000		\$4,500		\$2,250	
lab supplies	\$3,500		\$5,500		\$5,500		\$5,500		\$5,500		\$3,000	
publications supplies	\$2,000		\$7,000		\$4,000		\$4,000		\$4,000		\$4,000	
total university non-salary costs (rows 44-46)	\$7,500		\$16,500		\$13,500		\$13,500		\$14,000		\$9,250	
Annual totals (sum rows 18, 27, 34, 41, and 47)	\$256,134		\$535,901		\$538,152		\$549,115		\$559,688		\$286,957	
University Overhead, 10% until 6/30/13 cap 36.7% thereafter	\$25,613		\$53,590		\$197,502		\$201,525		\$205,405		\$105,313	
rate used to calculate overhead	10%		10%		36.70%		36.70%		36.70%		36.70%	
Grand Annual Totals	\$281,747		\$589,491		\$735,654		\$750,640		\$765,093		\$392,270	

CITY COUNCIL
CITY AND COUNTY OF HONOLULU
HONOLULU, HAWAII
C E R T I F I C A T E

RESOLUTION 12-144, CD1

Introduced: 06/15/12 By: ERNEST MARTIN (BR)

Committee: PUBLIC WORKS AND
SUSTAINABILITY

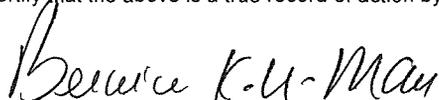
Title: RESOLUTION RELATING TO AN AGREEMENT BETWEEN THE CITY AND COUNTY OF HONOLULU AND THE UNIVERSITY OF HAWAII WATER RESOURCES RESEARCH CENTER TO CONDUCT AN ASSESSMENT OF THE IMPACT OF OCEAN SEWER OUTFALLS ON THE MARINE ENVIRONMENT OFF OAHU, HAWAII.

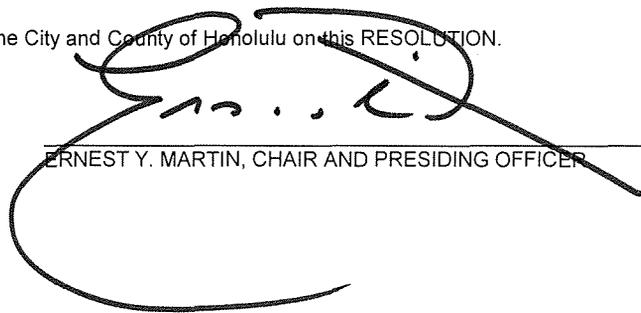
Links: [RES12-144](#)
[RES12-144, CD1](#)
[CR-209](#)

Voting Legend: Y= Aye, Y* = Aye w/Reservations, N = No, A = Absent, ABN = Abstain

PUBLIC WORKS AND SUSTAINABILITY	06/25/12	CR-209 – RESOLUTION REPORTED OUT OF COMMITTEE FOR ADOPTION AS AMENDED IN <u>CD1</u> FORM.							
COUNCIL	07/11/12	CR-209 AND RESOLUTION 12-144, CD1 WERE ADOPTED.							
ANDERSON	Y	BERG	Y	CACHOLA	Y	CHANG	Y	GABBARD	Y
GARCIA	Y	HARIMOTO	A	KOBAYASHI	Y	MARTIN	Y		

I hereby certify that the above is a true record of action by the Council of the City and County of Honolulu on this RESOLUTION.


BERNICE K. N. MAU, CITY CLERK


ERNEST Y. MARTIN, CHAIR AND PRESIDING OFFICER