United States Environmental Protection Agency
Region 2
Clean Water Division
290 Broadway
New York, New York 10007

FACT SHEET

DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
Palo Seco Power Station
PERMIT No. PR0001031

This Fact Sheet sets forth the principle facts and technical rationale that serve as the legal basis for the requirements of the accompanying draft permit. The draft permit has been prepared in accordance with Clean Water Act (CWA) section 402 and its implementing regulations at Title 40 of the *Code of Federal Regulations* (CFR), Parts 122 through 124, and the interim Water Quality Certificate (WQC) issued by the Puerto Rico Environmental Quality Board (EQB) pursuant to CWA section 401 requirements.

Pursuant to 40 CFR 124.53, the Commonwealth of Puerto Rico must either grant a certification pursuant to CWA section 401 or waive this certification before the U.S. Environmental Protection Agency (EPA) may issue a final permit. On March 19, 2014 EQB provided in the interim WQC that the permitted discharge will not cause violations to the applicable water quality standards at the receiving water if the limitations and monitoring requirements in the WQC are met. In accordance with CWA section 401, the EPA has incorporated the conditions of the interim WQC into the draft permit. Any changes to the interim WQC will be incorporated into the final issuance of the permit. The WQC conditions are discussed in this Fact Sheet and are no less stringent than allowed by federal requirements. Additional requirements might apply to comply with other sections of the CWA. Review and appeals of limitations and conditions attributable to the WQC shall be made through the applicable procedures of the Commonwealth of Puerto Rico and not through EPA procedures.

PART I. BACKGROUND

A. Permittee and Facility Description

The Puerto Rico Electric Power Authority (referred to throughout as the Permittee) has applied for renewal of its National Pollutant Discharge Elimination System (NPDES) permit. The Permittee is discharging pursuant to NPDES Permit No. PR0001031. The Permittee submitted Application Forms 1, 2C, and 2F dated August 30, 1996 and applied for an NPDES permit to discharge treated wastewater from the PREPA Palo Seco Power Plant in Levittown, Puerto Rico, referred herein as the facility. The facility is classified as a major discharger by EPA in accordance with the EPA rating criteria.

The Permittee owns and operates this oil powered steam electric generating station. Attachment A of this Fact Sheet provides a map of the area around the facility and a flow schematic of the facility.

<u>Facility Description</u>

The Palo Seco Power Plant complex consists of four oil fired steam units and six oil fired gas turbine units; Unit 1 was placed in operation in 1960, Unit 2 in 1961 and Units 3 and 4 in 1970. Units 1 and 2 have a capacity of 85 MW each; Units 3 and 4 have a capacity of 216 MW each. Six gas turbines having a combined capacity of 132 MW were put in operation between 1973 and 1975. The total combined capacity of the plant is 724 MW. The expected lifetime of the plant is 45 years.

Palo Seco Power Plant has three outfalls covered by NPDES Permit No. PR0001031: 001A, 001C, and 002. Outfalls 001A and 001C discharge to the old Bayamon river bed; Outfall 002 discharges directly to Boca Vieja Bay. Outfall 001A discharges the cooling waters with other miscellaneous sources adding more volume. Outfall 001B discharges minor equipment drainages. Outfall 001C discharges wastewater treatment plant effluent. Outfalls 002 and 003 handle stormwater runoff. Outfall 001A is composed primarily of once-through cooling water from the Boca Vieja Bay. The maximum flow rate is 652.6 MGD. Of this amount, 650 MGD is cooling water. The remaining 2.6 MGD is primarily sea water used to wash screens and the impact on the Outfall 001A discharge is negligible. No chemicals are added in the wash operation.

The seawater that passes through the condensers for non-contact cooling is directly discharged through Outfall 001A into the old Bayamon River bed/discharge canal. The cooling water enters the old Bayamon River bed/discharge canal through three parallel discharge tunnels. At the end of the tunnels, discharge waters flow into a concrete discharge channel to the old Bayamon River bed, which flows to San Juan Bay. As mentioned above, the EPA has made a “waters of the United States” decision which finds that the waters of the U.S. begin at the point when the cooling water enters from the concrete channel to the old Bayamon Riverbed/discharge canal. The water depth at this point is typically 3.5 ft. At the maximum cooling water flow rate, the discharge flow rate in Outfall 001A is 652.6 MGD. Of this amount, 650 MGD is condenser cooling water. The remaining 2.6 MGD is primarily screen wash water and blowdown, with other miscellaneous sources adding minor volume. The August 1996 permit application indicates a range of monthly average flow from 364 to 645 MGD, and a long term average flow rate of 531.2 MGD from April 1995 to August 1996.

Summary of Permittee and Facility Information

Permittee	Puerto Rico Electric Power Authority – Palo Seco Power Plant
Facility contact, title, phone	Rafael Marrero Carrasquillo, Environmental Protection and Quality Assurance Division Head, (787) 521-4960
Permittee (mailing) address	GPO Box 364267
Facility (location) address	PR-165 KM. 3.8, Levittown, Puerto Rico 00949
Type of facility	Steam Electric Power Generating Station, SIC Code 4911
Pretreatment program	N/A
Facility monthly average flow	362 – 645 MGD
Facility design flow	652.6 MGD
Facility classification	Major

B. Discharge Points and Receiving Water Information

The permit authorizes the discharge from the following discharge point(s):

Outfall	Effluent description	Outfall latitude	Outfall longitude	Receiving water name and classification
001A	Once-Through Cooling Water, Hydrostatic Test Water, Building Equipment Drains, Screen Wash Water, Storm Water, Wastewater Treatment Plant Effluent	18°, 27′, 25″ N	66°, 9′, 45″ N	San Juan Bay via Old Bayamon River Bed, SC
001C		18°, 27′, 26″ N	66°, 9′, 45″ N	San Juan Bay via Old Bayamon River Bed, SC
002	Storm Water	18°, 27′, 30″ N	66°, 9′, 45″ N	Boca Vieja Bay, SC

As indicated in the Puerto Rico Water Quality Standards (PRWQS) Regulations, the designated uses for Class **SC** receiving waters include:

1. Primary and secondary contact recreation; and
2. Propagation and preservation of desirable species, including threatened and endangered species.

CWA section 303(d) requires the Commonwealth of Puerto Rico to develop a list of impaired waters, establish priority rankings for waters on the list, and develop TMDLs for those waters. The receiving water **has not** been determined to have water quality impairments for one or more of the designated uses as determined by section 303(d) of the CWA.

Source and Receiving Water

Boca Vieja Bay

The bay is 2.5 miles by 1.5 miles extending from the mouth and covers an area of approximately 3.8 square miles. The depths range from a few feet to about 30 feet. The total water volume is about 120,000 million gallons (based on an estimated average depth of 15 feet and an area of 3.8 square miles).

Old Bayamon River Bed/Discharge Canal

The Old Bayamon River bed is an abandoned river bed presently serving as a discharge canal for transporting power plant discharge waters from the outfall location to San Juan Bay, a distance of approximately 0.75 miles. The cooling water enters the old Bayamon River bed/discharge canal through three parallel discharge tunnels. At the end of the tunnels, discharge waters flows into a concrete discharge channel to the old Bayamon River bed, which flows to San Juan Bay. The Bayamon River was channelized and diverted by the Army Corps of Engineer over twenty years ago. The discharge canal remains earthen and still possesses the natural, irregular contours formed by the river. Canal widths vary from 20 feet at the plant discharge point to a maximum of 150 feet. Measured depths in the canal range from 3 to 7 feet. Tidal elevations vary approximately by approximately 2 feet.

The EPA made a “waters of the United States” decision in 1996 which found the discharge canal formed by the abandoned river bed of the Bayamon River to be U.S. water. The discharge point under the NPDES permit would be at the discharge structure emanating from the plant, and not at the confluence of the discharge canal and San Juan Bay.

San Juan Bay

San Juan Bay is classified as "SC" (coastal waters intended for uses where the human body may come in indirect contact with the water (e.g. fishing and boating) and for use in propagation and preservation of desirable species) by the Puerto Rico Environmental Quality Board (EQB). The mouth of San Juan Bay is 0.5 miles across and up to 40 feet deep. The bay extends 3 miles landward from the mouth and covers 5.8 square miles. The depth ranges from a few feet to 20 feet and up to 40 feet within the dredged channels. The mean tide range is 1.6 feet. The average total volume of water entering San Juan Bay is estimated to be 1,200 million gallons.

Water quality in San Juan Bay has degraded due to point and nonpoint sources. Point sources are primarily industrial wastewater discharges. Nonpoint sources include soil contamination from chemical spills, urban runoff, and contamination associated with dredging. High turbidity and bacterial contamination are the two most serious water quality problems. Fecal coliform counts continue to exceed water quality standards especially in canals and rivers surrounding the bay (numerous non-sewered residences are located in the area). Sediments of San Juan Bay contain heavy metals, pesticides, and petroleum constituents. The water quality of the outer bay where the thermal plume enters San Juan Bay is expected to be better than that of the waters of the inner bay, because of extensive mixing and dilution. The San Juan Bay estuarine system is part of the National Estuary Program. The area surrounding San Juan Bay contains a variety of wildlife habitats.

C. Mixing Zone/Dilution Allowance

A mixing zone or dilution allowance has not been authorized for this discharge.

D. Compliance Orders/Consent Decrees

The Permittee has completed the NPDES permit related actions required by the 1999 Consent Decree. There are no ongoing NPDES enforcement actions at this facility.

E. Summary of Basis for Effluent Limitations and Permit Conditions - General

The effluent limitations and permit conditions in the permit have been developed to ensure compliance with the following, as applicable:

1. Clean Water Act section 401 Certification
2. NPDES Regulations (40 CFR Part 122)
3. PRWQS (March 2010)
4. Effluent Limitation Guidelines for the Steam Electric Power Generating Sector
5. Technology-based limits are included based upon 40 CFR §122.45(h),
6. Effluent Limitation Guidelines (ELG) for the Steam Electric Generating Point Source Category at 40 CFR §423.12, and §423.13
7. EPA Region II Revised Guidance for Cooling Water and Storm Water Runoff dated September 5, 1991.
8. Clean Water Act §316(b) Existing Facilities Final Rulemaking signed May 19, 2014, and implementing regulations at 40 CFR §125.94.

PART II. RATIONALE FOR EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

CWA section 301(b) and 40 CFR 122.44(d) require that permits include limitations more stringent than applicable technology-based requirements where necessary to achieve applicable water quality standards. In addition, 40 CFR 122.44(d)(1)(i) requires that permits include effluent limitations for all pollutants that are or may be discharged at levels that cause, have the reasonable potential to cause, or contribute to an exceedance of a water quality criterion, including a narrative criterion. The process for determining reasonable potential and calculating water quality-based effluent limits (WQBELs) is intended to protect the designated uses of the receiving water, and achieve applicable water quality criteria. Where reasonable potential has been established for a pollutant, but there is no numeric criterion for the pollutant, WQBELs must be established using (1) EPA criteria guidance under CWA section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information, as provided in 40 CFR 122.44(d)(1)(vi).

The effluent limitations and permit conditions in the permit have been developed to ensure compliance with all federal and state regulations, including PRWQS. The basis for each limitation or condition is discussed below.

A. Effluent Limitations

The permit establishes both Technology-based Effluent Limitations (TBELs) and WQBELs for several pollutants and the basis for these limitations are discussed below**.**

1. **Flow:** An effluent limitation for flow has been established in the permit. Monitoring conditions are applied pursuant to 40 CFR 122.21(j)(4)(ii) and the WQC.

2. **Whole Effluent Toxicity (WET):** CWA section 101(a) establishes a national policy of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. Specifically, CWA section 101(a)(3) and PRWQS Rule 1303(I) prohibit the discharge of toxic pollutants in toxic amounts. Federal regulations at 40 CFR 122.44(d) also require that where the permitting authority determines, through the analysis of site-specific WET data, that a discharge causes, shows a reasonable potential to cause, or contributes to an excursion above a water quality standard, including a narrative water quality criterion, the permitting authority must establish effluent limits for WET. To satisfy the requirements of the CWA, its implementing regulations, and the PRWQS, a reasonable potential analysis for WET was conducted for this discharge.

PRWQS do not provide a numeric criterion for toxicity. Therefore, consistent with the recommendations of section 2.3.3 of EPA's *Technical Support Document* (TSD) *for Water Quality-Based Toxics Control* (EPA-505-2-90-001), values of 0.3 acute toxic unit (TU_a) and 1.0 chronic toxic unit (TU_c) were used to interpret the narrative water quality criteria for WET established in PRWQS Rule 1303(I). In addition, the permit establishes a requirement for the Permittee to conduct accelerated testing and develop a Toxicity Reduction Evaluation (TRE) Workplan as Special Conditions. These requirements are necessary to ensure that the Permittee has a process for addressing effluent toxicity if toxicity is observed.

3. **Free Available Chlorine, Total Residual Chlorine, Copper, Chromium, Iron, Zinc, Polychlorinated Biphenyls (PCBs), Total Suspended Solids, and monitoring requirements for 126 Priority Pollutants** are based on Steam Electric Power Generating Point Source Category cooling tower blowdown waste sources effluent guideline, representing the degree of effluent reduction attainable by the application of BAT (40 CFR 423.13(d)(1)). This guideline also includes a requirement that no detectable amount of the 126 Priority Pollutants be discharged, and a prohibition on the discharge of PCBs.

4. **Toxic Metals, Organic Compounds, Sulfide and Cyanide:** In accordance with 40 CFR 122.44(d), a WQBEL must be established if the discharge of a pollutant demonstrates that it is or might be discharged at a level that will cause, have the reasonable potential to cause, or contributes to an excursion above any state water quality standard. The need for WQBELs is based on the procedures specified in section 5 of EPA's TSD and by comparing effluent data and water quality criteria established in PRWQS Rule 1303 and the National Toxics Rule at 40 CFR 131.36(d)(4).

5. **Temperature**

On April 15, 1997, the permittee requested relief from the EQB from the applicable provisions of Article 3 (now Rule 1303) of the Puerto Rico Water Quality Standards Regulation (PRWQSR), which are the numeric water quality standards. This request was based on Article 4 of the PRWQSR, which applies to Intermittent Streams (now Rule 1304). The permittee submitted this request anticipating that such a determination would have granted relief from the applicable water quality standards, due to the intermittent nature of the receiving water. Pursuant to the PRWQSR, this would have had the effect of application of water quality standards for San Juan Bay at the point of discharge in the discharge canal.

The EPA wrote to PREPA on February 24, 2010 requesting that PREPA update the data provided in the Intermittent Streams application, in order to facilitate EQB action on this request. PREPA provided the requested information in a letter dated April 22, 2010.

In letter dated August 31, 2012, PREPA withdrew its request under the Intermittent Stream mechanism and requested, pursuant to Rule 1306.11 of the PRWQSR, as amended, an alternate mechanism for Temperature at discharge 001A and water quality standards at the end of the pipe as effluent limitations for the other parameters. To support their request PREPA submitted a copy of the 1997 §316(a) Demonstration for Palo Seco Power Plant (November 1997), and a 2005 Biological Evaluation Study. This request was accompanied by statistical calculations provided by the permittee, requesting an alternative limitation of 104.7°F, with the following permit language:

> The discharge temperature shall not exceed 104.7°F (40.4°C) at the 001A monitoring location. Further, the annual upper 99th percentile temperature (as measured daily at this location) shall not exceed 99°F (33.5 °C). To comply with this limit, the temperature cannot exceed 99 °F (33.5 °C) on more than 4 days a year.

After evaluating the discharge monitoring data from 2009-2013 for temperature, and considering the provisions of the PRWQSR, EQB proposed this limit in the March 19, 2014 Interim WQC, which establishes limitations the Commonwealth believes are necessary to meet water quality standards.

6. **Chemical Oxygen Demand, Total Suspended Solids, and Oil and Grease** are based on *EPA Region II Revised Guidance for Cooling Water and Storm Water Runoff (September 5, 1991),* which established effluent limitations based on best professional judgement (BPJ) for discharges of storm water and non-

contact cooling water from industrial facilities in Puerto Rico. These limitations were also included in the previous permit. Where there is a WQBEL or effluent limitation guideline for any of the above parameters, the most stringent limitation is included in this permit.

B. Effluent Limitations Summary Table

Effluent Limitation Summary Tables along with the basis for effluent limitations are provided as an Attachment B to this fact sheet.

C. Monitoring Requirements

NPDES regulations at 40 CFR 122.48 require that all permits specify requirements for recording and reporting monitoring results. The Part III of the Permit establishes monitoring and reporting requirements to implement federal and state requirements. The following provides the rationale for the monitoring and reporting requirements for this facility.

1. **Influent Monitoring Requirements**

   This facility is not subject to influent monitoring requirements.

2. **Effluent Monitoring Requirements**

   Effluent monitoring frequency and sample type have been established in accordance with the requirements of 40 CFR 122.44(i) and recommendations in EPA's TSD. Internal monitoring requirements are pursuant to the Steam Electric Power Generating Point Source Category representing the degree of effluent reduction attainable by the application of BAT (40 CFR 423.13, which are most appropriately measured for compliance at the point of the internal waste stream.

D. Compliance with Federal Anti-Backsliding Requirements and Puerto Rico's Anti-Degradation Policy

Federal regulations at 40 CFR 131.12 require that state water quality standards include an anti-degradation policy consistent with the federal policy. The discharge is consistent with the anti-degradation provision of 40 CFR 131.12, 72 Federal Register 238 (December 12, 2007, pages 70517-70526), EPA Region 2's Anti-backsliding Policy dated August 10, 1993, and EQB's *Anti-Degradation Policy Implementation Procedure* in Attachment A of PRWQS. In addition, CWA sections 402(o)(2) and 303(d)(4) and federal regulations at 40 CFR 122.44(l) prohibit backsliding in NPDES permits. These anti-backsliding provisions require effluent limitations in a reissued permit to be as stringent as those in the previous permit with some exceptions where limitations may be relaxed. All effluent limitations in the permit are at least as stringent as the effluent limitations in the existing permit.

PART III. RATIONALE FOR STANDARD AND SPECIAL CONDITIONS

A. Standard Conditions

In accordance with 40 CFR 122.41, standard conditions that apply to all NPDES permits have been incorporated by reference in Part IV.A.1 of the permit and expressly in Attachment B of the permit. The Permittee must comply with all standard conditions and with those additional conditions that are applicable to specified categories of permits under 40 CFR 122.42 and specified in Part IV.A.2 of the Permit.

B. Special Conditions

In accordance with 40 CFR 122.42 and other regulations cited below, special conditions have been incorporated into the permit. This section addresses the justification for special studies, additional monitoring requirements, Best Management Practices, Compliance Schedules, and/or special provisions for POTWs as needed. The special conditions for this facility are as follows:

1. **Special Conditions from the Water Quality Certificate**

   In accordance with 40 CFR 124.55, the EPA has established Special Conditions from the WQC in the permit that EQB determined were necessary to meet PRWQS. The Special Conditions established in this section are only those conditions from the WQC that have not been established in other parts of the permit.

2. **Storm Water Pollution Prevention Plan (SWPPP) / Best Management Practices (BMP) Plan**

   In accordance with 40 CFR 122.2 and 122.44(k), a SWPPP is a plan that includes BMPs, which are schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution to waters of the United States. The Permittee is required to develop a SWPPP in Part IV.B.4 of the permit to control or abate the discharge of pollutants.

3. **Clean Water Act §316(b) Reports**

   The permit includes a schedule of submittals in compliance with the Clean Water Act §316(b) Existing Facilities Final Rulemaking, 40 CFR 125.94. The Decision Document that represents the EPA determination of Best Technology Available for this permit renewal for this facility is included as Attachment C.

3. Chemical Usage

The permittee is permitted to use chemicals to control biofouling in the service cooling towers, or for fire protection foam, provided that they meet the following conditions:

a. The discharge shall not cause a violation of any permit limit or cause or contribute to an exceedance of any applicable water quality standard for the receiving water.

b. Notification to the EPA of the optimum product dosage necessary to ensure no deleterious effects to the effluent aquatic toxicity. PREPA shall also document that adequate process controls are in place to ensure that excessive levels of the chemical products are not subsequently discharged.

c. The EPA may request that PREPA perform toxicity testing of the outfall discharges, or pilot test waste streams, to ensure that the use of chemicals does not contribute to effluent toxicity.

d. The EPA has prohibited the discharge of plastic pellets or rockets utilized in Condenser Cleaning Systems.

e. The EPA has included a requirement that PREPA use best management practices to prevent and minimize any discharges of fire protection foam.

f. The EPA has included a procedure for pilot testing of materials and chemicals to ensure that permit limitations are met at all times.

The EPA recommends the following pollution prevention practices during future chemical useage pilot tests:

- Utilize alternative firefighting foam products that exhibit high biodegradability, and that do not contain flourosurfactants;
- Conduct pilot tests in bermed areas away from storm drain inlets, drainage facilities or water bodies;
- Configure the discharge area with a sump to allow collection and disposal of foam to the sanitary sewer system; and
- Discharge foam waste to a sanitary sewer to the maximum extent practicable.

PART IV. COMPLIANCE WITH APPLICABLE PROVISIONS OF OTHER FEDERAL LAWS OR EXECUTIVE ORDERS

A. Coastal Zone Management Act

Under 40 CFR 122.49(d), and in accordance with the Coastal Zone Management Act of 1972, as amended, 16 *United States Code* (U.S.C.) 1451 *et seq*. section 307(c) of the act and its implementing regulations (15 CFR Part 930), the EPA may not issue an NPDES permit that affects land or water use in the coastal zone until the Permittee certifies that the proposed activity complies with the Coastal Zone Management Program in Puerto Rico, and that the discharge is certified by the Commonwealth of Puerto Rico to be consistent with the Commonwealth's Coastal Zone Management Program. The Permittee is in the process of pursuing of requesting the Puerto Rico Planning Board to issue a consistency certification that provides that the discharge complies with its Coastal Zone Management Plan. The EPA has included a reopener clause and will ensure that the final permit issued includes all conditions required by the certification from the Puerto Rico Planning Board.

B. Endangered Species Act

Under 40 CFR 122.49(c), the EPA is required pursuant to section 7 of the Endangered Species Act (ESA), 16 U.S.C. 1531 *et seq*. and its implementing regulations (50 CFR Part 402) to ensure, in consultation with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) that the discharge authorized by the permit is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat.

The ESA requires the Regional Administrator to ensure, in consultation with the Secretary of the Interior or Commerce, that any action authorized by the EPA is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat.

In a May 2000 memo to the Regions, EPA Headquarters provided guidance to the Regions in making a determination as to whether a final permit may be issued while waiting for consultation to be concluded. As part of this permit action, if consultation has not been completed by final permit issuance and the EPA has concluded that permit issuance is consistent with section 7 prior to the conclusion of consultation, the EPA will re-issue the final permit before consultation is concluded and will document this decision in the Administrative Record. At the time consultation is completed, the EPA may decide that changes to the permit are warranted after permit issuance based on the results of the consultation. Therefore, a reopener provision to this effect has been included in the Permit Part IV.A.1.b.

C. Environmental Justice

The EPA is conducting an Environmental Justice (EJ) Analysis for the discharge in accordance with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Population and Low-Income Populations*, and EPA's Plan EJ 2014. EJ is the right to a safe, healthy, productive and sustainable environment for all, where "environment" is considered in its totality to include the ecological, physical, social, political, aesthetic and economic environments. In the NPDES permitting program, the public participation process provides opportunities to address EJ concerns by providing appropriate avenues for public participation, seeking out and facilitating involvement of those potentially affected, and including public notices in more than one language where appropriate. The facility is in an area characterized as a Community of Concern and therefore is subject to the EJ requirements. The EPA is committed to taking all necessary actions to minimize potential adverse effects on the area surrounding Levittown, Puerto Rico from the Palo Seco Power Station. The EPA will be considering and responding to all comments received during the public comment period for this permit. A detailed discussion of the EJ Analysis will be provided in the Administrative Record for the final permit action and will be available for review upon request.

D. Coral Reef Protection

Under Executive Order 13089, *Coral Reef Protection*, the EPA is required to ensure that discharge authorized under the permit will not degrade any coral reef ecosystem. No corals or coral ecosystems are in the vicinity of the discharge.

E. Climate Change

The EPA has considered climate change when developing the conditions of the permit. This is in accordance with the draft *National Water Program 2012 Strategy: Response to Climate Change* that identifies ways to address climate change impacts by NPDES permitting authorities (77 Federal Register 63, April 2, 2012, 19661-19662). Climate change is expected to affect surface waters in several ways, affecting both human health and ecological endpoints. As outlined in the draft National Water Program 2012 Strategy, the EPA is committed to protecting surface water, drinking water, and ground water quality, and diminishing the risks of climate change to human health and the environment, through a variety of adaptation and mitigation strategies. These strategies include encouraging communities and NPDES permitting authorities to incorporate climate change strategies into their water quality planning, encouraging green infrastructure and recommending that water quality authorities consider climate change impacts when developing water load and load allocations for new TMDLs, identifying and protecting designated uses at risk from climate change impacts. The 2010 *NPDES Permit Writers' Manual* also identifies climate change considerations for establishing low-flow conditions that account for possible climatic changes to stream flow. The conditions established in the permit are consistent with the draft National Water Program 2012 Strategy.

F. National Historic Preservation Act

Under 40 CFR 122.49(b), the EPA is required to assess the impact of the discharge authorized by the permit on any properties listed or eligible for listing in the National Register of Historic Places (NRHP) and mitigate any adverse effects when necessary in accordance with the National Historic Preservation Act, 16 U.S.C. 470 et seq. the EPA analysis indicates that no adverse effects to resources on or eligible for inclusion in the NHRP are not anticipated as part of this permitted action.

G. Magnuson-Stevens Fishery Conservation and Management Act

Under 40 CFR 122.49, the EPA is required to ensure that the discharge authorized by the permit will not adversely affect Essential Fish Habitat (EFH) as specified in section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), 16 U.S.C. 1801 *et seq*. The EPA is coordinating with NMFS for this facility. While the EPA is reissuing the permit at this time, the EPA may decide that changes to the permit are warranted based EFH on discussions with NMFS. A reopener provision to this effect has, therefore, been included in the permit.

PART V. PUBLIC PARTICIPATION

The procedures for reaching a final decision on the draft permit are set forth in 40 CFR Part 124 and are described in the public notice for the draft permit, which is published in ***El Vocero.*** Included in the public notice are requirements for the submission of comments by a specified date, procedures for requesting a hearing and the nature of the hearing, and other procedures for participation in the final agency decision. The EPA will consider and respond in writing to all significant comments received during the public comment period in reaching a final decision on the draft permit. Requests for information or questions regarding the draft permit should be directed to

Karen O'Brien
U.S. EPA Region 2, Clean Water Division
Permit Writer Phone: (212) 637-3717
Permit Writer Email: obrien.karen@epa.gov

A copy of the draft permit is also available on EPA's website at www.epa.gov/region02/water/permits.html.

ATTACHMENT A — FACILITY MAP AND PROCESS FLOW SCHEMATIC

The facility map and flow schematic are attached as provided by the Permittee in the application.

Note: Outfall 001B has been eliminated since the time of the original NPDES permit application.

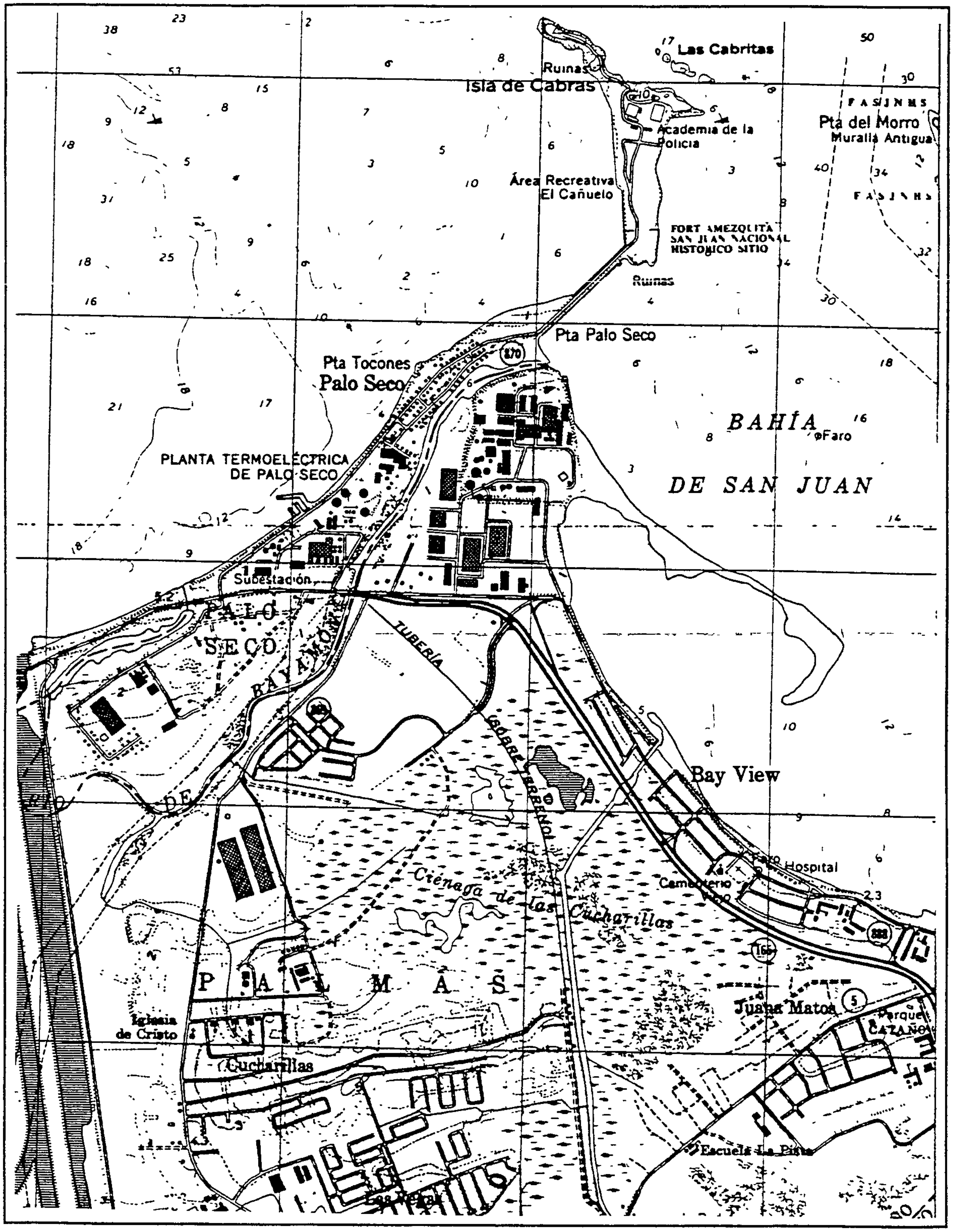


FIGURE 2-1
Palo Seco Power Plant Location Map

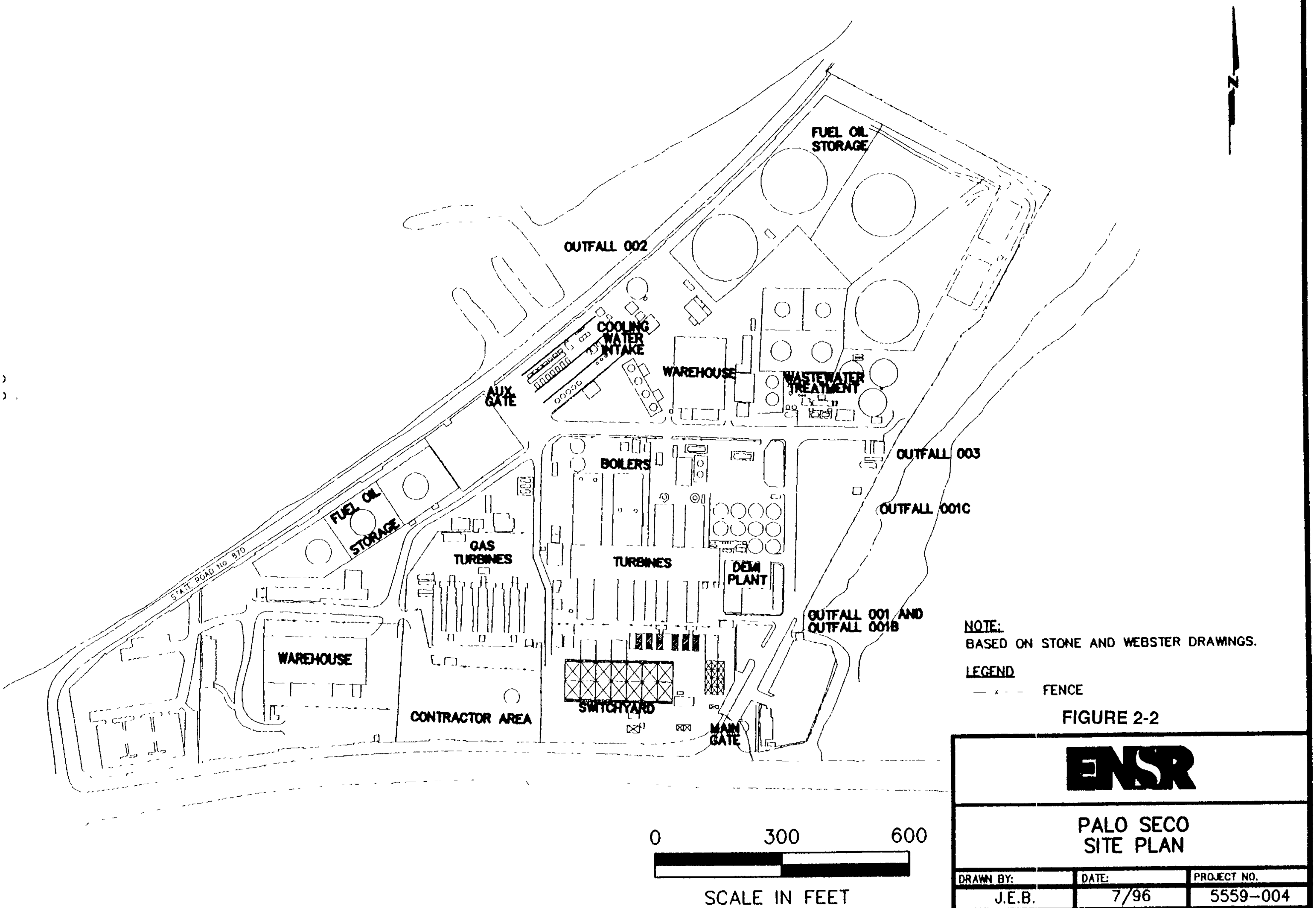
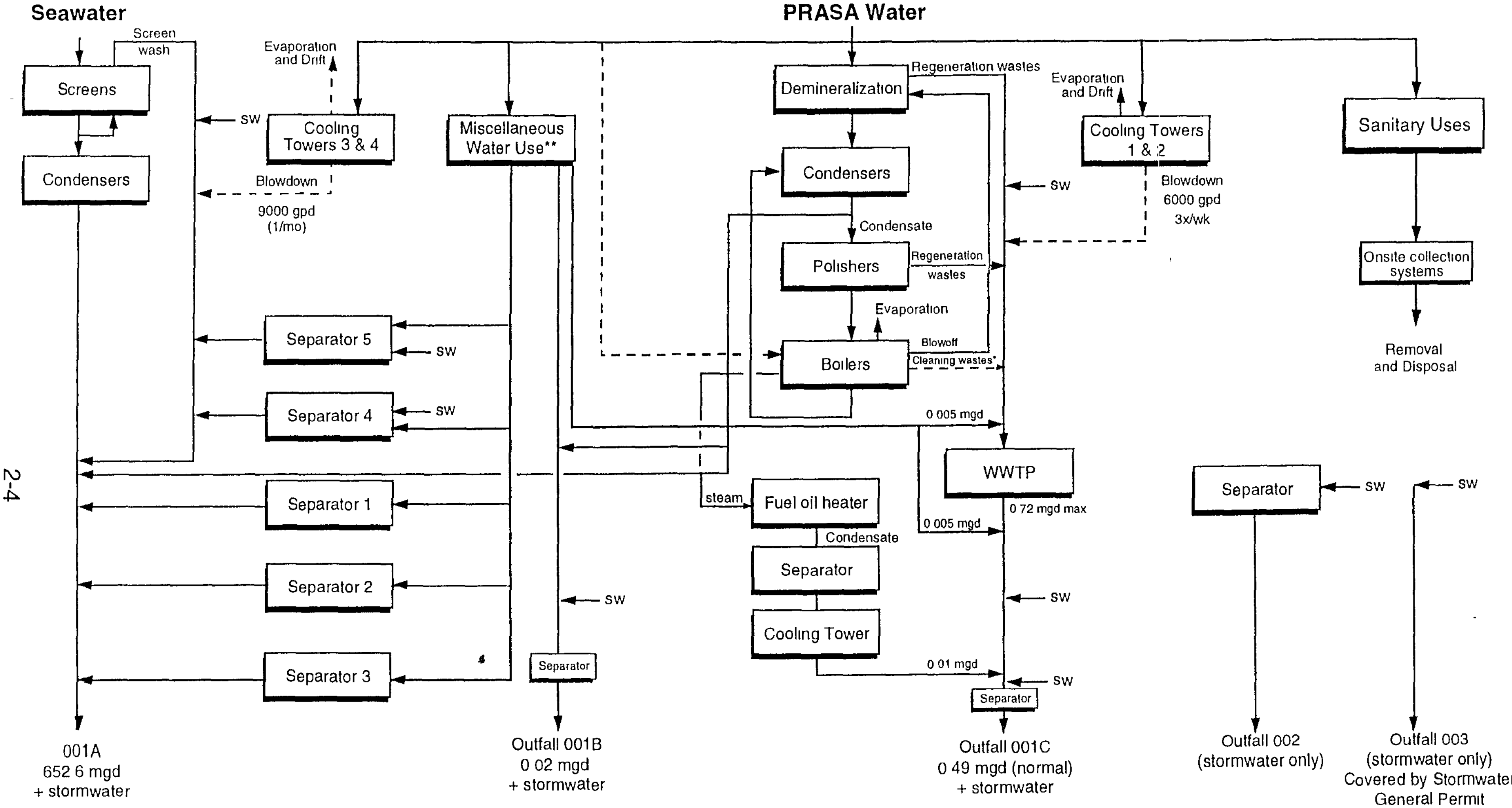


FIGURE 2-2

PALO SECO SITE PLAN



SW = Stormwater
— — — = Intermittent discharge

* includes air preheater cleaning
fan wash
boiler fireside cleaning
boiler chemical cleaning

** includes washdown
samplers
safety showers
instrumentation
equipment drains

FIGURE 2-3
Palo Seco Power Plant Water Balance Diagram

ATTACHMENT B – EFFLUENT LIMITATIONS BASIS TABLES

Highest reported values are based on available ICIS data for the period July 1, 2009 to June 30, 2014.

Effluent Limitations Table A-1 – Outfall 001A (Cooling Tower Blowdown)						
		Effluent limitations				
Parameter	**Units**	**Averaging period**	**Highest Reported Value**	**Existing limits**	**Final limits**	**Basis**
Effluent Flow	mgd	Average Monthly Maximum Daily	650		3.0	WQBEL
2,4,6-Trichlorophenol	ug/L	Maximum Daily			Monitor only	WQBEL
Antimony	ug/L	Maximum Daily			Monitor only	WQBEL
BOD, 5-day (20ºC)	mg/L	Maximum Daily	15	45	45	WQBEL
Cadmium	ug/L	Maximum Daily			8.85	WQBEL
Chemical Oxygen Demand	mg/L	Maximum Daily	73	100	100	TBEL
Chromium VI	ug/L	Maximum Daily	46	50	50.35	WQBEL
Color	Pt-Co Units	Maximum Daily	50	Shall not be altered by other than natural causes.		WQBEL
Copper	ug/L	Maximum Daily	30	50	3.73	WQBEL
Cyanide, Free	ug/L	Maximum Daily			1.0	WQBEL
Dissolved Oxygen	mg/L	Maximum Daily	Minimum 4	Shall not contain less than 4.0 mg/l.		WQBEL
Iron	ug/L	Maximum Daily	705	200	200.0	WQBEL
Lead	ug/L	Maximum Daily			8.52	WQBEL
Mercury	ug/L	Maximum Daily			0.051	WQBEL
Nickel	ug/L	Maximum Daily			8.28	WQBEL
Nitrogen (NO_3, NO_2, NH_3)	ug/L	Maximum Daily			----	WQBEL
Oil & Grease	mg/L	Maximum Daily		The waters of Puerto Rico shall be substantially free from floating non-petroleum oils and greases as well as petroleum derived oils and greases.		WQBEL
Oil & Grease	mg/L	Average Monthly Maximum Daily	5	15 20	15 20	TBEL
pH	S.U.	Maximum Daily	Minimum 7.3 Maximum 8.5	Minimum 7.3 Maximum 8.5	Minimum 7.3 Maximum 8.5	
Total Residual Chlorine	mg/l	Maximum Daily			0.2	TBEL
Polychlorinated Biphenyls (PCBs)	ug/L	Maximum Daily	Not Detected	There shall be no discharge of Polychlorinated Biphenyl compounds such as those commonly used for transformer fluids.		TBEL
Silver	ug/L	Maximum Daily			2.24	WQBEL

Effluent Limitations Table A-1 – Outfall 001A (Cooling Tower Blowdown)						
		Effluent limitations				
Parameter	**Units**	**Averaging period**	**Highest Reported Value**	**Existing limits**	**Final limits**	**Basis**
Solids and Other Matter		Maximum Daily		The waters of Puerto Rico shall not contain floating debris, scum, or other floating materials attributable to the discharge in amounts sufficient to be unsightly or deleterious to the existing or designated uses of the waterbody.		WQBEL
Sulfates	ug/L	Maximum Daily			Monitor only	WQBEL
Sulfide (Undissociated H_2S)	ug/L	Maximum Daily			2	WQBEL
Suspended, Colloidal or Settleable Solids	mL/L	Maximum Daily	0.3	Solids from wastewater source shall not cause deposition in or be deleterious to the existing or designated uses of the waterbody.		WQBEL
Taste and Odor Producing Substances		Maximum Daily		Shall not be present in amounts that will render any undesireable taste or odor to edible aquatic life.		WQBEL
Temperature	°F (°C)	Maximum Daily	135°F (57.2 °C)	The discharge temperature shall not exceed 110°F (44°C). For the receiving water, the rate of temperature change shall not be more than 1°F per hour and shall not exceed a total of 5 °F in any 24 hr. period except when due to natural causes.	The discharge temperature shall not exceed 104.7 °F (40.4 °C). Further, the annual upper 99th percentile temperature shall not exceed 99 °F (33.5 °C). To comply with this limit, the temperature cannot exceed 99 °F (33.5 °C) on more than 4 days per year.	
Thallium	ug/L	Maximum Daily			0.47	WQBEL
Total Suspended Solids	mg/l	Average Monthly Maximum Daily	28	30.0 100.0	30.0 100.0	WQBEL
Total Residual Chlorine	ug/l	Maximum Daily		0.2	0.2	TBEL
Turbidity	NTU	Maximum Daily	10.3	10	10	WQBEL
Zinc	ug/l	Maximum Daily	40.4	50	50	WQBEL

Effluent Limitations Table A-2 – Outfall 001A – A1 (Boiler Blowdown)						
		Effluent limitations				
Parameter	**Units**	**Averaging period**	**Highest Reported Value**	**Existing limits**	**Final limits**	**Basis**
Flow	mgd	Average Daily Maximum Daily				
Total Suspended Solids	mg/l	Average Daily Maximum Daily	16	30.0 100.0	30.0 100.0	TBEL
Total Suspended Solids	kg/day	Average Daily Maximum Daily		11.4 37.9	11.4 37.9	TBEL
Oil and Grease	mg/l	Average Daily Maximum Daily		15.0 20.0	15.0 20.0	TBEL
Oil and Grease	kg/day	Average Daily Maximum Daily		5.7 7.6	5.7 7.6	TBEL
pH	S.U.	Average Daily Maximum Daily	6.2 - 9	6.0 – 9.0	6.0 – 9.0	TBEL
Polychlorinated Biphenyls (PCBs)	ug/l	Average Daily Maximum Daily		There shall be no discharge of Polychlorinated Biphenyl compounds such as those commonly used for transformer fluids.		TBEL

Effluent Limitations Table A-3 – Outfall 001A-A2 (Cooling Tower Blowdown Intermittent Unit 3&4)						
		Effluent limitations				
Parameter	**Units**	**Averaging period**	**Highest Reported Value**	**Existing limits**	**Final limits**	**Basis**
Flow	mgd	Average Daily Maximum Daily				
Free Available Chlorine		Average Daily Maximum Daily	0.5	0.2 0.5	0.2 0.5	TBEL
Total Residual Chlorine		Maximum Daily		0.2	0.2	TBEL
Total Zinc		Average Daily Maximum Daily	0.9	1.0 1.0	1.0 1.0	TBEL
126 Priority Pollutants		Average Daily Maximum Daily		No Detectable Amount Allowed		TBEL
pH	S.U.	Average Daily Maximum Daily		6.0 – 9.0	6.0 – 9.0	TBEL

Effluent Limitations Table A-4 – Outfall 001A-A3 (Gas turbine equipment drains and storm water runoff)						
		Effluent limitations				
Parameter	**Units**	**Averaging period**	**Highest Reported Value**	**Existing limits**	**Final limits**	**Basis**
Flow	mgd	Average Daily Maximum Daily				TBEL
Total Suspended Soilds	mg/l	Average Daily Maximum Daily		30.0 100.0	30.0 100.0	TBEL
Oil and Grease	mg/l	Average Daily Maximum Daily		15.0 20.0	15.0 20.0	TBEL
pH	S.U.	Average Daily Maximum Daily		6.0 – 9.0	6.0 – 9.0	TBEL

Effluent Limitations Table A-5 – Outfall 001C (Wastewater from waste treatment plant, cooling tower and boiler blowdown, equipment drains and stormwater runoff, water from hydrostatic test performed in tanks, waters from the decantation tank and phreatic ground water)						
		Effluent limitations				
Parameter	**Units**	**Averaging period**	**Highest Reported Value**	**Existing limits**	**Final limits**	**Basis**
Effluent Flow	m^3/day (mgd)	Maximum Daily			2801.2 (0.74)	WQBEL
2,4,6-Trichlorophenol	ug/L	Maximum Daily			--	WQBEL
2,4- Dichlorophenol	ug/L	Maximum Daily			--	WQBEL
2-Chlorophenol	ug/L	Maximum Daily			--	WQBEL
2-Methyl-4,6-Dinitrophenol	ug/L	Maximum Daily			--	WQBEL
Arsenic	ug/L	Maximum Daily			36.00	WQBEL
BOD, 5-day (20ºC)	mg/L	Maximum Daily		30	30	Existing Permit TBEL
Cadmium	ug/L	Maximum Daily			--	WQBEL
Chemical Oxygen Demand	mg/L	Maximum Daily		100	100	TBEL
Color	Pt-Co Units	Maximum Daily		Shall not be altered by other than natural causes.		WQBEL
Copper	ug/L	Maximum Daily			3.73	WQBEL
Cyanide, Free	ug/L	Maximum Daily			1.0	WQBEL
Dissolved Oxygen	mg/L	Maximum Daily		Shall not contain less than 4.0 mg/l.		WQBEL
Lead	ug/L	Maximum Daily			8.52	WQBEL
Mercury	ug/L	Maximum Daily			0.051	WQBEL
Nickel	ug/L	Maximum Daily			8.28	WQBEL
Nitrogen (NO_3, NO_2, NH_3)	ug/L	Maximum Daily			--	WQBEL
Oil & Grease		Maximum Daily		The waters of Puerto Rico shall be substantially free from floating non-petroleum oils and greases as well as petroleum derived oils and greases.		TBEL
Oil & Grease	mg/L	Average Monthly Maximum Daily			15 20	TBEL
Pentachlorophenol	ug/l	Maximum Daily			--	WQBEL
pH	standard units	Maximum Daily		Minimum 7.3 Maximum 8.5		WQBEL
Polychlorinated Biphenyls (PCBs) (ug/L)	ug/L	Maximum Daily		There shall be no discharge of Polychlorinated Biphenyl compounds such as those commonly used for transformer fluids.		TBEL
Silver (ug/L)	ug/L	Maximum Daily			2.24	WQBEL

Effluent Limitations Table A-5 – Outfall 001C (Wastewater from waste treatment plant, cooling tower and boiler blowdown, equipment drains and stormwater runoff, water from hydrostatic test performed in tanks, waters from the decantation tank and phreatic ground water)						
		Effluent limitations				
Parameter	**Units**	**Averaging period**	**Highest Reported Value**	**Existing limits**	**Final limits**	**Basis**
Solids and Other Matter		Maximum Daily		The waters of Puerto Rico shall not contain floating debris, scum, or other floating materials attributable to the discharge in amounts sufficient to be unsightly or deleterious to the existing or designated uses of the waterbody.		WQBEL
Sulfates (ug/L)	ug/L	Maximum Daily			2,800	WQBEL
Sulfide (Undissociated H_2S)	ug/L	Maximum Daily			2	WQBEL
Suspended, Colloidal or Settleable Solids	mL/L	Maximum Daily		Solids from wastewater source shall not cause deposition in or be deleterious to the existing or designated uses of the waterbody.		WQBEL
Taste and Odor Producing Substances		Maximum Daily		Shall not be present in amounts that render any undesirable taste or odor to edible aquatic life.		WQBEL
Temperature	°F (°C)	Maximum Daily		Except by natural causes, no heat may be added to the waters of Puerto Rico, which would cause the temperature of any site to exceed 90°F (32.2 °C)		WQBEL
Thallium	ug/l	Maximum Daily			0.47	WQBEL
Total Suspended Solids	mg/l	Maximum Daily			30 100	TBEL
Turbidity	NTU	Maximum Daily			10	WQBEL

Effluent Limitations Table A-6 – Outfall 001 – C1 (Wastewater Treatment Plant Effluent)						
		Effluent limitations				
Parameter	Units	Averaging period	Highest Reported Value	Existing limits	Final limits	Basis
Flow	Mgd	Maximum Daily	0.56	0.48	0.48	
Copper	kg/day	Average Daily Maximum Daily		1.7 1.7	1.7 1.7	TBEL
Iron	kg/day	Average Daily Maximum Daily	0.1	1.7 1.7	1.7 1.7	TBEL
Total Suspended Solids	kg/day	Average Daily Maximum Daily	8.2	51.1 170.4	51.1 170.4	TBEL
Oil and Grease	mg/l	Average Daily Maximum Daily	7.8	25.6 34.1	25.6 34.1	TBEL
Free Available Chlorine	mg/l	Average Daily Maximum Daily		0.2 0.5	0.2 0.5	TBEL
Total Residual Chlorine	mg/l	Maximum Daily		0.2	0.2	TBEL
Total Chromium	mg/l	Average Daily Maximum Daily		0.2 0.2	0.2 0.2	TBEL
Total Zinc	mg/l	Average Daily Maximum Daily	0.1	1.0 1.0	1.0 1.0	TBEL
126 Priority Pollutants	ug/l	Average Daily Maximum Daily		No detectable amount allowed.		TBEL
pH	S.U.	Average Daily Maximum Daily	7.4 - 8.5	Shall always lie between 6.0 – 9.0		TBEL

Effluent Limitations Table A-7 – Outfall 002 storm water runoff

Parameter	Units	Averaging period	Highest Reported Value	Existing limits	Final limits	Basis
		Effluent limitations				
Chemical Oxygen Demand	mg/L	Maximum Daily	16	100	100	
Color	Pt-Co Units	Maximum Daily		Shall not be altered by other than natural causes.		WQBEL
Dissolved Oxygen	mg/L	Maximum Daily		Shall not contain less than 4.0 mg/l.		WQBEL
Lead	ug/L	Maximum Daily			Monitor only	WQBEL
Mercury	ug/L	Maximum Daily			0.051	WQBEL
Nickel	ug/L	Maximum Daily			Monitor only	WQBEL
Oil & Grease		Maximum Daily	5	The waters of Puerto Rico shall be substantially free from floating non-petroleum oils and greases as well as petroleum derived oils and greases.		WQBEL
Oil & Grease	mg/L	Maximum Daily		15 20	15 20	TBEL
pH	standard units	Maximum Daily	6.5 – 8.9	Minimum 7.3 Maximum 8.5	Minimum 7.3 Maximum 8.5	WQBEL
Turbidity	NTU	Maximum Daily		10.0	10.0	WQBEL
Polychlorinated Biphenyls (PCBs) (ug/L)	ug/L	Maximum Daily		There shall be no discharge of Polychlorinated Biphenyl compounds such as those commonly used for transformer fluids.		WQBEL
Silver (ug/L)	ug/L	Maximum Daily			2.24	WQBEL
Solids and Other Matter	ug/L	Maximum Daily		The waters of Puerto Rico shall not contain floating debris, scum, or other floating materials attributable to the discharge in amounts sufficient to be unsightly or deleterious to the existing or designated uses of the waterbody.		WQBEL
Suspended, Colloidal or Settleable Solids	ml/l	Maximum Daily		Solids from wastewater source shall not cause deposition in or be deleterious to the existing or designated uses of the waterbody.		WQBEL
Temperature	°F (°C)	Maximum Daily	80.4 °F (26.9 °C)	Except by natural causes, no heat may be added to the waters of Puerto Rico, which would cause the temperature of any site to exceed 90°F (32.2°C)		WQBEL
Total Suspended Solids		Maximum Daily	5	30.0 100.0	30.0 100.0	TBEL
Turbidity	NTU	Maximum Daily			10	WQBEL

ATTACHMENT C

Puerto Rico Electric Power Authority Palo Seco Power Plant Complex 316(b) Decision Document

Prepared for:
EPA Office of Wastewater Management and EPA Region II

Prepared By:
Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030

Under EPA Contract: EP-C-11-009
Work Assignment 2-21

Contents

Exhibits

1 Introduction

The Puerto Rico Electric Power Authority's (PREPA) Palo Seco Power Plant Complex (PSPPC) currently holds a National Pollutant Discharge Elimination System (NPDES) permit issued December 27, 1991 and expired February 28, 1997. PSPPC is located on the west coast of peninsula Punta Palo Seco, which separates Boca Vieja Cove from San Juan Bay. The facility withdraws cooling water from the Atlantic Ocean (via the Ensenada de Boca Vieja) through two shoreline cooling water intake structures (CWIS) in Boca Vieja Cove and discharges to a canal (abandoned channel of the Bayamon River), which ultimately empties to San Juan Bay. As a result, the facility is subject to requirements under Clean Water Act (CWA) section 316(b). In November 1997, PSPPC submitted a section 316(b) Demonstration Study detailing impingement and entrainment (I&E) at the facility as part of its permit application (ENSR 1997). EPA requested that Tetra Tech review the section 316(b) study (and other documents) to determine if additional technologies or operational measures are needed at the facility to reduce I&E in accordance with statutory requirements. [1] The results of the review are presented in this report.[2]

1.1 Summary of Decision

As currently configured and operated, the existing intake technology cannot be considered as Best Technology Available (BTA) for impingement reduction. Specifically, the current traveling screen debris return system is not designed or operated in a manner that minimizes injury and promotes the survival of impinged fish consistent with applicable regulations. Recommended fish return system improvements necessary to increase survival of impinged fish are described later in this report. With respect to entrainment, the existing sampling data is insufficient to fully characterize the scope of entrainment and definitively conclude whether a measurable impact is occurring. Additional entrainment monitoring is recommended to inform such an analysis.

1.2 Section 316(b) Requirements

Under CWA section 316(b), NPDES permits must regulate cooling water intake structures at facilities that also have permitted discharges. Section 316(b) requires that "the location, design, construction, and capacity of cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impact" to protect aquatic organisms from being killed or injured by impingement (being pinned against screens or other parts of a cooling water intake structure) or entrainment (being drawn into cooling water systems and subjected to thermal, physical or chemical stresses).

USEPA promulgated national BTA requirements for all existing facilities on May 19, 2014. The Existing Facility Rule applies to existing power generating facilities and existing manufacturing and industrial facilities that are point sources and that use one or more CWISs to withdraw more than 2 million gallons per day (MGD) of water from waters of the U.S. and use at least twenty-five (25) percent of the water they withdraw exclusively for cooling purposes. As an existing electric generating facility with a DIF of close to 650 MGD, these requirements apply to PSPPC; see 40 CFR 125.91 for more information on the applicability criteria. The Existing Facility Rule establishes a framework for developing BTA requirements for both impingement mortality and entrainment, as described below. The Existing Facility

[1] CWA section 316(b) requires that a facility employ the "best technology available to minimize adverse environmental impact" at cooling water intake structures.

[2] This review supplements a review conducted by Tetra Tech in September 2006, where EPA requested technical support in reviewing materials submitted by Palo Seco up to that time. Subsequently, PSPPC provided additional information on April 2012 in a report entitled, *Impingement Mortality & Entrainment Characterization Study and Current Status Report (*PREPA 2012). This review incorporates the updated information.

Rule also establishes a process for facilities to collect and submit information to their permitting authority (in the case of PSPPC, USEPA Region II) to support development of appropriate NPDES permit requirements.

1.2.1 Impingement Mortality

The Existing Facility Rule provides seven compliance alternatives for reducing impingement mortality. These requirements are fully described at 40 CFR 125.94(c). In general, they are:

- Operate a closed-cycle recirculating cooling system, as defined at 40 CFR 125.92;
- Operate a cooling water intake structure with a design intake velocity of less than 0.5 feet per second through-screen velocity;
- Operate a cooling water intake structure with an actual intake velocity of less than 0.5 feet per second through-screen velocity;
- Operate an existing offshore velocity cap, as defined at 40 CFR 125.92;
- Operate modified traveling screens, as defined at 40 CFR 125.92;
- Operate a system of technologies, management practices and operational measures that optimizes impingement mortality; or
- Achieve an impingement mortality annual performance standard.

Each facility subject to the Existing Facility Rule must select one of the above compliance alternatives.

1.2.2 Entrainment

Under the Existing Facility Rule, a determination of BTA for entrainment is developed on a site-specific, best professional judgment (BPJ) basis by the permitting authority. The rule requires that facilities achieve the maximum reduction in entrainment warranted after consideration of several relevant factors specified in the rule. Facilities with an actual intake flow greater than 125 million gallons per day (MGD) must collect and submit certain information to the permitting authority to inform the BTA determination. These submittals are described in more detail below.

1.2.3 Application Requirements

Section 316(b) is implemented through NPDES permits. The Existing Facility Rule establishes requirements for a facility to submit materials as part of its NPDES permit renewal application. The permitting authority then reviews these materials and develops appropriate permit conditions for impingement mortality and entrainment. The specific permit application materials are described below.

All existing facilities are required to complete and submit the following application studies:

- Description of the source water body (§ 122.21(r)(2));
- Description of the cooling water intake structures (§ 122.21(r)(3));
- Characterization of the biological community in the vicinity of the cooling water intake structure (§ 122.21(r)(4));
- Description of the cooling water system (§ 122.21(r)(5));
- Identification of the facility's chosen compliance method for impingement mortality (§ 122.21(r)(6));
- Description of any previously conducted entrainment performance studies (§ 122.21(r)(7)); and
- Description of the facility's operational status (§ 122.21(r)(8)).

Facilities (such as PSPPC) that have an actual intake flow greater than 125 MGD must also submit the following studies:

- Entrainment characterization study (§ 122.21(r)(9));
- Comprehensive technical feasibility and cost evaluation study (§ 122.21(r)(10));
- Benefits valuation study (§ 122.21(r)(11));
- Non-water quality environmental and other impacts assessment (§ 122.21(r)(12)); and
- Description of the peer review process for studies submitted under § 122.21(r)(10)-(12) ((§ 122.21(r)(13)).

Given that the permit for PSPPC has already expired, the permitting authority must establish a schedule for the above submittals.

1.2.4 Threatened and Endangered Species

The Clean Water Act and any requirements established pursuant to section 316(b) and the Existing Facility Rule are intended to supplement efforts to protect threatened and endangered species. Nothing in the Existing Facility Rule authorizes the take of a species protected by the Endangered Species Act. The facility and permitting authority are required to coordinate with the National Marine Fisheries Service and/or United States Fish and Wildlife Service to determine if any impact to threatened and endangered species may be occurring and, if so, how to address the operation of the cooling water intake structure. The permitting authority may develop additional requirements including (but not limited to) additional or more specific biological monitoring or additional technology requirements.

A discussion of BTA and Existing Facility Rule implementation issues for PSPPC are discussed later in this report.

2 Background

This section includes a description of the facility, intake and receiving water, and intake structures.

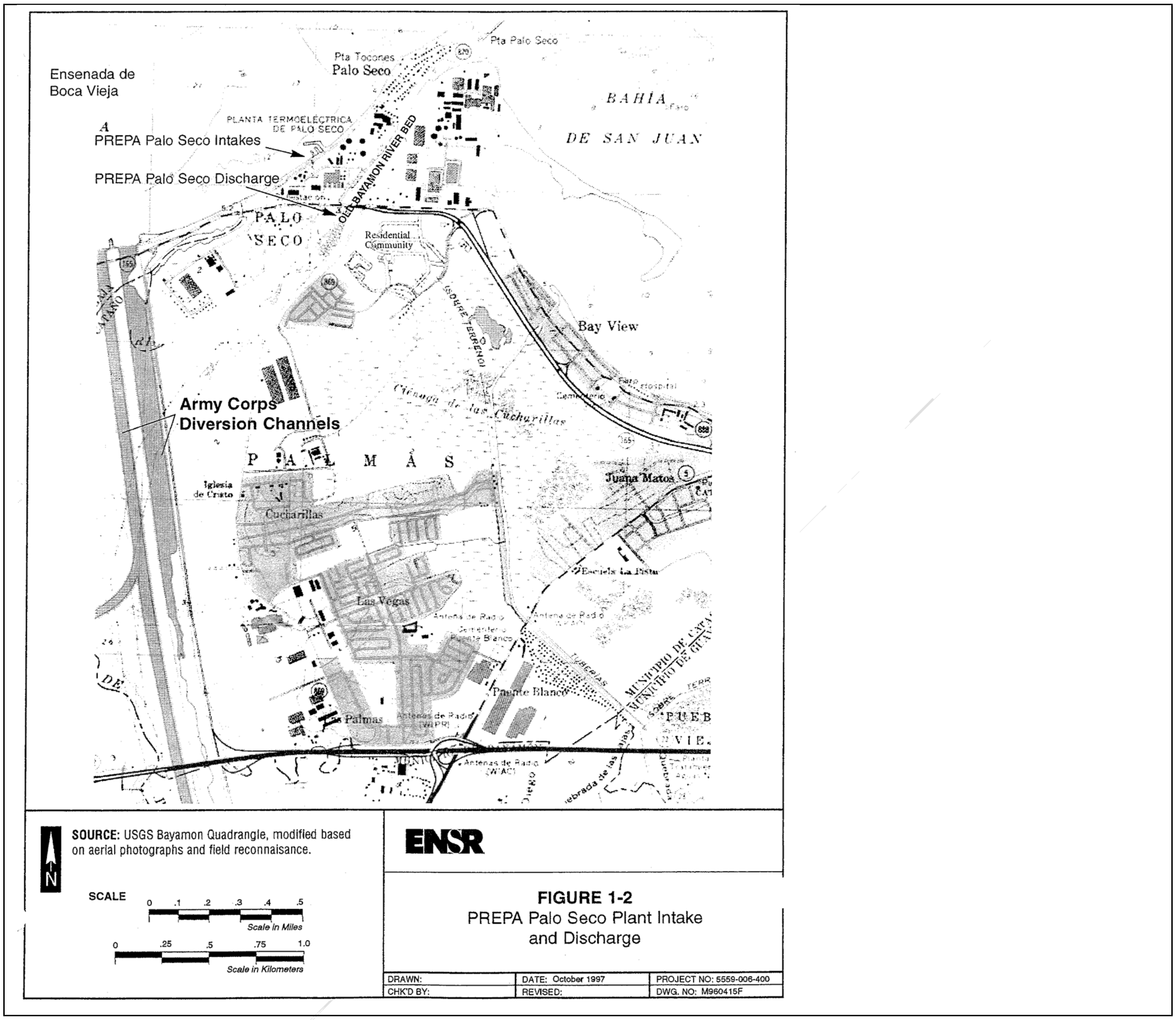
2.1 Facility Description

PSPPC consists of two oil-fired 85 MW steam-electric generating units (Units 1 & 2), two oil-fired 216 MW steam-electric generating units (Units 3 & 4), and six gas turbine generators with a combined output of 132 MW. The four steam-electric generating units employ a once-through cooling water system. PSPPC is a base load facility and is expected to continue to operate as a base load facility in the future.

2.2 Location/Waterbody Description

PSPPC is located at the western end of a peninsula that divides Boca Vieja Bay (Ensenada de Boca Vieja) to the north and west from San Juan Bay (Bahia de San Juan) to the east (Exhibit 1). Cooling water is withdrawn from the Atlantic Ocean via a shoreline structure located in the southeastern area of the Boca Vieja Bay and is discharged to the abandoned river bed of the Bayamon River which flows into the northwestern portion of San Juan Bay.

Exhibit 1. Palo Seco Power Plant intake and discharge locations. (ENSR 1977)



2.2.1 Description of Intake Waterbody

Boca Vieja Bay is a small semi-circular embayment on the Atlantic Ocean that lies immediately west of the entrance to San Juan Bay. The bay is bounded by the Isla de Bahia on the east and by Punta Silinas approximately 4 kilometers to the west. The peninsula separating the two waterbodies consists of the Isla de Cabras and a connecting causeway constructed in the 1950s. The peninsula, which extends nearly 3 kilometers into the ocean from the mouth of the old Bayamon River, effectively separates the intake waterbody from the discharge waterbody. Water depths in the Boca Vieja Bay range from approximately 10 to 16 ft in the vicinity of the intake and increase to depths over 20 ft towards the center of the bay (NOAA 2006).

2.2.2 Description of Receiving Waterbody

Historically, the Bayamon River discharged into Boca Vieja Bay, forming a large cuspate delta. Over time, west to east long-shore currents formed an emergent bar that diverted the Bayamon River into San

Juan Bay. As a result, sediment from the Bayamon River threatened to fill the channel into San Juan Harbor. In the 1970s, the US Army Corps of Engineers channelized the Bayamon River and diverted it to empty into Boca Vieja Bay. Only a small portion of the original freshwater flow from the lowland areas cut off by the river channelization flows into the old river channel, which today serves as the discharge channel for PSPPC. The majority of the flow volume through the river is the facility's discharge. The length of the channel from the plant to the discharge into Bahia de San Juan is approximately 1320 yards. The discharge canal still possesses the natural irregular contours formed by the river and is lined by mangroves. Channel widths vary from 20 ft at the plant discharge point to a maximum of 300 ft; depths in the channel range from 2 to 9 ft. Tidal elevations vary approximately 2 ft. A shallow sediment sill located at the mouth of the channel prevents flow reversal in the river, which can be caused by tidal influence or wind-driven currents.

The San Juan Bay is located on the north coast of Puerto Rico and encompasses an area of approximately 5.79 square miles (15 square kilometers). The mouth of San Juan Bay is 0.5 miles across and up to 40 feet deep. The bay extends 3 miles landward from the mouth. The depth ranges from a few feet to 20 feet and reaches a maximum of 40 feet within the dredged channels. The mean tide range is 1.6 feet. Water depth in the vicinity of the discharge is generally in excess of 30 feet, such that the water is quite deep in relation to the normal tidal range of 1.6 feet. Waters of San Juan Bay are classified as "SC – coastal waters intended for uses where the human body may come in indirect contact with the water (e.g. fishing and boating) and for use in propagation and preservation of desirable species" by the Puerto Rico Environmental Quality Board (EQB).

The San Juan Bay is a highly disturbed environment due to heavy ship traffic (the bay is a major deep-water port), industrialized shoreline, domestic sewage discharges, and dredging activities. The natural shoreline has been greatly altered by filling, bulkheading, piers, and industrial development. Most of the natural bottom of the Bahia de Puerto Nuevo has been altered by dredging to create the Army terminal turning basin, Army terminal channel, and Puerto Nuevo channel. Water quality has degraded due to both point and non-point sources. Point sources are primarily industrial wastewater discharges. Non-point sources include chemical spills, urban runoff from agricultural, industrial and residential areas, and contamination associated with dredging. High turbidity and bacterial contamination are the two most serious water quality problems. Fecal coliform counts continue to exceed water quality standards, especially in canals and rivers surrounding the bay (numerous non-sewered residences are located in the area). Sediments of San Juan Bay contain heavy metals, pesticides, and petroleum constituents.

2.3 Cooling Water Intake Structure Description

The intake consists of two intake bays, one for Units 1 & 2, and one for Units 3 & 4. Each bay is bordered and separated by three rock jetties. For both intakes, the intake technology sequence starts with trash racks (7-inch spacing) at tunnel inlets, followed by multiple rectangular intake tunnels, trash racks (2-inch openings) located near the end of each tunnel, followed by multiple dual flow traveling screens each followed by single speed intake pumps. There are common plenums that allow for flow redistribution within each intake between the tunnels and the traveling screens and between the traveling screens and the pumps. Exhibit 2 provides a summary of the cooling system technology specification/performance data.

Exhibit 2. Cooling Water System Data

Intake	Units 1 & 2	Units 3 & 4
Inlet Velocity—Low Tide	1.1 ft/sec	2.3 ft/sec
Inlet Velocity—High Tide	0.86 ft/sec	1.96 ft/sec

Exhibit 2. Cooling Water System Data

Intake	Units 1 & 2	Units 3 & 4
Number of Tunnels/Traveling Screens	3	7
Reported Mean Through-screen Velocity for Traveling Screens	0.5 ft/sec	0.77 ft/sec
Number of Pumps (including one backup each)	3	5
Total Pumping Capacity (excluding backup)	97,400 gal/min (gpm)(140 million gallons per day (MGD))	356,000 gpm (513 MGD)
Range of Monthly Average Total Condenser Flow (May 1996 through May 1997)	362 – 645 MGD	
Screen Mesh Size	0.1 in	0.1 in
Calculated Temperature Increase at Full Load	18.2 °F	12.8 °F
Combined Temperature Increase at Full Load	14.2 °F	

The double-entry single-exit traveling screens are constructed of smooth wire mesh panels with 1/10-inch[3] square openings and fish troughs. Debris is washed off the screens by a high pressure spray and is combined in a concrete trough which transports fish and debris to the condenser outlet tunnel which discharges through Outfall 001A. The screen debris wash water trough also receives other miscellaneous wastestreams including cooling tower blowdown (intermittent), boiler blowdown (intermittent), and miscellaneous wastewater. As a result, impinged organisms are subjected to the high pressure spray, then exposed to any pollutants from the other waste streams, and finally discharged into the condenser effluent with exposure to the heated condenser water occurring for an extended period until the effluent stream finally exits the old Bayamon River channel. Currently the traveling screens are operated continuously.

[3] Recent documents indicate mesh has 1/10 inch openings but previous documents have indicated 1/8 inch openings.

3 Impacts of Existing Intake Structure

PSPPC's CWIS is located along the southeast shore of Ensenada de Boca Vieja. Ensenada de Boca Vieja is a relatively shallow bay on Puerto Rico's northern coast, with an aerial extent of approximately 3.8 square miles. It extends a maximum of 1.5 miles from its mouth to its southern shoreline and is approximately 2.5 miles wide. The bay is bounded by two peninsulas, Isla de Cabras to the east and Punta Salinas to the west. Depths vary from a few feet up to 30 feet in the bay, and increase steeply (e.g., to 150 feet) in the Atlantic Ocean outside the mouth of the bay. Ensenada de Boca Vieja receives freshwater inflow (from the diverted Bayamon River channel) that is typically low but varies dramatically with local precipitation. Water circulation in the bay is characterized by strong water currents and tidal exchange; therefore, residence times for waters of the bay are relatively short. The eastern portion of Ensenada de Boca Vieja has notable living habitat structures provided by macroalgae and seagrasses. Coral reefs are limited in the bay by strong wave action and high sediment loads. More extensive "rock reefs" are present in the deeper portions of the area near the intake (Raytheon 1994).

The fishes of San Juan Bay have been reported by PRWRA (1976), PREQB (1983), Stoner and Goenaga (1987), and ENSR (1997). An approximate total of 45 fish taxa are known to have been collected from south east San Juan Bay (United Engineers 1983). A small subsistence-type commercial fishery exists in the Palo Seco area; however, the primary local fishery grounds are located offshore of San Juan Bay and Ensenada de Boca Vieja. In Ensenada de Boca Vieja, a recreational fishery exists for snook (*Centropomus* spp.), mojarra (Gerreidae), yellow snapper (*Ocyurus chrysurus*), and tarpon (*Megalops atlanticus*) (United Engineers 1983). Contemporary studies of Ensenada de Boca Vieja fishes and invertebrates and the impingement/entrainment impacts associated with PSPPC's intake include reports prepared by Raytheon (1994), Raytheon (1997), and ENSR (1997). The following sections consider the sampling methodologies and results of these studies to assess potential impacts from PSPPC's intake.

3.1 Impingement

Evaluations of impingement mortality are limited to three studies from September 1976 through February 1977 (PRWRA 1977), December 1993 through October 1994 (ENSR 1997), and August 2010 through June 2011 (PREPA 2012). The following details the results of these studies.

3.1.1 Historic Data

The PRWRA (1977) survey conducted 24-hour sampling every two weeks, resulting in 10 samples. Fifty-seven (57) fish were collected during the surveys, with 47 specimens partially decayed (i.e., apparently dead before impingement). The majority of impinged fishes were sardines (Engraulidae) and cutlassfish (*Trichiurus lepturus*) (United Engineers 1983). The 1976/77 results are provided for historical perspective; however, their applicability and utility for current consideration is limited due to the fact that PSPPC traveling screens were fitted with 3/4-inch mesh at the time of the surveys (versus current 1/4-inch mesh).

The ENSR (1997) study consisted of six sampling events (December, February, April, June, August, and October). A frame and screen device, using 1/4-inch mesh to match the traveling screen, was constructed to fit into the screen wash trough to collect material washed from the traveling screens. The collection devices were inspected over a 24-hour period during each of the sampling events and impinged invertebrates were collected, sorted, identified, and enumerated. Over the period of study, 20 orders of invertebrates (Exhibit 3), and 9,514 fish representing 46 families (Exhibit 4) were collected.

Impinged invertebrates comprised three classes of mollusks (cephalopods, gastropods, and bivalves), polychaete annelids, arthropods, and decopods (Exhibits 5 and 6). Molluscs were the most common invertebrate group (mostly gastropods), followed by polychaetes (8 families of worms collected), and arthropods. Decapods were well-represented in samples, with up to 10 species of shrimp, 26 species of crab, and 1 species of lobster impinged. Crevice skulling crab (*Cronius timudulus*) was the most common crab, with an average of 266 individuals impinged per day (maximum: 914 per day in February, 1994). Other commonly impinged invertebrates include Coastal mud shrimp (*Upogebia affins*; average 107 impinged per day) and Caribbean spiny lobster (*Panulirus argus*; maximum 133 impinged per day in February, 1994).

Fish impingement ranged from 476 per day in December 1993 to 3,392 per day in June 1994 (average: 1,586 fish per day). Individuals of the anchovy family (Engraulidae) were most frequently impinged, averaging 780 fish per day (total: 4,673) (Exhibits 7 and 8). Second in abundance were bonefish (Albulidae), averaging 210 individuals impinged per day. Other commonly impinged species include ladyfish (Elopidae) (92/day), mojarras (Gerreidae (89/day), puffers (Tetradontidae) (65/day), and herrings (Clupeidae) (46/day).

Data for species with high daily impingement rates, were converted average to annual estimates. Results indicated that annual impingement losses for anchovies were slightly less than 5 percent of the Ensenada de Boca Vieja population. Atlantic thread herring and all Clupeidae, spotfin mojorras and all Gerreidae, and spiny lobster impingement rates were compared to local (annual) commercial catches, and losses were found to be equal to 2.5, 4 and 50 percent of the local commercial catch rate, respectively.

Exhibit 3. Invertebrates impinged at the Palo Seco CWIS during five sampling event between February and October 1994. Figure scanned from ENSR (1977).

Table 7-8
T[illegible]nomy of Invertebrates Impinged at Palo Seco
Fe[illegible]ruary 1994 to October 1994

Order	Suborder	Family	Taxa	Common Name	Number per day Feb-94	Apr-94	Jun-94	Aug-94	Oct-94	Avg
Amphipoda	Gammaridea	Gammaridae	Gammarid amphipods	Gammarid amphipod	0	0	0	8	0	1.6
Amphipoda	Gammaridea	Gammaridae	unid. gammarid amphipod	Gammarid amphipod	0	59	0	0	0	11.8
Amphipoda	Gammaridea	Gammaridae	unid. Gammaridea	Gammarid amphipod	601	0	0	0	0	120.1
Anaspidea		Aplysiidae	Aplysia sp.	Seahare sp	0	0	0	15	28	8.7
Anaspidea		Aplysiidae	Aplysia sp. A	Seahare sp	25	7	0	0	0	6.4
Anthozoa*			unid. anemone		25	0	0	0	0	5.0
Archaeogastopoda		Phasianellidae	Tricolia affinis	Checkered pheasant	83	0	0	0	0	16.5
Archaeogastopoda		Phasianellidae	Tricolia tessellata	Pheasant sp	0	0	3	0	0	0.6
Ascidiacea*		Cho - Ascidia	unid. ascidian	Ascidian	0	7	0	0	0	1.4
Cephalopoda*			unid octopus	Octupus	0	0	0	2	0	0.4
Cephalopoda*			unid squid	Squid	0	0	0	0	9	1.7
Cubomedusae		Carybdeidae	Carydea sp. A	Snapping shrimp	8	115	34	267	103	105.3
Cubomedusae			Cubomedusa sp. B	Jellyfish sp	0	0	0	8	57	13.0
Cyclophoridae		Epitoniidae	Nitidella dichroa	Dovesnail sp	25	0	0	0	0	5.0
Decapoda	Anomura	Callianassidae	Callianassa sp. A	Ghost shrimp sp	15	7	0	0	0	4.4
Decapoda	Anomura	Paguridae	Paguridae sp. A	Right-handed hermit crab sp	0	0	0	2	0	0.4
Decapoda	Anomura	Paguridae	Paguridae Type A	Right-handed hermit crab sp	148	14	0	0	0	32.3
Decapoda	Anomura	Paguridae	Paguridae Type B	Right-handed hermit crab sp	8	0	0	0	0	1.5
Decapoda	Anomura	Paguridae	Pagurus sp. A	Right-handed hermit crab sp	108	0	0	0	0	21.5
Decapoda	Anomura	Paguridae	Pagurus sp.	Juv. hermit crab sp	30	0	0	0	0	6.1
[illegible]poda	Anomura	Porcellanidae	Pachycheles sp. A	Porcelain crabs sp	0	8	0	0	0	1.6
[illegible]apoda	Anomura	Upogebiidae	Upogebia affinis	Coastal mud shrimp	253	57	5	2	219	107.3
Decapoda	Brachyrhyncha	Grapsidae	Pachygrapsus transversus	Mottled shore crab	8	8	0	0	9	4.9
Decapoda	Brachyrhyncha	Portunidae	Callinectes exasperatus	Rugose swimming crab	100	0	0	0	0	20.0
Decapoda	Brachyrhyncha	Portunidae	Callinectes larvatus	Masked swimming crab	15	0	7	2	75	19.8
Decapoda	Brachyrhyncha	Portunidae	Callinectes sapidus	Blue crab	0	7	0	0	0	1.4
Decapoda	Brachyrhyncha	Portunidae	Callinectes sp.	Swimming crab sp	0	0	10	0	44	10.7
Decapoda	Brachyrhyncha	Portunidae	Cronius tumidulus	Crevice Sculling Crab	914	64	41	85	226	266.0
Decapoda	Brachyrhyncha	Portunidae	Portunus floridanus	Redhair swimming crab	75	0	0	0	0	15.0
Decapoda	Brachyrhyncha	Portunidae	Portunus sp. A	Swimming crab sp	33	35	4	2	162	47.2
Decapoda	Brachyrhyncha	Portunidae	Portunus sp. B	Swimming crab sp	0	0	1	23	0	4.8
Decapoda	Brachyrhyncha	Xanthidae	Panopeus occidentalis	Furrowed mud crab	25	0	0	2	0	5.4
Decapoda	Brachyrhyncha	Xanthidae	Panopeus sp. (juv.)	Mud crab sp	8	0	0	0	0	1.5
Decapoda	Brachyrhyncha	Xanthidae	Panopeus sp. A	Mud crab sp	0	0	1	0	0	0.3
Decapoda	Brachyrhyncha	Xanthidae	Pilumnus sp. A	Hairy crab sp	25	0	3	0	0	5.6
Decapoda	Brachyrhyncha	Xanthidae	Pilumnus sp. B	Hairy crab sp	0	8	12	0	11	6.2
Decapoda	Brachyrhyncha	Xanthidae	Pilumnus sp. C	Hairy crab sp	0	7	0	0	0	1.4
Decapoda	Brachyura	Portunidae	juv. Callinectes	Snapping shrimp	88	45	0	0	0	26.6
Decapoda	Brachyura	Portunidae	juv. Portunidae	Swimming crab sp	236	0	0	0	0	47.1
Decapoda	Caridea	Alpheidae	Synalpheus sp. A	Snapping shrimp sp	138	14	1	6	0	31.8
Decapoda	Caridea	Alpheidae	Synalpheus sp. B	Snapping shrimp sp	75	0	6	2	0	16.6
Decapoda	Caridea	Palaemonidae	Periclimenes portoricensis	Bigclaw river shrim	75	8	18	14	222	67.5
Decapoda	Caridea	Palaemonidae	Periclimenes sp. A	Shrimp sp	23	0	0	0	0	4.5
Decapoda	Caridea	Palaemonidae	Periclimenes sp. B	Shrimp sp	25	0	0	0	0	5.0
Decapoda	Caridea	Pasiphaeidae	Alpheus sp. A	Snapping shrimps sp	0	0	3	0	325	65.5
Decapoda	Caridea	Pasiphaeidae	Leptochela sp. A	Glass shrimps sp	0	0	3	0	0	0.6
[illegible]poda	Oxyrhyncha	Majidae	Epialtus bituberculatus	Variegate spider crab	25	43	1	0	11	16.0
[illegible]poda	Oxyrhyncha	Majidae	Microphrys bicornuta	Speck-claw decorator	0	0	0	0	11	2.2
Decapoda	Oxyrhyncha	Majidae	Mithrax sculptus	Green clinging crab	115	30	4	0	86	47.1
Decapoda	Oxyrhyncha	Majidae	Mithrax sp. A	Spider crab sp	0	8	0	0	0	1.6
Decapoda	Oxyrhyncha	Majidae	Mithrax sp. B	Spider crab sp	0	7	1	2	9	3.8

Exhibit 3. Invertebrates impinged at the Palo Seco CWIS during five sampling event between February and October 1994. Figure scanned from ENSR (1977).

Table 7-8
T[illegible]nomy of Invertebrates Impinged at Palo Seco
Feoruary 1994 to October 1994

Order	Suborder	Family	Taxa	Common Name	Number per day					
					Feb-94	Apr-94	Jun-94	Aug-94	Oct-94	Avg
Decapoda	Oxyrhyncha	Majidae	Podochela sp. A	Spider crab sp	0	7	0	0	0	1.4
Decapoda	Oxyrhyncha	Majidae	Stenorhynchus seticornis	Yellowline arrow crab	0	7	0	0	0	1.4
Decapoda	Oxyrhyncha	Parthenopidae	Cryptopodia concava	Elbow crab sp	0	7	0	0	0	1.4
Decapoda	Palinura	Palinuridae	Panulirus argus	Caribbean spiny lobster	133	14	7	6	11	34.4
Decapoda	Penaeoidea	Penaeidae	Penaeus duorarum	Northern pink shrimp	573	36	10	50	143	162.4
Decapoda	Penaeoidea	Sergestidae	Acetes americanus	Aviu shrimp	0	7	0	0	0	1.4
Decapoda	Penaeoidea	Sergestidae	Acetes americanus	Aviu shrimp	0	0	1	15	457	94.6
Decapoda	Penaeoidea	Sicyoniidae	Sicyonia laevigata	Rock shrimp sp	50	14	3	6	22	19.0
Decapoda	Penaeoidea	Sicyoniidae	Sicyonia sp. A	Rock shrimp sp	8	0	3	0	0	2.0
Decapoda	Stenopodidea	Stenopodidae	Stenopodidea	Coral shrimp sp	0	8	0	0	0	1.6
Decapoda	Stenopodidea	Stenopodidae	Stenopus hispidus	Banded coral shrimp	25	28	1	2	0	11.2
Echinoidea*			juv. urchin	Urchin sp	30	0	0	0	0	6.1
Flabellifera (Isopoda)		Cirolanidae	Cirolana sp. A	Isopod sp	15	0	0	0	0	3.0
Flabellifera (Isopoda)		Corallanidae	Excorallana sp. A		25	14	0	0	0	7.8
Flabellifera (Isopoda)		Sphaeromatidae	Paracereis sp. A		25	0	0	0	0	5.0
Flabellifera (Isopoda)		Sphaeromatidae	Sphaeroma sp. A		25	0	0	0	0	5.0
Myoida	Myina	Corbulidae	Corbula caribaea	Corbula sp.	0	8	0	0	0	1.6
Mytiloida		Mytilidae	Brachidontes exustus	Scorched mussel	0	0	3	0	0	0.6
Nudibranchia			unidentified nudibranch		0	0	7	2	11	4.0
Ostreoida		Ostreidae	Crassostrea rhizophorae	Oyster sp.	25	0	0	0	0	5.0
Polychaeta*		Amphinomidae	Hermodice carunculata		65	8	4	0	20	19.5
[illegible]haeta*		Amphinomidae	Amphinomidae sp. C	Paddle footed annelid	0	0	0	2	0	0.4
P[illegible]ychaeta*		Amphinomidae	Amphinomidae sp. E	Paddle footed annelid	0	0	1	0	0	0.3
Polychaeta*		Amphinomidae	Amphinomidae Type A	Paddle footed annelid	50	0	0	0	0	10.0
Polychaeta*		Aphroditidae	Aphroditidae sp. A	Paddle-footed annelid	0	0	1	2	11	2.9
Polychaeta*		Aphroditidae	Aphroditidae Type A	Paddle-footed annelid	25	0	0	0	0	5.0
Polychaeta*		Eunicidae	Eunicidae sp. A	Paddle-footed annelid	0	0	8	0	0	1.7
Polychaeta*		Eunicidae	Eunicidae Type A	Paddle-footed annelid	323	0	0	0	0	64.7
Polychaeta*		Glyceridae	Glyceridae sp. A		0	0	0	0	11	2.2
Polychaeta*		Nereidae	Nereidae sp. A	Polychaete sp	0	0	0	12	81	18.7
Polychaeta*		Nereidae	Nereidae sp. B	Polychaete sp	0	0	0	0	11	2.2
Polychaeta*		Nereidae	Nereidae sp. C	Polychaete sp	0	0	0	2	0	0.4
Polychaeta*		Nereidae	Nereidae Type A	Polychaete sp	33	7	0	0	0	7.9
Polychaeta*		Sabellidae	Sabellidae sp. A	Paddle-footed annelid	0	0	34	95	61	38.0
Polychaeta*		Sabellidae	Sabellidae Type A	Paddle-footed annelid	50	52	0	0	0	20.4
Polychaeta*		Terebellidae	Terebellidae sp. A	Paddle footed annelid	0	0	0	0	11	2.2
Pterioida	Pteriina	Pteriidae	Pinctada sp.	Clam sp.	25	0	0	0	0	5.0
Pteroida		Pteriidae	Pteria colymbus	Atlantic wing-oyster	0	0	1	0	0	0.3
Rhizostomeae	Kolpophorae	Mastigiidae	Phyllorhiza punctata	Jellyfish sp	0	0	0	2	0	0.4
Semaeostomear		Ulmaridae	Aurelia aurita	Moon jelly	0	16	97	272	0	77.0
Stomatopoda		Gonodactylidae	Gonodactylus sp. A	Mantis shrimp sp	196	387	0	4	11	119.6
Stomatopoda		Squillidae	Squilla sp. A	Mantis shrimp sp	0	0	0	0	9	1.7
Total					5030	1176	343	917	2476	1989

Notes:
December 1993 data were not enumerated.
*Class

Exhibit 4. Fish impinged at the Palo Seco CWIS during six sampling event between December 1993 and October 1994. Figure scanned from ENSR (1977).

Table 7-7
Taxonomy of Fish Impinged at Palo Seco
December 1993 to October 1994

					Number per Day						
Order	SubOrder	Family	Genus species	Common Name	Dec-93	Feb-94	Apr-94	Jun-94	Aug-94	Oct-94	Average
Anguilliformes	Anguilloidei	Dysommidae	*Dysomma anguillare*	Shortbelly eel	0	8	0	0	0	0	1.3
			Dysomma sp.	Eel sp	0	0	7	0	0	0	1.2
		Muraenidae	*Echidna catenata*	Chain moray	0	0	0	0	0	20	3.3
			Gymnothorax sp. (lepto.)	Moray sp	12	0	0	0	0	0	2.1
			Muraenidae (lepto.)	Moray sp	0	0	7	0	0	0	1.2
			unid. leptocephalus	Moray sp	4	0	0	0	0	0	0.7
		Ophichthidae	*Myrophis punctatus*	Speckled worm eel	0	23	0	0	0	0	3.8
			Myrophis punctatus (lepto.)	Speckled worm eel	25	0	0	0	0	0	4.1
			Ophichthidae (lepto.)	Snake eel sp	0	23	0	0	0	0	3.8
			Ophicthidae sp. 1	Snake eel sp	0	0	0	3	0	0	0.5
			Ophicthidae sp. 2	Snake eel sp	0	0	0	3	0	0	0.5
			unid. leptocephalus	Snake eel sp	8	0	0	0	0	0	1.3
		Xenocongridae	*Chilorhinus suensoni*	Seagrass eel	0	0	7	0	0	0	1.2
Atheriniformes	Exocoetoidei	Hemiramphidae	*Hemiramphus brasiliensis*	Ballyhoo	8	30	7	9	0	0	9.1
Elopiformes	Elopoidei	Elopidae	*Elops saurus*	Ladyfish	8	0	49	105	324	0	81.1
			Elops saurus (lepto.)	Ladyfish	0	0	16	0	0	0	2.7
			Megalops atlanticus	Tarpon	0	0	0	36	10	0	7.7
Gadiformes	Ophidoidei	Ophidiidae	*Lepophidium profundorum*	Fawn cusk-eel	4	0	0	0	0	0	0.7
Gasterosteiformes	Aulostomoidei	Aulostomidae	*Aulostomus maculatus*	Trumpetfish	0	8	0	0	0	0	1.3
		Fistulariidae	*Fistularia tabacaria*	Bluespotted cornetfish	0	8	0	9	6	0	3.8
	Syngnathoidei	Syngnathidae	*Hippocampus reidi*	Longsnout seahorse	0	0	0	0	2	9	1.8
			Ichthyocampus pawneei	Lost pipefish	0	0	7	0	0	0	1.2
			Syngnathus dunckeri	Pugnose pipefish	4	0	--	0	0	0	0.8
			Syngnathus floridae	Dusky pipefish	0	0	7	0	0	0	1.2
			Syngnathus pelagicus	Sargassum pipefish	0	0	0	0	2	9	1.8
			Syngnathus sp.	Pipefish sp	0	25	0	3	2	0	5.0
Gobiesociformes		Gobiesocidae	*Arcos sp.*	Clingfish sp	0	25	0	0	0	0	4.2
Lophiiformes	Antennaroidei	Antennariidae	*Antennarius multiocellatus*	Longlure frogfish	0	0	0	0	4	0	0.7
Myctophiformes		Synodontidae	*Synodus sp.*	Lizard fish sp	0	0	0	0	0	11	1.8
Perciformes	Acanthuroidei	Acanthuridae	*Acanthurus coeruleus*	Blue tang	8	0	0	0	0	0	1.3
			Acanthurus sp.	Doctorfish sp	0	0	0	0	4	0	0.7
			Acanthurus sp. (juv.)	Doctorfish sp	0	8	7	0	0	--	2.9
	Albuloidei	Albulidae	*Albula vulpes*	Bonefish	0	0	0	63	265	55	63.7
			Albula vulpes (lepto.)	Bonefish	37	247	614	0	0	0	149.7
	Blennoidei	Blenniidae	*Blennius cristatus*	Molly miller	8	0	0	0	0	0	1.3
			Hypleurochilus springeri	Orangespotted blenny	0	8	14	1	0	0	3.8
		Clinidae	*Labrisomus bucciferus*	Puffcheek blenny	0	25	0	0	0	9	5.6
			Labrisomus nuchipinnis	Hairy blenny	0	0	15	0	0	0	2.5
			Malacoctenus sp.	Scaled blenny sp	0	30	0	0	0	0	5.0
			Malacoctenus versicolor	Arfin blenny	12	0	0	0	0	0	2.1
			Paraclinus neorhegmis	Surf blenny	4	0	0	0	0	0	0.7
	Clupoidei	Clupeidae	*Chirocentrodon bleekerianus*	Dogtooth herring	0	25	0	0	0	0	4.2
			Clupeidae (post lar.)	Herrings sp	0	15	0	0	0	0	2.5
			Harengula clupeola	False pilchard	0	0	14	3	10	0	4.5
			Harengula sp.	Sardine sp	0	0	7	126	8	0	23.5
			Jenkinsia lamprotaenia	Dwarf herring	0	61	8	0	2	0	11.8
		Engraulidae	*Anchoa hepsetus*	Striped anchovy	0	0	0	3	0	0	0.5
			Anchoa parva	Little anchovy	0	0	0	0	0	28	4.7
			Anchoa sp.	Anchovy	0	0	0	2,760	637	357	625.7
			Anchoviella perfasciata	Flat anchovy	199	0	0	0	0	0	33.1
			Anchoviella sp.	Anchovy	0	432	224	0	0	0	109.2
			Engraulidae	Anchovy sp	0	33	0	0	0	0	5.4

Exhibit 4. Fish impinged at the Palo Seco CWIS during six sampling event between December 1993 and October 1994. Figure scanned from ENSR (1977).

Table 7-7
Taxonomy of Fish Impinged at Palo Seco
December 1993 to October 1994

Order	SubOrder	Family	Genus species	Common Name	Number per Day						
					Dec-93	Feb-94	Apr-94	Jun-94	Aug-94	Oct-94	Average
	Gobioidei	Gobiidae	*Gobiidae*	Goby sp	0	0	7	0	0	0	1.2
			Microgobius microlepis	Banner goby	4	0	21	0	0	0	4.2
			unid. goby	Goby sp	4	0	0	0	0	0	0.7
			unid. post lar.	Goby sp	4	0	0	0	0	0	0.7
	Mugiloidei	Mugilidae	*Mugil curema*	White mullet	32	23	42	1	2	0	16.7
	Percoidei	Apogonidae	*Apogon maculatus*	Flamefish	0	8	7	0	0	0	2.4
			Apogon sp.	Cardinalfish sp	0	0	0	0	2	0	0.3
			Cheilodipterus affinis	Cardinalfish sp	20	0	28	51	98	0	32.9
		Carangidae	*Alectis ciliaris*	African pompano	0	0	0	9	4	0	2.2
			Carangoides crysos	Crevallies sp	8	0	0	0	0	0	1.4
			Caranx latus	Horse-eye jack	0	0	0	6	0	0	1.0
			Chloroscombrus chrysurus	Atlantic bumper	0	0	0	9	0	11	3.3
			Oligoplites saurus	Leather jack	4	0	14	3	0	9	4.9
			Selene vomer	Lookdown	0	0	0	0	4	0	0.7
			Trachinotus falcatus	Permit	0	15	0	0	0	0	2.5
		Chaetodontidae	*Chaetodon capistratus*	Foureye butterflyfish	0	0	7	0	2	0	1.5
			Chaetodon striatus	Banded butterflyfish	0	0	8	0	0	0	1.3
		Ephippidae	*Chaetodipterus faber*	Atlantic spadefish	0	0	0	3	2	0	0.8
		Gerreidae	*Diapterus rhombeus*	Rhomboid mojarra	0	0	0	27	0	0	4.5
			Diapterus sp.	Mojarras sp	0	0	0	0	4	0	0.7
			Eucinostomus argenteus	Spotfin mojarra	0	0	0	0	31	0	5.1
			Eucinostomus sp.	Mojarra sp.	0	129	175	120	51	0	79.2
		Haemulidae	*Haemulon aurolineatum*	Tomtate	0	0	7	0	0	0	1.2
		Labridae	*Doratonotus megalepis*	Dwarf wrasse	4	0	0	3	0	11	3.0
		Lutjanidae	*Lutjanus analis*	Mutton snapper	4	0	0	0	0	0	0.7
			Lutjanus griseus	Gray snapper	0	0	0	3	0	0	0.5
			Lutjanus sp.	Snapper sp	0	0	14	3	8	–	5.0
			Ocyurus chrysurus	Yellowtail snapper	0	0	7	0	0	0	1.2
		Pempherididae	*Pempheris schomburgki*	Glassy sweeper	0	0	7	0	0	0	1.2
		Pomacentridae	*Abudefduf saxatilis*	Sergeant major	0	0	8	0	0	9	2.8
			Stegastes dorsopunicans	Damselfish sp	0	0	0	0	0	11	1.8
			Stegastes sp.	Damselfish sp	0	15	0	0	0	0	2.5
		Scaridae	*Scarus sp.*	Parrotfish sp	0	25	0	0	0	0	4.2
			Sparisoma sp.	Parrotfish sp	0	40	0	0	6	22	11.4
			Sparisoma sp. (juv.)	Parrotfish sp	0	75	0	0	0	0	12.5
		Sciaenidae	*Bairdiella ronchus*	Ground croaker	0	15	0	0	0	9	4.0
			Larimus breviceps	Shorthead drum	0	0	0	3	0	0	0.5
			Larimus breviceps (post lar.)	Shorthead drum	4	0	0	0	0	0	0.7
			Odontoscion dentex	Reef croaker	0	194	0	0	2	9	34.1
			Serranidae	Sea bass sp	0	8	0	0	0	0	1.3
		Sparidae	*Calamus sp.*	Porgy sp	0	8	0	0	0	0	1.3
			Sparidae sp.		0	0	77	0	0	0	12.8
	Polynemoidei	Polynemidae	*Polydactylus virginicus*	Barbu	0	15	0	6	0	0	3.5
	Scombroidei	Trichiuridae	*Trichiurus lepturus*	Atlantic cutlassfish	0	8	0	6	19	0	5.4
	Sphyraenoidei	Sphyraenidae	*Sphyraena barracuda*	Great barracuda	0	0	0	0	10	0	1.7
Pleuronectiformes	Pleuronectoidei	Bothidae	*Bothus ocellatus*	Eyed flounder	0	0	7	0	0	0	1.2
			Bothus sp.	Flounder sp	0	15	28	0	0	0	7.2
			Bothus sp. (post lar.)	Flounder sp	8	0	0	0	0	0	1.4
			Citharichthys arenaceus	Sand wiff	0	0	0	0	0	11	1.8
			Citharichthys sp.	Sanddab	0	0	50	0	0	0	8.3
			Citharichthys spilopterus	Bay whiff	0	0	0	0	2	0	0.3
			Paralichthys sp. (post lar.)	Summer flounder sp	4	0	0	0	0	0	0.7
	Soleoidei	Achiridae	*Achirus lineatus*	Lined sole	4	0	0	0	0	0	0.7
		Cynoglossidae	*Symphurus sp.*	Tonguefish sp	0	8	0	0	0	0	1.3
Scorpaeniformes	Scorpaenoidei	Scorpaenidae	*Scorpaena sp.*	Scorpionfish sp	0	8	0	0	0	0	1.3
			Scorpaena sp. (post lar.)	Scorpionfish sp	4	0	0	0	0	0	0.7

Exhibit 4. Fish impinged at the Palo Seco CWIS during six sampling event between December 1993 and October 1994. Figure scanned from ENSR (1977).

Table 7-7
Taxonomy of Fish Impinged at Palo Seco
December 1993 to October 1994

					Number per Day						
Order	SubOrder	Family	Genus species	Common Name	Dec-93	Feb-94	Apr-94	Jun-94	Aug-94	Oct-94	Average
Tetraodontiformes	Balistoidei	Balistidae	*Cantherhines pullus (post lar.)*	Tail-light filefish	4	0	0	0	0	0	0.7
		Ostraciidae	*Lactophrys triqueter*	Smooth trunkfish	0	0	0	0	2	0	0.4
	Tetraodontoidei	Diodontidae	*Diodon holacanthus*	Balloonfish	0	0	0	3	0	0	0.5
		Tetraodontidae	*Canthigaster rostrata*	Sharpnose puffer	20	98	21	6	14	112	45.2
			Chilomycterus sp.	Burrfish sp	0	0	0	0	0	0	0.0
			Sphoeroides greeleyi	Caribbean puffer	0	8	0	3	0	0	1.8
			Sphoeroides sp.	Puffer sp	0	0	8	0	18	33	9.9
			Sphoeroides spengleri	Bandtail puffer	0	33	0	0	0	0	5.4
			Sphoeroides testudineus	Checkered puffer	0	15	0	3	0	0	3.0
Total					476	1,790	1,551	3,392	1,562	743	1,587.1

Exhibit 5. Daily and annual impingement rates for invertebrates collected during 1994 surveys at the Palo Seco CWIS. Figure scanned from ENSR (1977)

SIO Common Name	Average Daily Impingement Rate[1]	Calculated Annual Impingement Rate[2,3]	Annual Adult Equivalent Loss Rate[4]
Copepods	0	0	0
Slate-pencil urchin	0	0	0
Blue crab	7[1]	630[3]	63
All swimming crabs	458.6	167,000	16,700
Pink shrimp	162.4	59,000	5900
All penaeid shrimps	258.4	94,000	9400
Spiny lobster	34.4	12,500	1250
Stomatopoda	121.3	44,300	-
Misc polychaete annelids	197.5	72,000	-

1 Impingement rates for species that show strong periodicity of occurrence are based on actual impingement data rather than on average impingement rates. Strong periodicity would occur if the species was collected in three or fewer collection events.

2 Unless otherwise noted, annual impingement rates are the average daily impingement rate multiplied by 365 days per year.

3 Estimates of annual impingement for species showing strong periodicity are calculated assuming that the animals will be on site the month prior to, the month following, and the period during which they were collected at the power plant. For example, for a species with a single occurrence, the impingement datum would be multiplied by 90, i.e. 3 months times 30 days per month.

4 Calculated assuming a larvae/juvenile to adult survival rate of 10%.

Exhibit 6. Number of invertebrates impinged per day during 1994 surveys at the Palo Seco CWIS. Figure scanned from ENSR (1977).

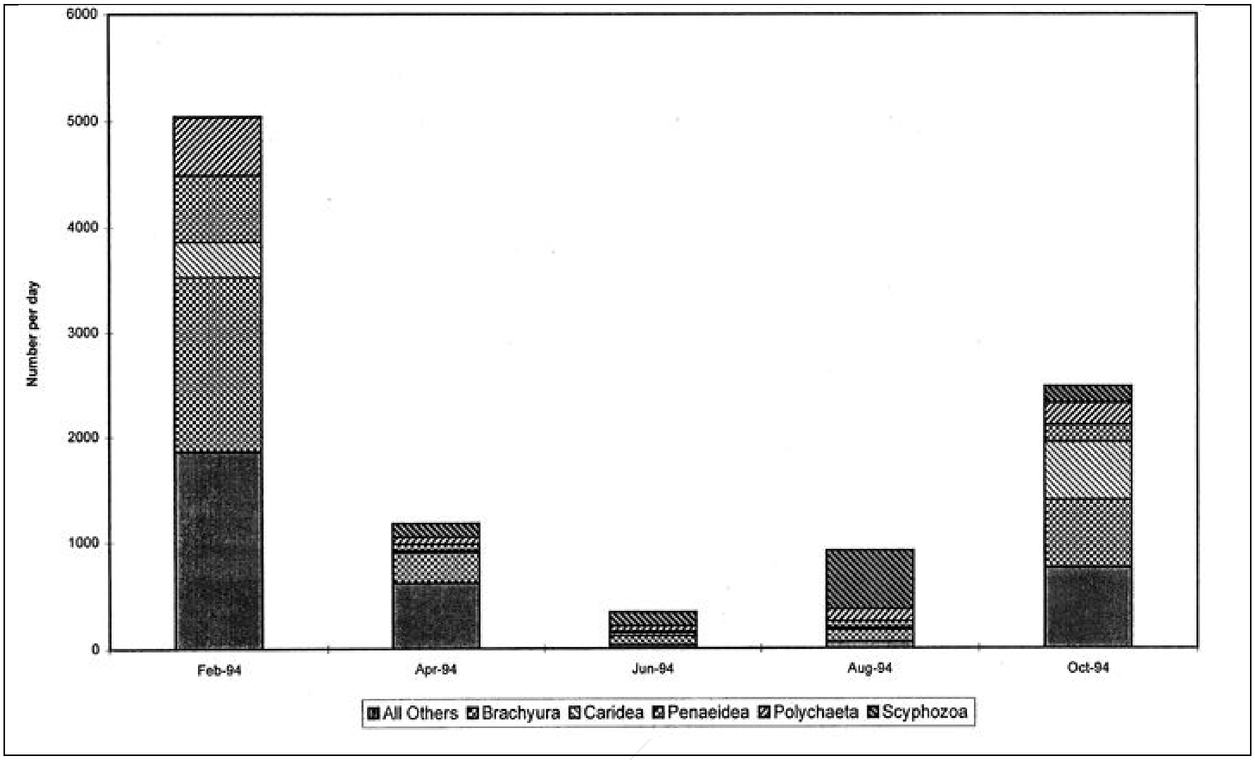


Exhibit 7. Daily and annual impingement rates for fishes collected during 1993-1994 surveys at the Palo Seco CWIS. Figure scanned from ENSR (1977).

SIO Common Name	Average Daily Impingement Rate[1]	Calculated Annual Impingement Rate[2,3]	Annual Adult Equivalent Loss Rate[7]
Atlantic thread herring[4]	15[1]	1350[3]	147
All Clupeidae	46.5	17,000	1853
Lane snapper[4]	5	1,825	18
All Lutjanidae	7.4	2,700	27
Dusky anchovy[4]	625.7[1]	265,000	28,885
All Engraulidae	778.8	284,000	30,956
Spotfin mojarra[5]	84.3	30,800	308
All Gerreidae	89.4	32,600	326
Crevalle jack	0	0	0
All Carangidae	16	5,800	58
Ladyfish	83.8	30,600	306
All Elopidae	91.5	33,400	334
Stoplight parrotfish	23.9	2,400[3]	24
All Scaridae	28.1[1]	2,800[3]	28
Foureye butterflyfish	1.5[1]	315[3]	4
All Chaetodontidae	2.8[1]	588[3]	6
Bone fish	213.5	78,000	780
Cardinal fish	36.9	50,000	500

1 Impingement rates for species that show strong periodicity of occurence are based on actual impingement data rather than on average impingement rates. Strong periodicity would occur if the species was collected in three or fewer collection events.

2 Unless otherwise noted, annual impingement rates are the average daily impingement rate multiplied by 365 days per year.

3 Estimates of annual impingement for species showing strong periodicity are calculated assuming that the animals will be on site the month prior to, the month following, and the period during which they were collected at the power plant. For example, for a species with a single occurrence, the impingement datum would be multiplied by 90, i.e. 3 months times 30 days per month.

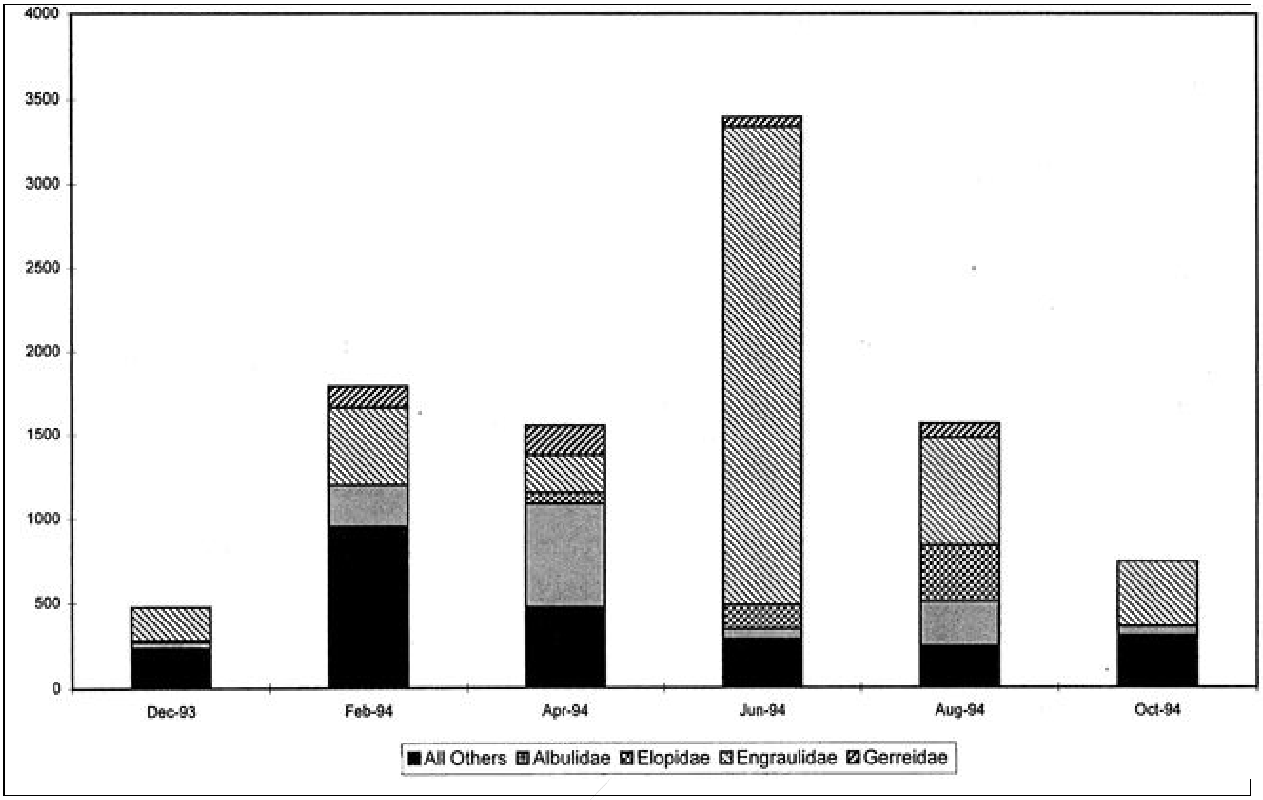
4 Atlantic thread herring, lane snapper, dusky anchovy did not occur, however, individuals of the same genus but not identified to species were included to be conservative.

5 Eucinostomus argenteus and Eucinostomus sp. were included in the estimate for spotfin mojarra to be conservative.

6 Since no Sarisoma viride were collected, Sparisoma sp. were included in the estimate for stoplight parrotfish to be conservative. Because individuals were collected at two times during the year, an annual average was used to calculate annual impingement rates.

7. Calculated assuming a survival rate from larvae/juvenile to adults of 1%. Clupidae and engraulidae estimates assumed that 10% of impinged were adults.

Exhibit 8. Number of fish impinged per day during 1994 surveys at the Palo Seco CWIS. Figure scanned from ENSR (1977).



Survival estimates were not available for fish or invertebrates impinged on PSPPC screens; however, considering screenwash conditions and the physical design of the fish conveyance/return system, survival is expected to be low. Impingement sampling was only conducted for one year and had a limited number of samples, suggesting that impingement impacts may not have been fully characterized.

3.1.2 Current Data

A contemporary impingement survey was conducted from August 2010 through June 2011 using a total of six bi-monthly sampling events during daytime (1300 to 1700) and nighttime (2000 to 2400) periods (PREPA 2012). Samples were collected from Units 3 and 4 using a 1/16-inch mesh bags attached to the fish return of each screen. Collections were made approximately every 20 minutes. All fish, brachyuran crabs, penaeid shrimp and spiny lobsters were sorted, identified, and assessed as live, dead, or injured. A subset of 30 individuals from each taxonomic group were weighed (grams) and measured (millimeters). With exception to larval fish, which were retained and preserved with formalin for laboratory identification, all specimens were returned to the fish return sluiceway.

A total of 3,119 fish and shellfish comprising 38 families were collected over the course of the study, ranging from 3 specimens collected in February to 1,397 specimens in June (mean = 260 specimens per sample period) (Exhibit 9). Engraulidae (anchovies) and Clupeidae (herrings, sardines, and shad) were most commonly encountered, representing 85 percent (2,657 individuals) of impinged specimens. Species of the families Tetraodontidae (puffers), Albulidae (bonefish), and Gerreidae (mojarras) were the next most commonly collected fishes, with 49, 46, and 41 specimens, respectively. The vast majority of impinged specimens were juveniles, as approximately 93 percent of fish were less than 60mm in length (mean = 35.7mm) and 81 percent of shellfish were less than 30mm (mean = 21.2mm; carapace length) (Exhibit 10).

Survival of impinged specimens, excluding larval fish, was 28 percent. Survival of larval fish was reported as follows: “Virtually no larval fish collected during the impingement study survived the collection and sortation process.” Thus, it is assumed larval survival is zero. The rate of impingement among species common to both the 1993/94 and 2010/11 studies was compared using a nonparametric Wilcoxin Signed Ranks Test. All comparisons (fish impingement, shellfish impingement, and total impingement) were not significant at $p = 0.05$ and, thus, indicate no change between current and historic sampling efforts.

Exhibit 9. Summary of the number of fish and shellfish impinged per sampling period at the Palo Seco Power Plant (2010-2011). Figure scanned from PREPA (2012).

Family	Group	August Day	August Night	October Day	October Night	December Day	December Night	February Day	February Night	April Day	April Night	June Day	June Night	Grand Total
Fish														
Acanthuridae	Surgeonfishes			1	1	1								3
Achiridae	American soles												1	1
Albulidae	Bonefishes, Ladyfishes		2		13	1	4			7	14		5	46
Apogonidae	Cardinalfishes				1	1								2
Belonidae	Needlefish				1						1			2
Blenniidae	Blennies	1	3						1					5
Bothidae	Lefteyed Flounders		2				2				6	3		13
Carangidae	Jacks, Pompanos		3	1			2				1	2	13	22
Clupeidae	Herring, Sardines, Shad	169	103	3	12	2					12	165	268	734
Elopidae	Ladyfish, Tarpon	2	2				6							10
Engraulidae	Anchovies		219	20	84		52				17	463	1,068	1,923
Fistulariidae	Cornetfishes										1			1
Gerreidae	Mojarras		2		2	1	30			1	2	3		41
Gobiidae	Gobies	2	6											8
Haemulidae	Grunts		2	1	1	1						2		7
Hemiramphidae	Halfbeaks				3		8				4		1	16
Lutjanidae	Snappers									2	4			6
Microdesmidae	Dartfishes, Wormfishes											1		1
Mugilidae	Mullets		16				6					2		24
Muraenidae	Eels		2										4	6
Ostraciidae	Boxfishes, Trunkfishes						2		1					3
Polynemidae	Threadfins				1	1						25		27
Pomacentridae	Damselfishes, Sergents											2		2
Pristigasteridae	Longfin herrings											1		1
Scaridae	Parrotfishes						2			3	1			6
Sciaenidae	Croakers, Drums			2										2
Scorpaenidae	Rockfishes, Scorpionfishes							1	1					2
Sparidae	Porgies						2							2
Sphyraenidae	Barracudas				2		2				3	1	2	10
Sygnathidae	Seahorses, Pipefish				2				1					3
Synodontidae	Lizardfishes				1		2							3
Tetraodontidae	Puffers, Blowfishes	2	3	7	2		10	1	1	5	12		6	49
Unidentfied	Unidentfied						6							6
Cephalopods														
Cephalopoda	Cuddlefish and Squid								1	1				2
Shellfish														
Calappidae	Box Crabs										1			1
Palinuridae	Spiny Lobsters	2	2	1	4						2	1		12
Penaeidae	Penaeid Shrimps		1		1								10	12
Portunidae	Swimming Crabs	1	11	8	19			1	3	12	30		19	104
Xanthidae	Mud Crabs	1												1
Grand Total		180	379	44	150	8	136	3	9	31	111	671	1,397	3,119

Exhibit 9. Summary of the number of fish and shellfish impinged per sampling period at the Palo Seco Power Plant (2010-2011). Figure scanned from PREPA (2012).

Exhibit 10. Length summary for impinged organisms at the Palo Seco Power Plant (2010-2011). Figure scanned from PREPA (2012).

Exhibit 9. Summary of the number of fish and shellfish impinged per sampling period at the Palo Seco Power Plant (2010-2011). Figure scanned from PREPA (2012).

	Bin Minimum	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	100	105	115	125	130	140	170	400
	Bin Maximum	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	105	110	120	130	135	145	175	500
Fish																											
Acanthuridae	Surgeonfishes			1													1										
Achiridae	American soles																							1			
Albulidae	Bonefishes, Ladyfishes									2	6	10															
Apogonidae	Cardinalfishes					1																					
Belonidae	Needlefish																				1	1					
Blenniidae	Blennies									1						1								1			
Bothidae	Lefteyed Flounders		2	1	3	1			1	1																	
Carangidae	Jacks, Pompanos			2	1		1	1	7	5		1															
Clupeidae	Herring, Sardines, Shad			4	10	19	14	4		1										1	2		1				
Elopidae	Ladyfish, Tarpon																										
Engraulidae	Anchovies			1	19	18	24	22	16	7	2	4	5														
Fistulariidae	Cornetfishes																					1					
Gerreidae	Mojarras			4		2	1																				
Gobiidae	Gobies																										
Haemulidae	Grunts			1	1		1																				
Hemiramphidae	Halfbeaks						3		1			1			2										1		
Lutjanidae	Snappers						3	3																			
Microdesmidae	Dartfishes, Wormfishes			1																							
Mugilidae	Mullets					2																					
Muraenidae	Eels													1		1		1								1	
Ostraciidae	Boxfishes, Trunkfishes		1																								
Polynemidae	Threadfins		4	14		6	1																				
Pomacentridae	Damselfishes, Sergents					1		1																			
Pristigasteridae	Longfin herrings																		1								
Scaridae	Parrotfishes					3			1																		
Sciaenidae	Croakers, Drums									2																	
Scorpaenidae	Rockfishes, Scorpionfishes						1																	1			
Sparidae	Porgies																										
Sphyraenidae	Barracudas					1	3						1														3
Sygnathidae	Seahorses, Pipefish									1	1	1															
Synodontidae	Lizardfishes																										
Tetraodontidae	Puffers, Blowfishes		7	2	10	13	2	1			1	1															
Unidentfied	Unidentfied																										
	Fish Subtotal		14	31	44	67	54	32	26	20	10	18	6	1	2	2	1	1	1	1	3	2	1	3	1	1	3
Cephalopods																											
Cephalopoda	Cuddlefish and Squid						1			1																	
Shellfish																											
Calappidae	Box Crabs			1																							
Palinuridae	Spiny Lobsters		8	2																							
Penaeidae	Penaeid Shrimps		1	2	1	4	2		2																		
Portunidae	Swimming Crabs	2	13	25	21	12	5	3	3	5	5	1	2							2							
Xanthidae	Mud Crabs					1																					
	Shellfish Subtotal	2	22	30	22	17	7	3	5	5	5	1	2							2							
	Grand Total	2	36	61	66	84	62	35	31	26	15	19	8	1	2	2	1	1	1	3	3	2	1	3	1	1	3

3.1.3 Impingement Overview

Fish community and impingement data presented in the aforementioned studies have limited applicability at PSPPC. Fisheries studies of Ensenada de Boca Vieja and San Juan Bay were last conducted between 1973 and 1994, thus providing composition and abundance information that is, at a minimum, nearly 20 years old. These data, while valuable for comparative purposes with more contemporary community surveys, are inappropriate in reference to quantifying the effect of impingement mortality. Similarly, the documentation of rare, threatened, and endangered species only relies on incidental catches during these early studies.

Impingement mortality, as reported in PREPA (2012), is 100 percent for larval fish and 78 percent for all organisms, excluding larval fish. The authors suggest initial survival is likely to be higher under normal operating conditions, but fail to provide evidence to support that assertion. Sampling or handling mortality is not quantified, nor is there any information on latent mortality of impinged organisms. Similarly, the fish return system, in which screen wash is collected in a trough and sluiced to a common discharge point through the cooling water discharge line, exposes fish to wide temperature fluctuations and displaces them (via the Bayamon River) from of Ensenada de Boca Vieja to San Juan Bay.

3.2 Entrainment

3.2.1 Historic Data

Historical entrainment data were available from October 1993 through November 1994, and were collected as part of PSPPC's 316(a) and (b) demonstration studies (ENSR 1997). Taxonomic composition, abundance, and temporal/spatial patterns were based on results from monthly (day and night) sampling events at the intake and outfall. Entrainment samples were collected by deploying a 0.5-meter diameter plankton net and allowing it to drift into the intake structure. Triplicate samples were collected using 202-micron mesh nets and a single sample was collected with a 50-micron mesh net during daylight and dark hours on each of the sampling event dates. Each deployment involved suspension of the net for 2-10 minutes near the center of the channel and below the water surface. All entrained organisms were identified to the lowest feasible taxon (e.g., ichthyoplankton were generally identified to family level) and were reported as densities per 100 cubic meters of water.

Results showed that fish egg and larval densities were highest at night in Ensenada de Boca Vieja source waters, with a maximum taxa richness value (for fish larvae in the bay) of 34 species. Over 50 larval fish taxa were collected in PSPPC entrainment nets (202- and 500-µm mesh) (Exhibit 11). Consistent with results from the source water, egg and larval densities were highest at night (Exhibit 12). Maximum entrainment densities ranged from 1,881 eggs per 100 cubic meters in day samples, to 9,890 eggs per 100 cubic meters during dark hours. Densities for pre-flexion larvae ranged from $17/100m^3$ to $412/100m^3$ in day samples, and from $26/100^3$ to $1,555/100^3$ in night samples. Post-flexion larval densities ranged from $0/100^3$ to $49/100^3$, and $10/100^3$ to $556/100^3$ in day and night samples, respectively. Both pre- and post-flexion larvae were dominated by gobies (Gobidae), herrings and sardines (Clupeiformes), and anchovies (Engraulidae). ENSR (1997) constructed an entrainment model and calculated equivalent adult losses based on ichthyoplankton survey results. The equivalent adult model predicted losses of 1.01 million anchovies, 95,000 gobies, and 51 jacks due to entrainment through PSPPC's CWIS.[4]

[4] The 316(b) Phase II rule used an adult equivalent model to calculate impingement and entrainment losses from the operation of CWISs. See 69 FR 41655.

Exhibit 11. List of larval fish taxa collected from the Palo Seco Power Plant intake, outfall, and source waters during 1993-1994 surveys. Figure scanned from ENSR (1997).

Taxon	Zone A	Zone B	Zone C	Zone D	Zone E	Palo Seco Intake	Palo Seco Outfall
Acanthuridae							
Acanthurus bahianus							x
Achiridae		x	x		x	x	x
Achirus lineatus						x	
Albulidae							
Albula vulpes						x	
Atherinidae				x	x	x	
Belonidae					x	x	
Blenniidae		x	x	x	x	x	x
Blenniini sp.				x			
Bothidae					x		x
Bothus sp.							x
Citharicththys sp.				x		x	
Carangidae		x	x	x	x	x	
Caranx sp.					x		
Oligoplites saurus				x	x		
Oligoplites sp.				x			
Centropomidae			x				
Clinidae		x					
Starksia sp.					x		
Clupeiformes	x	x	x	x	x	x	x
Clupeidae		x				x	x
Engraulidae	x	x	x	x	x	x	x
Anchoviella sp.						x	
Corphaenidae							
Coryphaena hippurus					x		
Cynoglossidae						x	
Elopidae				x	x		
Elops saurus							x
Megalops atlanticus		x					
Ephippidae							
Chaetodipterus faber					x	x	
Gerreidae	x	x	x			x	x
Eucinostomus sp.			x	x	x	x	x
Gobiidae	x	x	x	x	x	x	x
Bathygobius soporator			x	x	x		x
Gobiesocidae							x
GobiidaeType 1		x		x	x	x	x
GobiidaeType 2						x	x
GobiidaeType 3		x				x	x
Gobionellus sp.		x	x	x	x	x	x
Gobionellus sp. Type 1							x
Gobiosoma sp.						x	
Gobiosoma sp.Type 1						x	
Gobiosoma sp.Type 2						x	
Gobiosoma sp.Type 3						x	
Microgobius sp.	x						
Gonostomatidae					x		
Haemulidae			x				x

Exhibit 11. List of larval fish taxa collected from the Palo Seco Power Plant intake, outfall, and source waters during 1993-1994 surveys. Figure scanned from ENSR (1997).

Taxon	Zone A	Zone B	Zone C	Zone D	Zone E	Palo Seco Intake	Palo Seco Outfall
Hemiramphidae		x	x	x	x	x	x
Holocentridae		x			x		
Labridae						x	
Lutjanidae							
Lutjanus synagris						x	
Microdesmidae	x	x	x	x	x	x	x
Monacanthidae				x		x	
Mugilidae							x
Ophichthidae						x	
Opistognathidae					x		x
Polynemidae							
Polydactylus virginicus					x		
Scaridae			x			x	x
Sciaenidae	x	x	x	x	x	x	x
Bairdiella ronchus						x	
Scombridae		x	x		x		
Sparidae			x				
Calamus sp.						x	
Syngnathidae		x	x	x	x	x	x
Syngnathus sp.		x	x	x	x	x	
Sphyraenidae							
Oostethus lineatus				x			
Sphyraena barracuda				x		x	
Tetraodontidae		x	x	x	x	x	x
Sphoeroides sp.	x	x	x	x	x	x	x
Tripterygiidae		x	x	x	x	x	x
Xenocongridae							x
Unidentified	x	x	x	x	x	x	x

Exhibit 12. Entrainment densities (number per 100m³ for taxa collected during day and night sampling events at the Palo Seco CWIS October 1993 – November 1994 surveys. Figure scanned from ENSR (1997).

Non-RIS Taxa	Average Daytime Intake Density (ind/100m³)	Average Nighttime Intake Density (ind/100m³)	Average Daily Intake Density (ind/100m³)
Total Holoplankton	265,130	354,010	309,570
Total Meroplankton	52,790	89,990	71,390
Total Fish Eggs	677.4	1,864.1	1,270.8
Total Larvae	112.7	453.4	283.1
Gobies (Gobiidae)	28.4	128.7	78.6
SIO TAXA			
Calanoid Copepods	179,500	240,110	209,810
Spiny Lobster (*Panulirus argus*)	0	0	
Blue Crab (*Callinectes Sapidus*)	19.3	30.4	24.9
Shrimp (Panaeid and Caridean spp.)	86.2	234.5	160.4
Herrings (Clupeidae)	11.1	39.6	25.4
Snappers (Lutjanidae)	0.1	00	0.05
Anchovies (Engraulidae)	15.3	35.9	25.6
Mojarras (Gerreidae)	0	2.6	1.3
Jacks (Carangidae)	0	0.8	0.4
Tarpon (Elopidae)	0	0	0
Parrotfish (Scaridae)	0	2.1	1.1
Squirrelfish (Holocentridae)	0	0	0

Note 1: Includes Pre-flexion densities for unidentified Clupeiformes

The temporal distribution of fish egg abundance in entrainment samples indicates a nearly continuous pattern of fish reproduction/spawning in Ensenada de Boca Vieja (Exhibits 13 and 14). Monitoring results also demonstrated continuous temporal presence of fish larvae throughout the study period.

Exhibit 13. Abundance and temporal distribution of fish eggs and larvae collected (using 202µm mesh nets) during October 1993 – November 1994 entrainment surveys at the Palo Seco CWIS and outfall. Figure scanned from ENSR (1997).

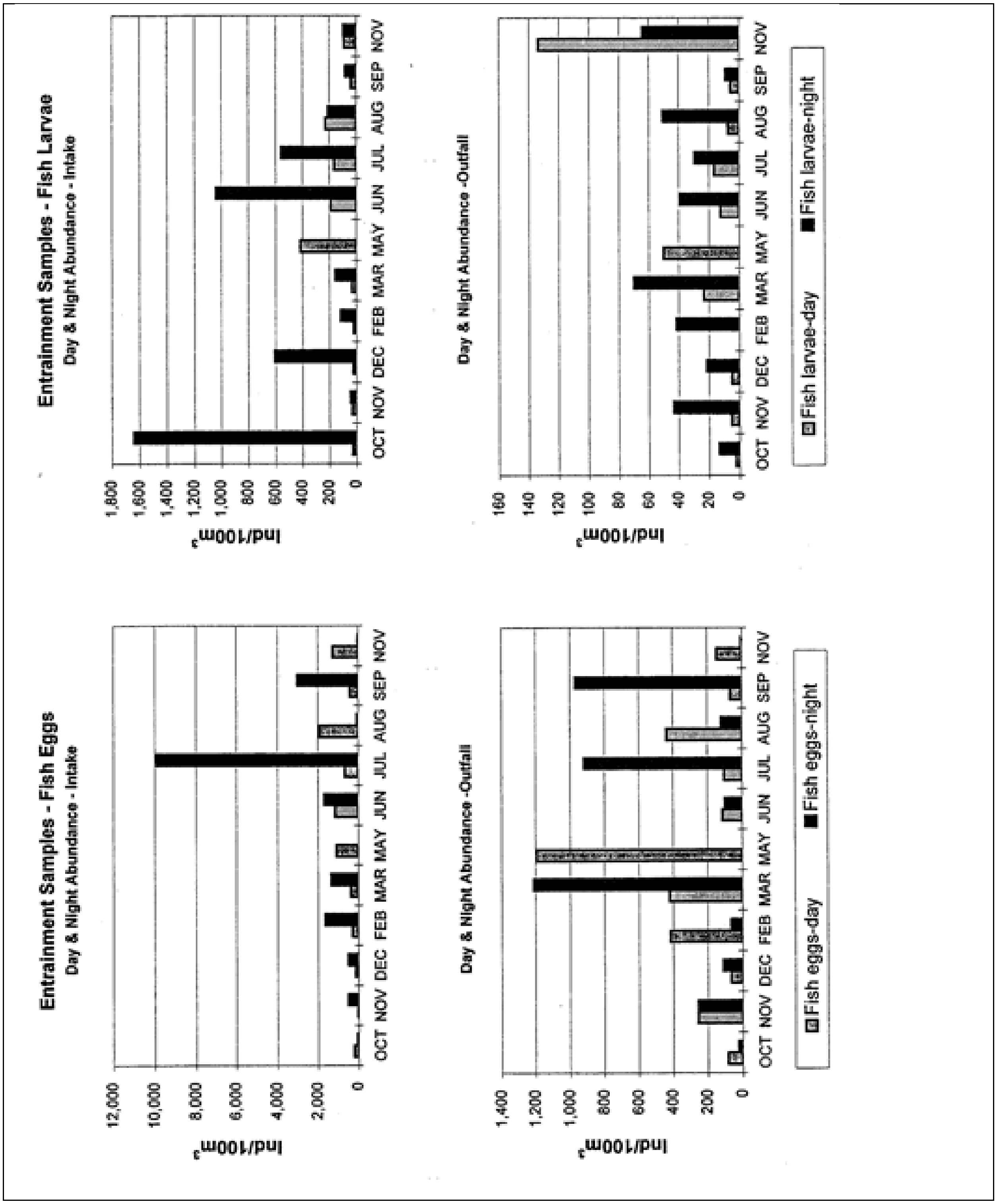
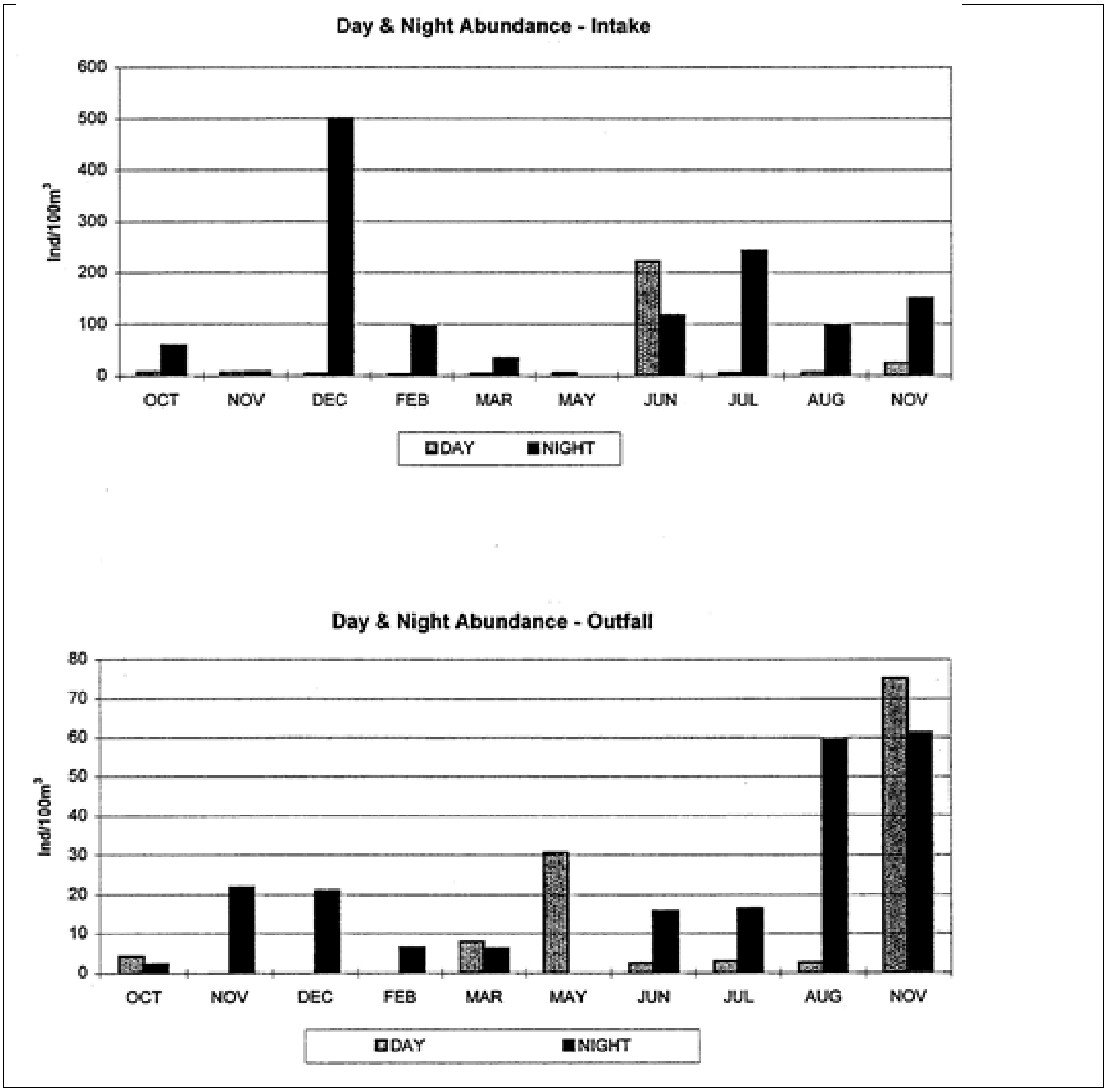


Exhibit 14. Abundance and temporal distribution of fish eggs and larvae collected (using 500µm mesh nets) during October 1993 – November 1994 entrainment surveys at the Palo Seco CWIS and outfall. Figure scanned from ENSR (1997).



3.2.2 Current Data

Paired entrainment samples (202µm and 500µm , 0.5-meter diameter plankton nets) were collected simultaneously in front of the travelling screens (intake location) and at Outfall 001 (discharge location) during daytime (1300 to 1700) and nighttime (2000 to 2400) periods from August 2010 through June 2011. Nets were deployed at each sampling location until the target filtered volume (100 m^3) was achieved. The entrained specimens were retained for laboratory identification to the lowest practicable taxonomic level and preserved using 10 percent buffered formalin. A total of 16 duplicate samples were collected and split evenly by mesh size and between the two sampling locations (i.e., 4 samples by mesh size and location).

A total of 14 larval fish taxa were identified during entrainment sampling, with larvae most often represented by Clupeaformes and Gobiidae at the intake and Engraulidae, Clupeaformes and Gobiidae at the discharge (see Exhibits 15 and 16). Density of entrained individuals was generally higher during nighttime sampling at both locations, regardless of mesh size. However, with exception of daytime samples collected with 500µm nets, intake densities were greater than those collected at the discharge. Conversely, those individuals collected at the intake averaged 7.0mm compared to those from the discharge at 7.9mm (see Exhibit 17).

Fourteen (14) duplicate samples were available for analysis due to the loss of two samples during processing. Results indicate high variability between primary and duplicate sample pairs, with densities varying from +274 percent to -100 percent. The mean difference among samples was 5 percent.

Entrainment data from the 2012 study were compared to 1993/94 data using a nonparametric Wilcoxin Signed Ranks Test. Analyses were limited to taxa common to both studies and to those samples collected during February, March, April, June, August, October, and December. Results indicate that 5 of 8 comparisons were significantly different; however, there were discrepancies regarding which study returned higher densities. Historic densities were higher for the 202µm collections for daytime samples at both sampling locations and during nighttime collections at the discharge. The current study densities were significantly higher for the 500µm collections at only the discharge location for both day and night sampling.

Exhibit 15. Entrainment at the intake (top table) and discharge (bottom table) locations using 202µm mesh nets (ind./100m^3) at the Palo Seco Power Plant. Figure scanned from PREPA (2012).

	August		October		December		February		April		June		
Taxon	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Average
Fish Eggs			16	494	98	3,419		61	43	100	131	170	378
Aulostomus maculatus								2					0.17
Bothidae				1									0.08
Brachyura			26	89	88	434		2,349	28	21	10	43	257
Carangidae											4	21	2.1
Clupeiformes		361		5	2			8	1	2			32
Engraulidae											4	63	5.6
Gerreidae		5											0.42
Gobiidae	36	748		7		12		36				18	71
Hemiramphidae					2	4							0.50
Labridae				1									0.08
Panulirus sp.		31											2.6
Scorpaenidae								2					0.17
Unidentified larvae				4								15	1.6
Unidentified yolk-sac larvae		33				4		2,129	2	3			181
Total Sample Density	36	1,178	42	601	190	3,873	0	4,587	74	126	149	330	
Average Density of All Samples													932
Average Density of Day Samples													82
Average Density of Night Samples													1,783

	August		October		December		February		April		June		
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Average
Fish Eggs				97		474		178	49	42	141	173	96
Brachyura	2		3	29	62	44	19		48	46	23	12	24
Carangidae												4	0.33
Clupeiformes	38	3			1					1			3.6
Engraulidae											4	24	2.3
Gerreidae		1									4		0.42
Gobiidae	28	3		4								4	3.3
Labridae				1									0.08
Scaridae						1							0.08
Unidentified larvae												12	1.0
Unidentified yolk-sac larvae	6				1	2				3			1.0
Total Sample Density	74	7	3	131	64	521	19	178	97	92	172	229	
Average Density of All Samples													132
Average Density of Day Samples													72
Average Density of Night Samples													193

Exhibit 16. Entrainment at the intake (top table) and discharge (bottom table) locations using 500µm mesh nets (ind./100m^3) at the Palo Seco Power Plant. Figure scanned from PREPA (2012).

	August		October		December		February		April		June		
Taxon	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Average
Fish Eggs		108	223	102	18	1,541	37	13	44	27		286	200
Blenniidae												6	6.0
Bothidae		5											5.0
Brachyura		26	104	51	15	113	8	1	13	11	4	48	36
Carangidae											4	58	31
Clupeiformes	21	507		2		4		2		1			90
Engraulidae											20	129	75
Gerreidae		5										4	4.5
Gobiidae	15	494	1	24		1		7		1		38	73
Muraenidae		5											5.0
Panulirus sp.		82											82
Scaridae								1					1.0
Syngnathidae			2										2.0
Unidentified larvae			1	2								8	3.7
Unidentified yolk-sac larvae		13			2								7.5
Total Sample Density	36	1,245	331	181	35	1,659	45	24	57	40	28	577	
Average Density of All Samples													355
Average Density of Day Samples													89
Average Density of Night Samples													621

	August		October		December		February		April		June		
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Average
Fish Eggs			68		73	343	19	20	53	98	495	214	115
Brachyura			55	47		25	6		5	24	5	5	14
Carangidae											2	6	0.67
Clupeidae												2	0.17
Clupeiformes	26	30	2										4.8
Engraulidae											8	32	3.3
Gerreidae										1			0.08
Gobiidae	5	27		7		2			2	2	3	4	4.3
Scaridae						1							0.08
Unidentified larvae												8	0.67
Unidentified yolk-sac larvae									2				0.17
Blenniidae							1						0.08
Total Sample Density	31	57	125	54	73	371	26	20	62	125	513	271	
Average Density of All Samples													144
Average Density of Day Samples													138
Average Density of Night Samples													150

Exhibit 17. Entrainment fish length summaries for total samples (top table), discharge only (middle table) and intake only (bottom table) locations at the Palo Seco Power Plant. Figure scanned from PREPA (2012).

Total Entrainment	Bin Minimum (mm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	31	57
	Bin Maximum (mm)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	32	58
Taxon	Common Name																				
Aulostomus maculatus	Trumpetfish								1												
Blenniidae	Blennies					1			1	1	1										
Bothidae	Lefteye Flounders								1											1	
Carangidae	Jacks and Pompanos	2	7	12	24	7	1														
Clupeidae	Herrings, shads and sardines																		1		
Clupeiformes	Anchovies and Sardines	1	6	12	18	14	19	27	22	17	15	15	3	2	3		1	1			
Elopidae	Ladyfishes										1										
Engraulidae	Anchovies		1	1		3	11	22	13	13	8	7	4	1	6		2	1	1		
Gerreidae	Mojarras			1			1		1	1		1		2							
Gobiidae	Gobies	2	14	23	18	12	11	46	32	20	14	20	4	4	1	1		2	2		
Hemiramphidae	Halfbeaks	1		1	1																
Labridae	Parrotfish and Wrasses								1	1											
Muraenidae	Eels																				1
Scaridae	Parrotfishes									2	1										
Scorpaenidae	Scorpionfishes						1														
Syngnathidae	Seahorse and Pipefish									1							1				
Unidentified larvae	Unidentified larvae	16	4	1						1											
Unidentified yolk-sac larvae	Unidentified yolk-sac larvae	32	11	2																	
	Totals	54	43	53	61	37	44	95	72	57	40	43	11	9	10	1	4	4	4	1	1
Abundance Weighted Average	7.3																				

Discharge Entrainment Samples	Bin Minimum (mm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	31	57
	Bin Maximum (mm)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	32	58
Taxon	Common Name																				
Aulostomus maculatus	Trumpetfish																				
Blenniidae	Blennies					1															
Bothidae	Lefteye Flounders																			1	
Carangidae	Jacks and Pompanos		1	2	2		1														
Clupeidae	Herrings, shads and sardines																		1		
Clupeiformes	Anchovies and Sardines	1	2	6	6	6	8	14	9	6	8	8	1	2	3		1	1			
Elopidae	Ladyfishes										1										
Engraulidae	Anchovies			1		1	4	6	5	4	3	2	2		1		1		1		
Gerreidae	Mojarras											1		2							
Gobiidae	Gobies		4	6	6	9	4	14	6	8	3	3	1	1	1	1		2	1		
Hemiramphidae	Halfbeaks																				
Labridae	Parrotfish and Wrasses									1											
Muraenidae	Eels																				
Scaridae	Parrotfishes									1	1										
Scorpaenidae	Scorpionfishes																				
Syngnathidae	Seahorse and Pipefish																				
Unidentified larvae	Unidentified larvae	3	1																		
Unidentified yolk-sac larvae	Unidentified yolk-sac larvae	10	3	1																	
	Totals	14	11	16	14	17	17	34	20	20	16	14	4	5	5	1	2	3	3	1	0
Abundance Weighted Average	7.9																				

Intake Entrainment Samples	Bin Minimum (mm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	31	57
	Bin Maximum (mm)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	32	58
Taxon	Common Name																				
Aulostomus maculatus	Trumpetfish								1												
Blenniidae	Blennies								1	1	1										
Bothidae	Lefteye Flounders								1												
Carangidae	Jacks and Pompanos	2	6	10	22	7															
Clupeidae	Herrings, shads and sardines																				
Clupeiformes	Anchovies and Sardines		4	6	12	8	11	13	13	11	7	7	2								
Elopidae	Ladyfishes																				
Engraulidae	Anchovies		1			2	7	16	8	9	5	5	2	1	5		1	1			
Gerreidae	Mojarras			1			1		1	1											
Gobiidae	Gobies	2	10	17	12	3	7	32	26	12	11	17	3	3					1		
Hemiramphidae	Halfbeaks	1		1	1																
Labridae	Parrotfish and Wrasses								1												
Muraenidae	Eels																				1
Scaridae	Parrotfishes									1											
Scorpaenidae	Scorpionfishes						1														
Syngnathidae	Seahorse and Pipefish									1							1				
Unidentified larvae	Unidentified larvae	13	3	1						1											
Unidentified yolk-sac larvae	Unidentified yolk-sac larvae	22	8	1																	
	Totals	40	32	37	47	20	27	61	52	37	24	29	7	4	5	0	2	1	1	0	1
Abundance Weighted Average	7.0																				

3.2.3 Entrainment Overview

PSPPC's CWIS configuration results in translocation of entrained organisms into the San Juan Bay ecosystem. Organisms that survive entrainment are removed from Ensenada de Boca Vieja, discharged into Old Bayamon River Bed, and transported to the mouth of San Juan Bay. Once in the bay, they are subject to tidal flushing near the mouth into the bay or enter the near-coastal ecosystem. In their assessments, ENSR (1997) assumed fish egg entrainment mortality to be 100 percent; however, they assumed that larval fish entrainment mortalities were 50 percent, applying a zooplankton 72-hour survival study value from studies conducted at San Juan Power Plant (ENSR 1997).

The rates of entrainment reported were often low enough that population-level impacts might not be expected. However, the rates of entrainment are of concern due to the continuous nature and periodically reported high levels of entrainment at this facility. Also of concern is the fact that existing information on entrainment rates is based on only one year of sampling. Efforts should be made to more fully characterize entrainment rates.

Additionally, the assumptions regarding larval entrainment survival are questionable, considering that zooplankton survival values were applied to ichthyoplankton, and that the supporting studies were conducted at the San Juan Power Plant CWIS not PSPPC.

4 Technical Basis

To meet section 316(b) requirements, a facility must employ CWISs that "reflect the BTA for minimizing adverse environmental impact." As discussed above, PSPPC is subject to the Existing Facility Rule, which establishes BTA requirements that the facility must achieve. For impingement mortality, the current configuration does not meet BTA. For entrainment, the facility must submit several studies that will enable EPA Region II to make a BTA determination using BPJ. These requirements will be implemented through PSPPC's NPDES permit via a compliance schedule. Below is a discussion of the technical basis for these requirements.

4.1 Additional Data Collection Under the Compliance Schedule

Under the compliance schedule set forth in this permit, PSPPC will develop and submit the appropriate information related to compliance with impingement mortality and entrainment requirements. Included in these submittals is a document in which PSPPC will select its preferred approach for achieving compliance with the impingement mortality requirements. Once a BTA determination has been reached by EPA Region II, PSPPC will be required to implement this approach; these requirements could include the installation of new technologies, adjustments to existing technologies, or other activities. Consistent with the Existing Facility Rule, the compliance deadlines for impingement mortality and entrainment have been synchronized; requirements for both will go into effect once EPA Region II has reached a BTA determination for entrainment.[5] EPA Region II expects that these requirements would likely be included in the facility's next permit renewal process in 2019, if not sooner.

See Section 5 below for a more detailed discussion of the specific elements of the compliance schedule.

[5] This synchronization prevents a facility from implementing a given impingement mortality option, only to discover a few years later that entrainment requirements are also needed and an entirely different approach would have been more appropriate.

4.2 Impingement Mortality

The existing traveling screens include some but not all features of the modified traveling screen technology that is considered a candidate BTA technology for impingement mortality in the Existing Facility Rule. The existing screens include fish buckets to hold and protect impinged fish carried to the top of the screen and operate at a relatively low average through-screen velocity that should help minimize injury to fish. However, impinged aquatic organisms must endure a high pressure spray, and are then combined with other waste streams and discharged along with the condenser effluent.

To achieve 316(b) compliance with impingement mortality requirements, PSPPC must select and implement one of seven compliance alternatives. As noted above, PSPPC's current configuration does not meet any of these seven alternatives. As part of the permit application process, PSPPC is required to evaluate these options and select one for compliance.

4.2.1 Compliance Alternatives for Impingement Mortality in the Existing Facility Rule

Each intake at the facility, or both intakes combined, must comply with the impingement standard through one of seven alternative compliance methods.

1) *Operate a closed-cycle recirculating system as defined at § 125.92* – Closed-cycle recirculating cooling systems can reduce a facility's intake flow by over 90%, reducing both the impingement and entrainment at a facility by an equivalent amount.[6] Closed-cycle systems have been identified by EPA as a best-performing technology for reducing impingement and entrainment. However, these cooling systems can also be challenging to install and may not be appropriate at all facilities.
2) O*perate a cooling water intake structure that has a maximum through-screen design intake velocity of 0.5 fps* – Reducing the intake velocity can be a highly effective method for reducing impingement, and by extension, impingement mortality.[7]
3) *Operate a cooling water intake structure that has a maximum through-screen intake velocity of 0.5 fps* – As noted above, reducing the intake velocity (here calculated using the actual intake flow as the basis) can provide significant reductions in impingement.
4) *Operate an offshore velocity cap as defined at § 125.92 that is installed before effective date of the rule* – The combination of using a control technology with an intake located far offshore can produce reductions in organisms densities (and therefore impingement mortality) that are approximately equivalent to the impingement mortality performance standard.
5) *Operate a modified traveling screen that the Director determines meets the definition at* § 125.92 and that the Director determines is the best technology available for impingement reduction – Numerous studies have shown that modified traveling screens can achieve high rates of impingement survival. This technology was the basis for the impingement mortality performance standard in the Existing Facility Rule.
6) Operate any other combination of technologies, management practices and operational measures that the Director determines is the best technology available for impingement reduction – This alternative may include any combination of technologies where the combined effect of estimated impingement mortality reductions from more than one component is determined to be equal to or greater than the impingement mortality performance standard. Technologies can include flow

[6] EPA assumed a reduction of unit flow would lead to an equivalent reduction in organisms impinged or entrained.
[7] EPA estimates the reduction to be well over 90%.

reduction, fish avoidance technologies, scheduling of maintenance downtime to coincide with increased biological activity, wedgewire screens, etc.

7) *Achieve the specified impingement mortality performance standard* – In the Existing Facility Rule, EPA calculated a numeric performance standard for impingement mortality and established a process for long-term compliance monitoring. A similar arrangement could be developed for PSPPC.

4.2.2 Upgraded Fish Return

To be most effective, a fish return should be designed to minimize injury to the fish, return fish to the source waterbody, and discharge at a location that minimizes predation and recirculation back into the intake. PSPPC's current fish return discharges to a condenser discharge tunnel and is combined with other wastestreams, exposing the fish to significantly increased temperatures and other pollutants for a prolonged period. At a minimum, EPA Region II expects that PSPPC's selected compliance alternative will address this concern.

4.2.3 Very Low Impingement

The Existing Facility Rule may include a provision for facilities that only impinge a very small number of fish.[8] Sometimes referred to as "de minimis," this provision would allow the permit writer to waive impingement mortality requirements in light of the costs associated with saving such a limited number of fish. At this time, it is not clear if this provision will be included in the final rule, how it will be implemented, or whether PSPPC's levels of impingement would be appropriate to consider under this provision. As a result, no further assessment of this provision is necessary.

4.3 Entrainment Reduction

Entrainment requirements will be developed on a BPJ basis, using information submitted by PSPPC under the terms of the compliance schedule. A variety of technologies and operational measures exist and should be examined for their feasibility to be implemented at PSPPC.

Currently, PSPPC's traveling screens employ 1/10 inch (2.5 mm) mesh. This smaller mesh size is capable of reducing entrainment of larger larvae and smaller juveniles but not most eggs and small larvae. In the Existing Facility Rule, entrainment is defined as organisms that would pass through a sieve with a maximum opening of 0.56 inches (same as ½ x ¼ in mesh). Since the existing screens have a maximum opening of 0.14 inches, a portion of the organisms collected on the screens would have otherwise been entrained through a larger size screen mesh (sometimes referred to as "entrainable organisms"). PSPPC's analysis of entrainment options can include consideration of this issue, provided that adequate biological or technical data (e.g., impingement survival rates for small organisms) is presented.

4.4 Interim BTA Requirements

As deemed necessary, EPA Region II can also develop interim requirements during the period when a BTA determination is under development (i.e., while the studies required under the compliance schedule are being completed). At this time, no interim measures (above and beyond those established in the compliance schedule) have been identified as appropriate for PSPPC.

Structural changes (such as installing new screens) can be used as an interim measure; however, as described in the Existing Facility Rule, it is often preferred to synchronize the compliance activities for

[8] EPA did not define a threshold value but the preamble implies that this value would be on the order of several fish per day. EPA did not adopt several industry suggestions for much higher numbers of individual organisms or biomass.

impingement mortality and entrainment, even if solutions for one (typically impingement mortality) may be implemented more quickly. This approach minimizes the risk that a solution for impingement mortality is decided upon and installed, only to be made partially or wholly obsolete by the subsequent solution for addressing entrainment. In cases such as PSPPC, the delay for submitting additional materials to assess entrainment requirements is relatively short.

Interim requirements involving operational changes or additional monitoring were also considered. Examples of these changes that are relatively easy to implement, do not result in significant increases in costs, and are not permanent changes or preclude future decision-making would be:

- Conduct a study to examine the feasibility and possible designs for relocating the fish return from the discharge canal to the source water. This could include a conceptual engineering design for crossing the road and selection of a discharge location that would minimize re-impingement and predation.
- Operate traveling screens on a continuous basis
- Align maintenance outages with higher E season
- Specific limit on daily, monthly, or annual intake flow
- Monitoring for unusually large impingement events
- Additional inter-related studies (e.g., examine thermal tolerances for fish in discharge canal)

None of these items was found to be appropriate for PSPPC. In some cases, the information will be collected by the studies in the compliance schedule. In other cases, the interim requirements may place unnecessary strain on the existing equipment that it was not designed to handle. In other cases, the costs for such interim requirements (including less quantifiable costs such as limitations on operations or electricity generation) are too high for such a brief period.

5 Recommendations

As described in this report, PSPPC is currently not compliant with section 316(b) requirements for either impingement mortality or entrainment. Under the recently promulgated Existing Facility Rule, PSPPC must submit several documents to 1) select a compliance path for impingement mortality and 2) provide information to allow the permitting authority to make an appropriate BTA determination for entrainment.

As a result, USEPA Region II should incorporate language into a renewed NPDES permit for PSPPC that establishes a compliance schedule for PSPPC to submit the materials required by the Existing Facility Rule.

5.1 Compliance Schedule

A suggested compliance schedule is provided below and considers the materials that have already been developed by PSPPC and how they might be used to fulfill the information submittal requirements. While the permitting authority has wide discretion in determining an appropriate compliance schedule, PSPPC has already completed much of the necessary work, suggesting that an extended schedule is unlikely to be necessary. Exhibit 18 below outlines the application requirements, with an assessment of whether materials that have already been developed will satisfy these requirements. If so, then there is little effort required of PSPPC to develop these materials and a short compliance schedule may be warranted. Consistent with the Existing Facility Rule, this compliance schedule also aligns the implementation schedules for complying with impingement mortality and entrainment requirements.

Exhibit 18. Comparison of Existing Documents to Application Requirements

Regulatory Requirement	Existing	Notes
Description of the source water body (§ 122.21(r)(2))	• Impingement Mortality & Entrainment Characterization Study and Current Status Report (2012) • Biological Evaluation for the Palo Seco Power Plant (2005) • Section 316(a) and (b) Demonstration Palo Seco Power Plant (1997) • Palo Seco Power Plant Draft Final 316 Plan of Study (1993) • Palo Seco Power Plant 316(a) Reopener Clause Plan of Study (1992)	• This document provides a recent description of the source water. • This document provides a brief description of the source water. • This document, while dated, provides information on the source water. • This document, while dated, provides information on the source water. • This document, while dated, provides information on the source water.
Description of the cooling water intake structures (§ 122.21(r)(3))	• Impingement Mortality & Entrainment Characterization Study and Current Status Report (2012) • Biological Evaluation for the Palo Seco Power Plant (2005) • Section 316(a) and (b) Demonstration Palo Seco Power Plant (1997) • Palo Seco Power Plant Draft Final 316 Plan of Study (1993)	• This document provides a recent description of the intake structure. • This document provides a brief description of the intake structure. • This document, while dated, provides information on the intake structure. • This document, while dated, provides information on the intake structure.
Characterization of the biological community in the vicinity of the cooling water intake structure (§ 122.21(r)(4))	• Impingement Mortality & Entrainment Characterization Study and Current Status Report (2012) • Biological Evaluation for the Palo Seco Power Plant (2005) • Section 316(a) and (b) Demonstration Palo Seco Power Plant (1997) • Palo Seco Power Plant 316(a) Reopener Clause Plan of Study (1992)	• This document provides a recent assessment of the local biological community. • This document provides a brief description of the local biological community. • This document, while dated, provides information on the local biological community. • This document, while dated, provides information on the local biological community.
Description of the cooling water system (§ 122.21(r)(5))	• Impingement Mortality & Entrainment Characterization Study and Current Status Report (2012) • Section 316(a) and (b) Demonstration Palo Seco Power Plant (1997) • Palo Seco Power Plant Draft Final 316 Plan of Study (1993)	• This document provides a recent description of the cooling water system. • This document, while dated, provides information on the cooling water system. • This document, while dated, provides information on the cooling water system.

Exhibit 18. Comparison of Existing Documents to Application Requirements

Regulatory Requirement	Existing	Notes
Identification of the facility's chosen compliance method for impingement mortality (§ 122.21(r)(6))	• Impingement Mortality & Entrainment Characterization Study and Current Status Report (2012)	• This document provides an argument that the existing configuration is BTA. However, given the requirements of the Existing Facility Rule, it is likely that the current configuration would not meet BTA requirements. As a result, the permittee would need to develop this submittal.
Description of any previously conducted entrainment performance studies (§ 122.21(r)(7))	• n/a	• As noted in this table, a number of relevant studies have been conducted and provided to USEPA Region II. If the permittee is aware of any other relevant studies, those would be provided in this submittal.
Description of the facility's operational status (§ 122.21(r)(8))	• Impingement Mortality & Entrainment Characterization Study and Current Status Report (2012) • Section 316(a) and (b) Demonstration Palo Seco Power Plant (1997)	• This document provides a recent description of the facility's operations. • This document, while dated, provides information on the facility's operations.
Entrainment characterization study (§ 122.21(r)(9))	• Impingement Mortality & Entrainment Characterization Study and Current Status Report (2012) • Section 316(a) and (b) Demonstration Palo Seco Power Plant (1997)	• This document provides a recent assessment of impingement morality and entrainment. • This document should provide a historical view of entrainment.
Comprehensive technical feasibility and cost evaluation study (§ 122.21(r)(10))	• Impingement Mortality & Entrainment Characterization Study and Current Status Report (2012)	• This document provides a very brief description of other potential technologies, but is not detailed enough to meet the requirements for this submittal.
Benefits valuation study (§ 122.21(r)(11))	• n/a	• It does not appear that the facility has conducted any studies that would meet the requirements for this submittal.
Non-water quality environmental and other impacts assessment (§ 122.21(r)(12))	• n/a	• It does not appear that the facility has conducted any studies that would meet the requirements for this submittal.
Description of the peer review process for studies submitted under (§ 122.21(r)(10)-(12)) (§ 122.21(r)(13))	• n/a	• This submittal cannot be developed until the referenced studies have been completed.

5.2 Time for Submittals

Given that the technical content of several of the required studies above has already been completed, an extended compliance schedule is not necessary. Materials that are substantially complete (using existing materials) can be due soon after permit reissuance. Remaining studies would then be due in subsequent submittals, as described in the suggested compliance schedule below (Exhibit 19). The times required to complete these studies are consistent with the time frames outlined in the Existing Facility Rule.

Exhibit 19. Suggested Compliance Schedule

Time Frame	Submittal
Within 6 months of permit issuance	§ 122.21(r)(2)-(8) (or equivalent)
Within 2 years of permit issuance	§ 122.21(r)(9) (or equivalent)
Within 3 years of permit issuance	§ 122.21(r)(10)-(13) (or equivalent)

6 References

ENSR. 1997. Section 316(a) and (b) Demonstration, Palo Seco Power Plant. Prepared for Puerto Rico Electric Power Authority, San Juan, PR. November 1997.

ENSR, 2005. Biological Evaluation for the Palo Seco Power Plant. June 2005.

NOAA. Charts read online at http://www.gulfcoast-solutions.com/shopcart/agora.cgi?product=PocketCharts&user2=Caribbean. Chart 25670 Bahia de San Juan and Chart 25668 Northern Coast of Puerto Rico. Accessed August 4, 2006.

PREPA (Puerto Rico Electric Power Authority). 2012. Impingement Mortality & Entrainment Characterization Study and Current Status Report. Prepared by URS Corporation. April 2012

PREPA (Puerto Rico Electric Power Authority). Palo Seco Steam Electric Generating Station Application for 316(a) Waiver Determination and Final Mixing Zone Determination. February 1983.

Raytheon (Raytheon Environmental Services). 1994. Palo Seco Power Plant 316(a) Supplement to the Draft Final Plan of Study. Prepared for Puerto Rico Electric Power Authority, San Juan, PR.

Raytheon (Raytheon Environmental Services). 1997. Palo Seco Power Plant 316(a) Reopener Clause 12 Month Data Report. Prepared for Puerto Rico Electric Power Authority, San Juan, PR.

Stoner, A.W., and C. Goenga. 1987. Benthic survey of the San Juan Harbor, Puerto Rico. Center for Energy and Environmental Research, University of Puerto Rico.

UCI, Ltd., 1993. Palo Seco Power Plant Draft Final 316 Plan of Study. April 1, 1993.

United Engineers. 1983. Palo Seco Steam Electric Generating Station, Application for 316(a) Waiver Determination and Final Mixing Zone Designation. Prepared for Puerto Rico Electric Power Authority, San Juan, PR.

United Engineers & Constructors, Inc., 1992. Palo Seco Power Plant 316(a) Reopener Clause Plan of Study. October 30, 1992.